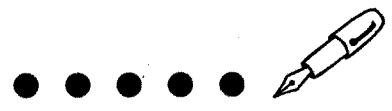
RESULTS AND DISCUSSION



"Do not believe in anything because it is presented so it is said to you, unless and until you, yourself explore the truth"

-Swami Vivekananda

4 FINDINGS AND DISCUSSION

The main objective of the study was to ergonomically study various aspects of storage units of kitchen and bedroom area of the elder people and suggest modifications in design on the basis of their anthropometric dimensions. Condition of existing storage units in both areas was studied. Pain and discomfort experienced by the respondents and posture adopted by them while using storage units, revealed the physiological problems faced by the respondent. The results regarding problems related to physical characteristics of the storage units in both areas provided the necessary information for modifications in design of storage units. Satisfaction level of the respondents for existing storage units was also studied. This chapter includes the results of the data collected and analyzed pertaining to various objectives. The results are presented in the following sub-sections.

Section: 1 Demographic information of the women in the third age

Section: 2 Health status including frequency of activities performed by the respondents

Section: 3 Anthropometric and reach measurements of the respondents

Section: 4 Existing storage facilities in kitchen and bedroom

Section: 5 Extent of Problems experienced with existing storage units in selected areas.

Section: 6 Level of satisfaction of the respondents with the existing storage units

Section: 7 Testing of hypotheses

Section: 8 Suggested ergonomically appropriate guidelines for storage design

Section: 1

4.1 Demographic information of the women in third age

For any research the back ground information of the respondents is essential. It provides the descriptive data of demographic variables of the

respondents which, further helps in interpreting some results of the study. The information regarding age, education, marital status, living arrangement, present and past occupation, family income, present personal income and information regarding house are described in this section.

Table 1: Distribution of the Respondents by the Background information

Personal Characteristics	Respondents n = 85	
	f	%
Age (in Years)		
60-65	64	75.30
66-70	21	24.70
Mean	63.72	
S.D.	2.81	
Marital Status		
Married	34	40
Unmarried	8	9.4
Widow	37	43.5
Separated	6	7.1
Education		
University's higher degree	5	5.9
Post graduate	12	14.1
Graduate	22	25.9
Higher secondary/Intermediate	28	32.9
Middle school	15	17.6
Primary education	3	3.6
Living Arrangement		
Alone	13	15.3
With spouse	34	40
With others/relatives	12	14.1
With servants	26	30.6

Age: About three fourth of the respondents were in the age group of 60-65 years and a little less than one fourth of the total respondents were in category of 66-65 years. (Table 1, Fig 15) The mean age of the respondents was found to be 63.72 years. **Gowri et al. (2003)** conducted a study on 400 elderly females, the data show sharp decline in the proportion of elderly with rise in the age of the elderly. The largest of the elderly constituting 31 per cent were of the age group 60-64. The elderly between 60-69 years of age comprised (57.5%) more

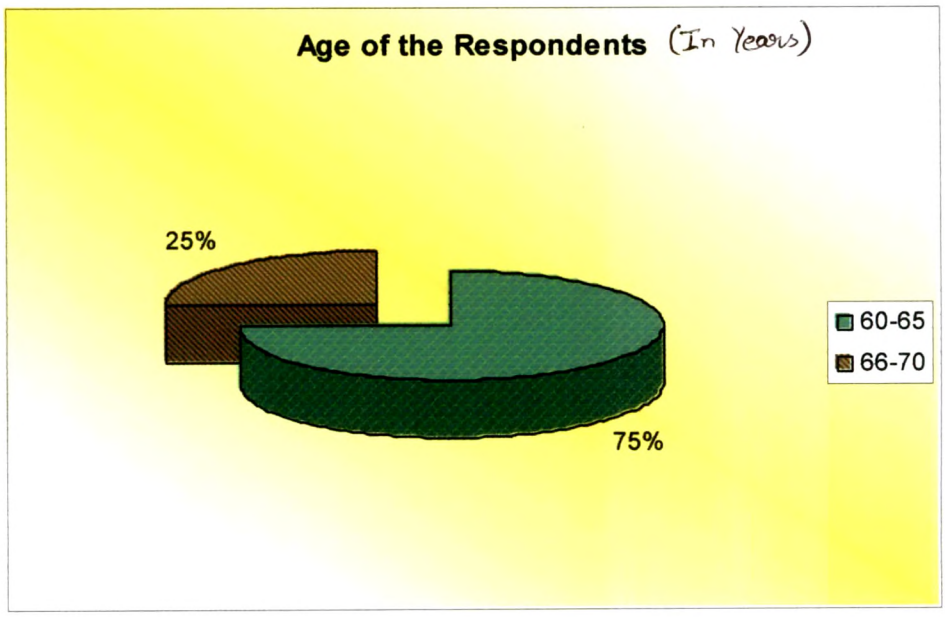


Fig 15: Age of the Respondents

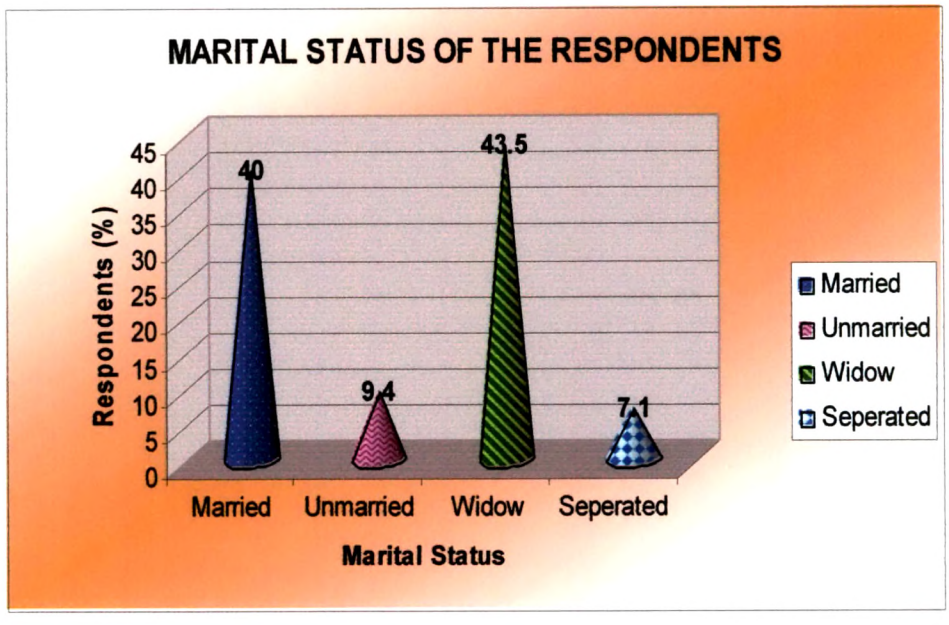


Fig 16: Marital Status of the Respondents

than half of the total respondents. The proportion of the elderly women declined sharply from age 70 onwards due to low chances of survival. They constituted only 8.7 per cent of the total elderly respondents.

Marital Status: As age advances, the need for security and companionship increases. The marital status of the aged people greatly influences their life style. Losing the spouse in old age brings a very hard time in the passage of one's life and the living partner has to face all the problems of old age without anybody to share or understand. It was found that there were somewhat an equal number of respondents who were married i.e were living with spouse (40 %) and widow (43.5). Whereas, very few (9.4 %) respondents were found to be unmarried and separated (7.1 %) from their spouse (Table 1, Fig. 16). The study conducted by **Gowri et.al. (2003)** reveal the predominance of widowed elderly in the sample population. The widowed elderly constituted nearly three-fourths of the sample population. The currently married female elderly constituted only a quarter of the sample elderly in Gowri's study.

Education: The well-being of the elderly is intimately linked to their education. Longevity also has a strong association with education as literacy levels and life expectancy at birth are highly correlated **(Granahan, 1972)**. The present study showed that about one-third of respondents were higher secondary/ intermediate pass out and around one-fourth respondents were graduate. However, very few respondents were holder of university's higher degree (5.9 per cent) and primary pass out (3.5 percent), (Table 1, Fig. 17). The study conducted by **Gowri et. al (2003)** showed that majority (87.0%) of the sample elderly females were illiterate. Whereas, literate constituted only 13 per cent of the sample elderly.

Living Arrangement: The traditional Indian family structure used to provide the required environment for comfortable living of the elderly. The extended family usually consisted of two generations living together wherein the elderly used to have a different status in the household. But with a rising number of

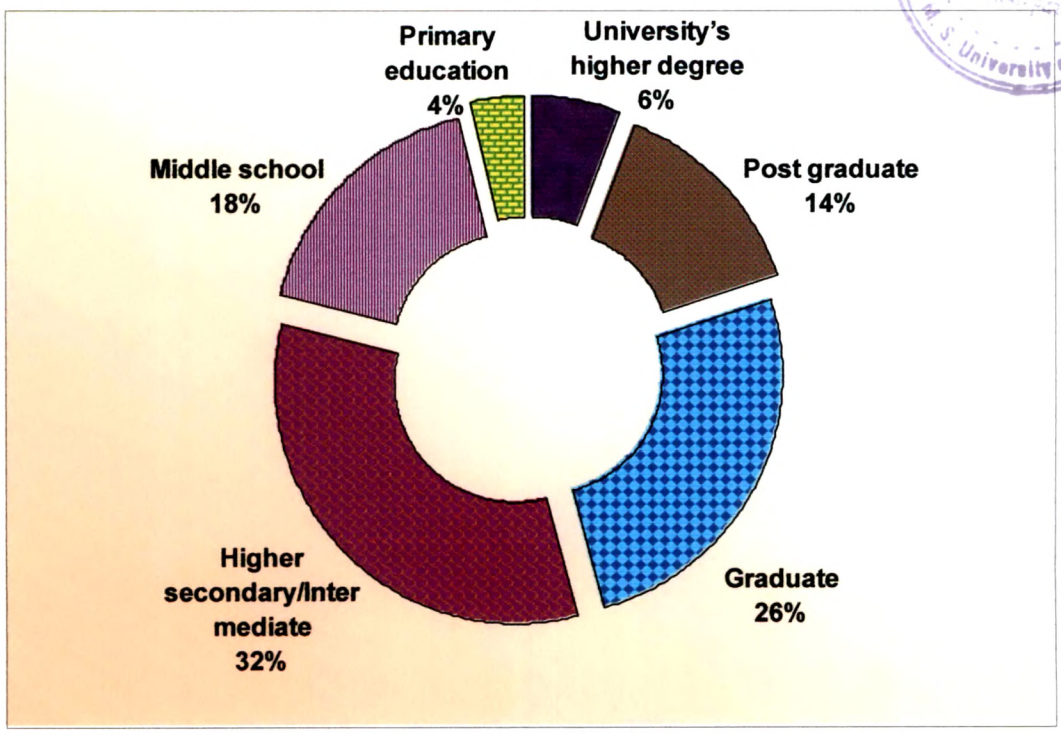


Fig 17: Percentage distribution of respondents by Education

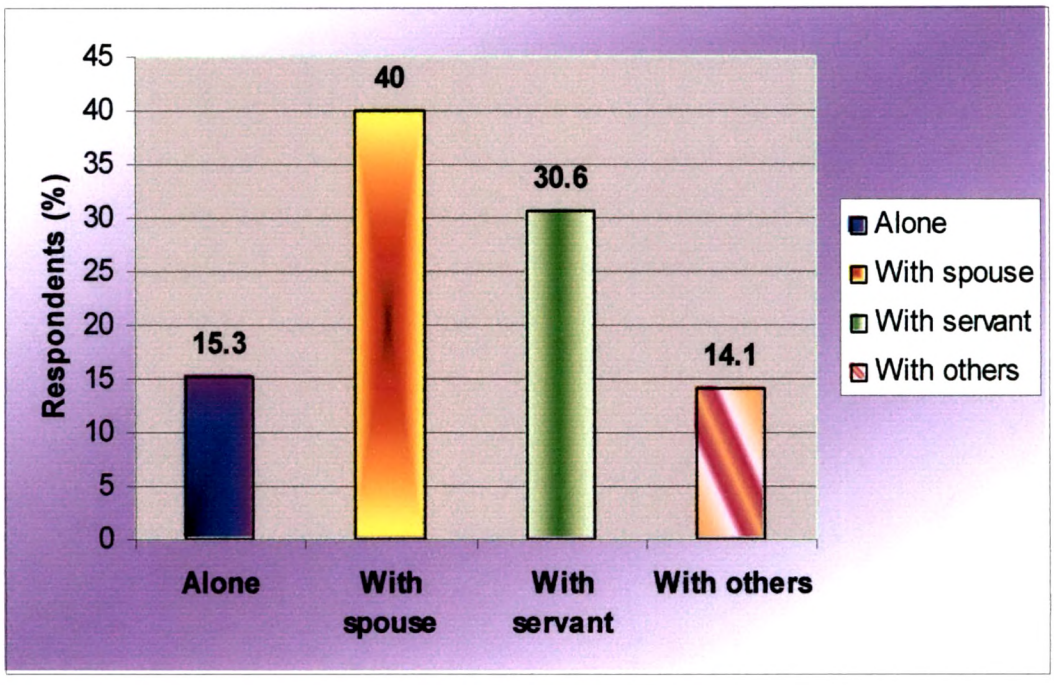


Fig 18: living arrangement of the respondents

nuclear families, the elderly seems to have been deprived of certain needs which are not adaptable to them. The present study showed that about one sixth of the total respondents were living alone whereas, all the married respondents were staying with their spouse (Table 1, Fig.18). In a study of old people in Madras city conducted by Nair in 1972, only 3 per cent of the people over age 60 were found living alone while 39 per cent were residing with married sons, 17 per cent with married daughters and 15 per cent with unmarried children.

Information regarding past occupation of the respondents

This part includes information regarding past occupation of the respondents such as employed or non employed, duration of occupation, type of occupation, sector and age of retirement of the respondents (Table 2).

Table 2: Distribution of respondents by information regarding their past occupation of the Respondents

Information about past Occupation Status	**Respondents (n=85=100%)**	
	f	**%**
Employed		
• Gainfully employed	16	18.8
• Self employed	8	9.4
Non-employed	61	71.8
Duration of Past occupation (In years) n=24		
25-30	5	5.9
31-35	14	16.5
36-40	5	5.9
Mean	33.42	
S.D.	0.67	
Type of occupation		
Full time	21	24.7
Part time	3	3.5
Sector (n=16)		
Public	9	10.6
Private	7	8.2
Age of Retirement (in years)		
Below 50	-	-
51-55	2	2.4
56-60	13	15.3
Above 61	1	1.2

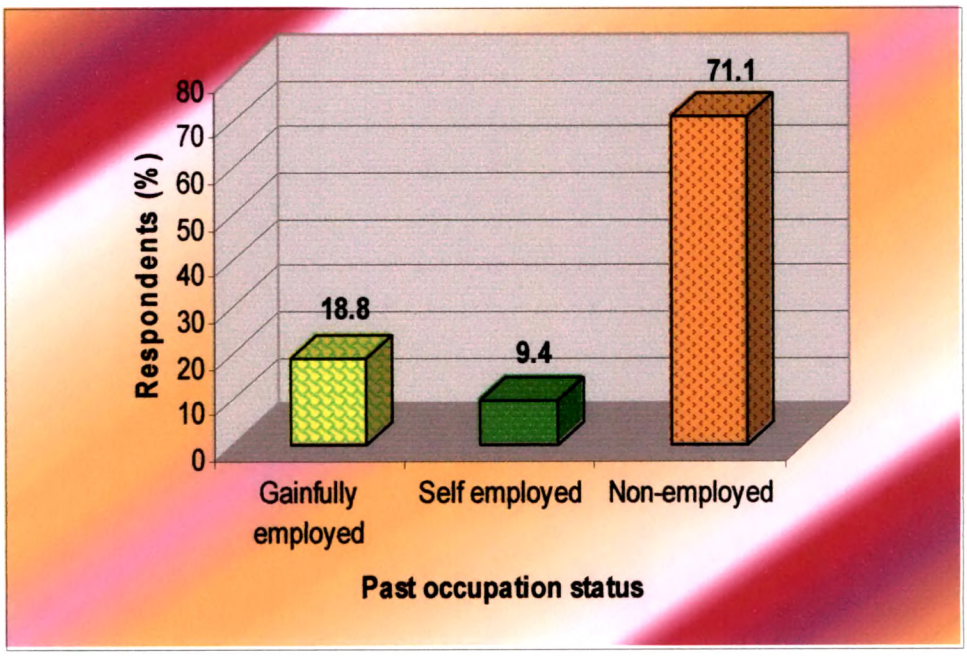


Fig 19: Past occupation status of the respondents

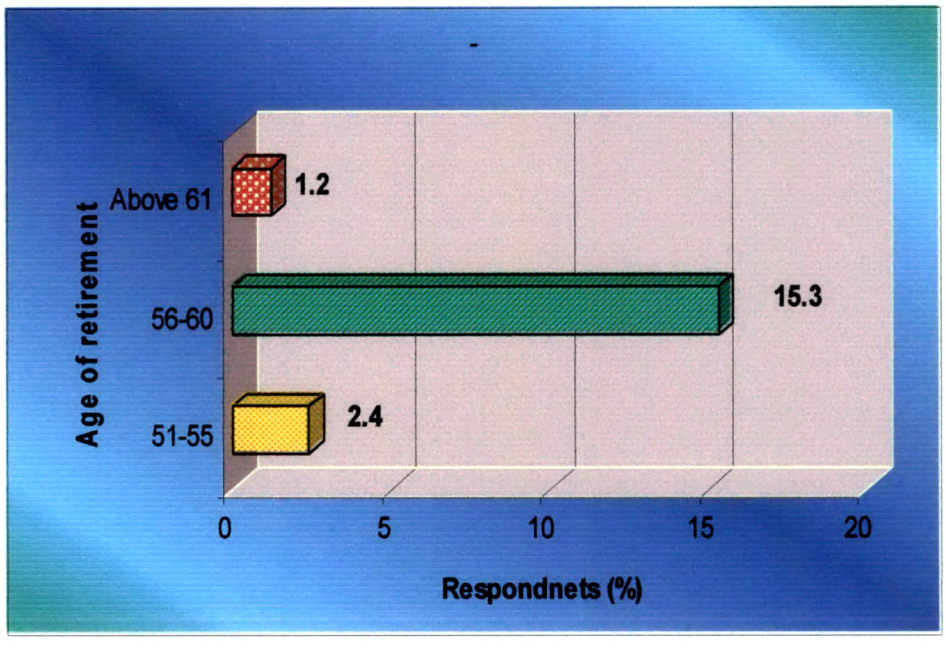


Fig 20. Age of retirement of the respondents

Mean	58.63	
S.D.	0.67	

Past Occupation Status: The past occupation status of the respondents under the present study showed that 71.8 per cent were non-employed, whereas 18.8 per cent were gainfully employed outside the home and only 9.4 per cent were running their own business (Table 2, Fig 19).

Duration of Past Occupation: It was found that 16.5 per cent respondents from the total sample worked for 31 to 45 years whereas equal number of respondents (i.e 5.9 percent) worked for 25 to 30 years and 36.40 years. The mean duration of past employment was found to be 33.42 years.

Type of Occupation: Nearly twenty five per cent respondents from the total sample worked full time while only 3.5 percent worked part time.

Sector: It was found that 10.6 per cent respondents were employed in public sector whereas only 8.2 per cent where involved in private sector.

Age of Retirement: The mean age of retirement of the respondents was found to be 58.50 years (Fig 20).

Information regarding present occupation

This part includes information of respondent's present occupation that whether they were employed or non-employed, the kind of job they were doing, hours and number of days spent by them on their occupation.

Occupation Status: It was found that maximum number (90.6 percent) of respondent's were presently non-employed housewives while only 9.4 percent of respondents were presently gainfully employed/self-employed (Table: 3, Fig 21)

Kind of Employment: It was found that all the gainfully/self employed respondents (8 in number) were running their own business (Table:3).

Days and Hours Spent: The mean number of days spent by the respondents for their occupation was found to be 23.38 days in a month. Whereas, the mean hours spent by the respondents for their occupation was found to be 4.38 hours/day (Table. 3)

Table 3: Distribution of respondents by Information regarding their present occupational status

Occupation status	**Respondents n = 85**	
	f	**%**
Employed/ Self employed	8	9.4
Non-employed	77	90.6
Kind of job	**n=8=100%**	
Service/Job	0	-
Self employed	8	100
Honorary voluntary service	0	-
Part time job	0	-
Hours spent for occupation	**n=8=100%**	
1-3 hrs	3	37.5
4-6 hrs	5	62.5
Mean	4.38	
S.D.	0.46	
Days spent for occupation	**n=8=100%**	
20-23	4	50
24-26	4	50
Mean	23.38	
S.D.	0.65	

Czaja (1990) stated that for 65+ women the decline in gainful employed was very small from 6 per cent in 1960 to 5 per cent in 1984. Yet, at the same time, 41 per cent of women aged 55-64 were employed. Altogether, the representation of people of 55 years and older in the workforce decreased to 11 per cent of the total workforce in 1985 from 14 per cent in 1981, but the elderly did more part time work. The reason for the reduction in work activities is manifold, but the often-postulated decline in performance with age has not been demonstrated except for heavy and fast-paced work.

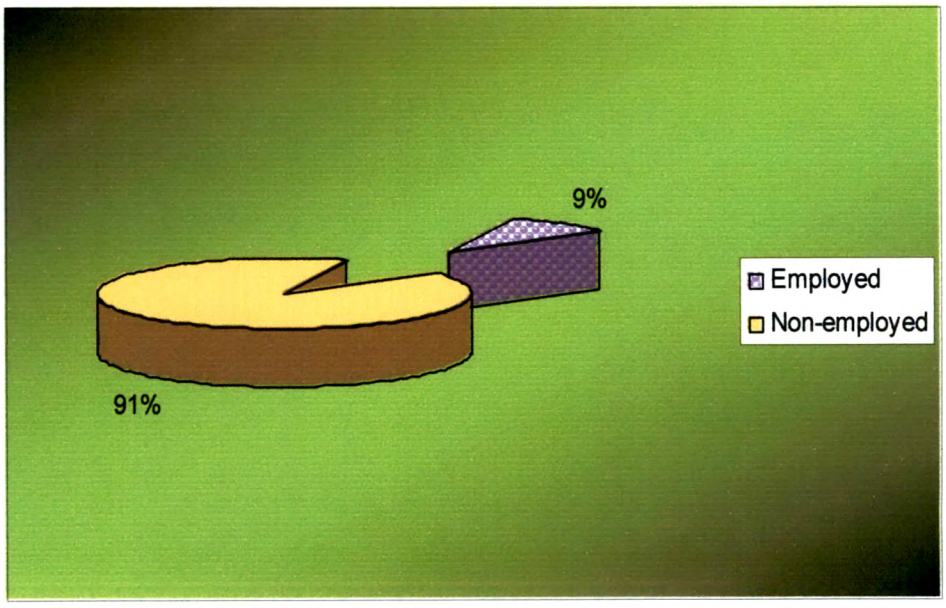


Fig 21: Present occupation status of the respondents

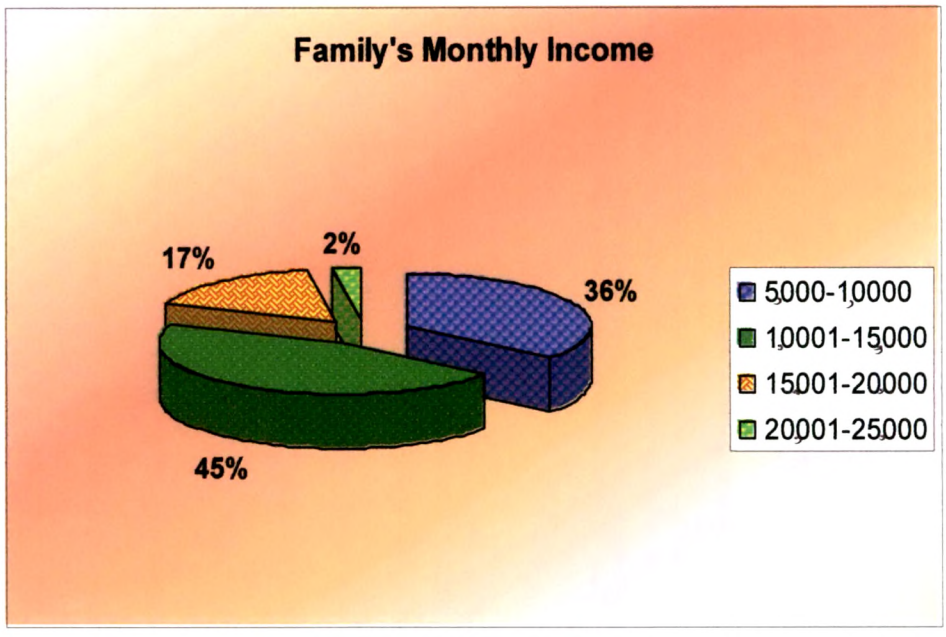


Fig 22: Family's Monthly Income

Information regarding present income

This part includes information regarding present income of the respondents such as family's monthly income, sources of their personal income.

Total Family Income: As regards the total family income of the selected respondents, the majority belonged to the first two categories of income range. Thirty five and 44 per cent of the respondents fall in the category of Rs. 5,000 to 10,000 and 10,001 to 15,000, respectively. However, sixteen per cent respondents fall in income category of Rs.15,001-20,000. The mean family income of the respondents was found to be Rs.13, 035.29 per month (Table.4, Fig 22). **Kaur (2008)** found that majority of the males and females of the third age were having the monthly income (i.e. 53 per cent and 62 per cent females) between Rs. 10,000- 14,999 per month.

Personal Income- Pension: There were 16 respondents who were employed earlier and who got pension. Mean Personal income of the respondents through pension was found to be Rs. 6,750 per month. Less than fifteen per cent of the respondents were getting pension between Rs. 5,001 to 10,000 whereas; only 4 per cent respondents were getting pension between Rs. 1,001 to 5,000 (Table.4, Fig. 23).

Personal Income- Present Employment: There were 8 (9.4 per cent) respondents who were working at present. All were self employed. The mean income of the respondents through present occupation was found to be Rs.10,500 per month. It was found that around seven per cent respondents were earning income between Rs.5,001 to 10,000 (Table.4, Fig. 24).

Personal Income- Investment/Saving/Retirement Benefit: It was found around 21 per cent respondents were receiving their personal income between Rs. 1,000 to 5,000 as investment/saving/retirement benefit. The mean personal income of the respondents through investment /savings / retirement benefits was Rs. 3,857.14 per month (Table.4, Fig 25).

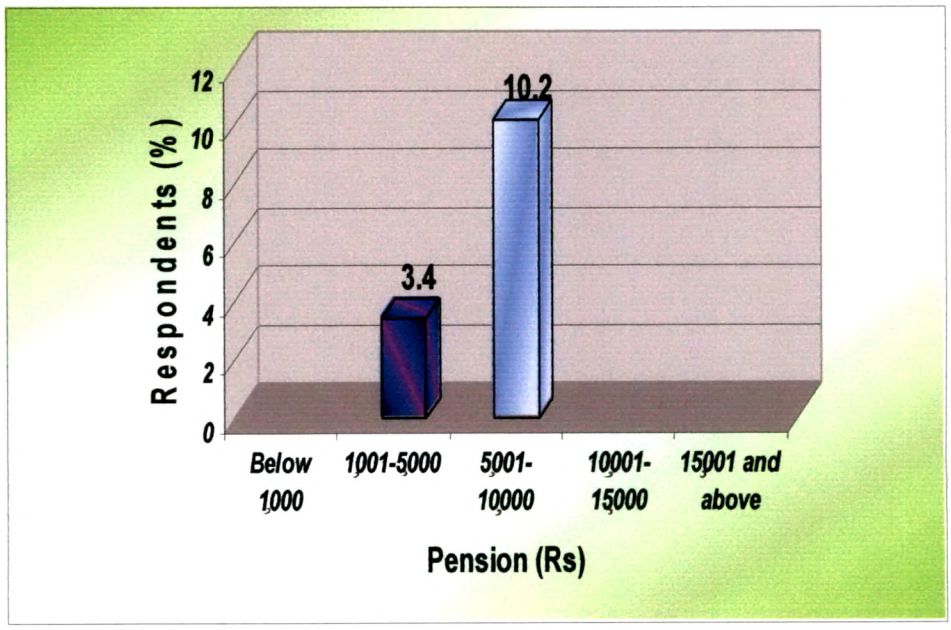


Fig 23. Amount of pension received by the respondents

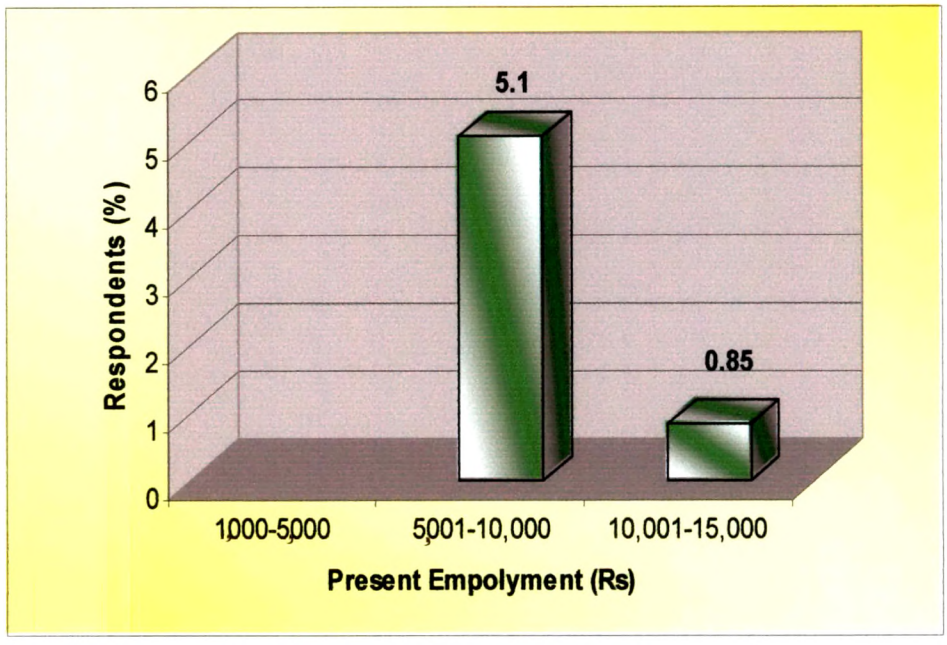


Fig 24. Amount of money received by the respondents through present employment

Allowance given by Children: There were only 9 respondents who received allowance from their children. The mean amount was found to be Rs.3,666.67 (Table.4., Fig. 26).

Table 4: Distribution of respondents as per Information regarding present income

Information about Income	Respondents n=85	
	f	%
Family's monthly income (RS.)		
5,000-10,000	30	35.29
10,001-15,000	38	44.7
15,001-20,000	14	16.48
20,001-25,000	02	02.35
25,001 and Above	01	01.18
Mean	13,035.29	
S.D.	447.35	
Source of personal income and amount (RS.)		
Pension (RS.)		
Below 1,000	-	-
1,001-5,000	04	3.4
5,001-10,000	12	10.2
10,001-15,000	-	-
15,001 and above	-	-
Mean	6,750	
S.D	469.9	
Present employment (RS.)		
1,000-5,000	-	-
5,001-10,000	06	5.1
10,001-15,000	01	0.85
Mean	10,500	
S.D.	1700.8	
Investment/saving/retirement benefit (n=21)		
1,000-5,000	18	15.3
5,001-10,000	03	2.55
10,001-15,000	-	-
15,001 and above	-	-
Mean	3,857.14	
S.D	310.8	
Allowance given by children		
1,000-3,000	04	3.4
3,001-6,000	05	4.25
6,001-9,000	-	-
9,001 and above	-	-
Mean	3,666.67	
S.D	408.2	

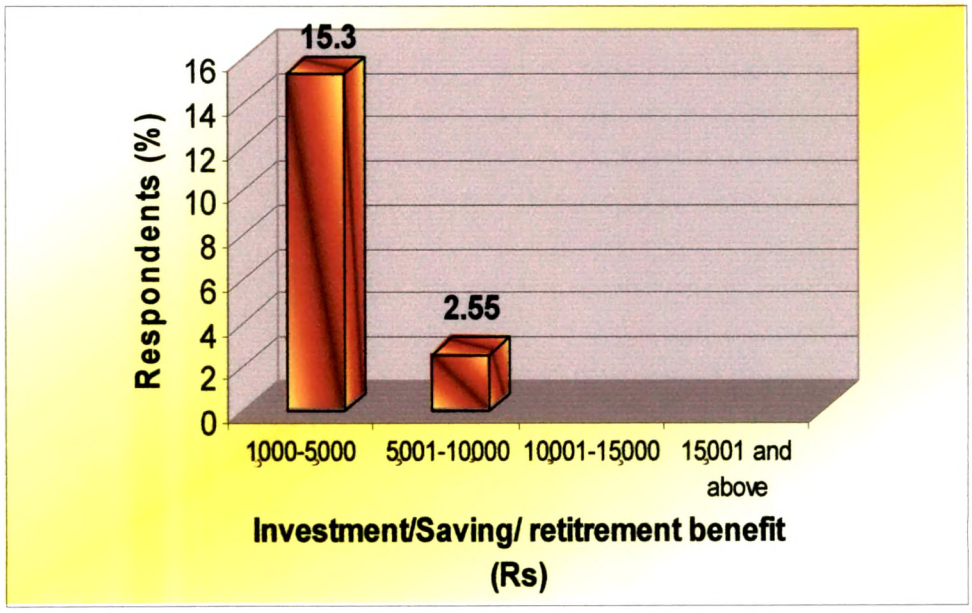


Fig 25. Amount of Investment/Saving/Retirement benefits received by the respondents

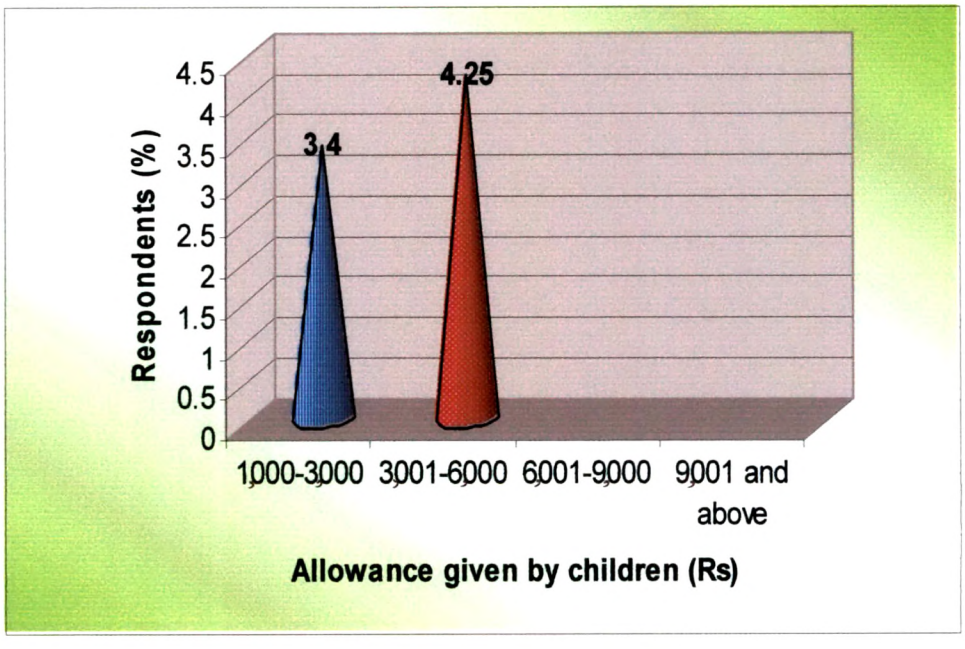


Fig 26. Allowance given by children to the respondents

Information regarding house

This part contains information related to ownership status and type of house possessed by the respondents.

Table 5: Distribution of Respondents by Information Regarding House:

Type of House	Respondents n = 85	
	f	%
Independent house	59	69.4
Flat	26	30.6

Maximum number of respondents (69.4 per cent) was having independent type of house, while around 30 per cent respondents were staying in flats (Fig 27).

Section: 2

4.2 Health Status of the respondents including frequency of activities performed by them

This section includes information regarding health of the respondents. It was gathered in several ways such as (i) Functional capacity (Activities performed by the respondents independently), (ii) general health condition as perceived by the respondents, (iii) status of body organs as perceived by the respondents, (iv) disease/ailment profile of the respondents, (v) problems related to movement of various body parts and (vi) body trouble experienced by respondents. The information was gathered step by step from general to specific so that the respondents feel comfortable and could disclose the health problems without hesitation.

4.2.1 Functional Capacity (Activities performed by the respondents independently)

This section includes findings about frequency and extent of various activities performed by the respondents in kitchen and bedroom to assess their functional capacity.

It was found that maximum respondents prepared tea (97.6 per cent), boiled milk (96.5 per cent) and prepared their breakfast (89.4 Percent) daily (Table 6). While more than 50 per cent of respondents never performed such

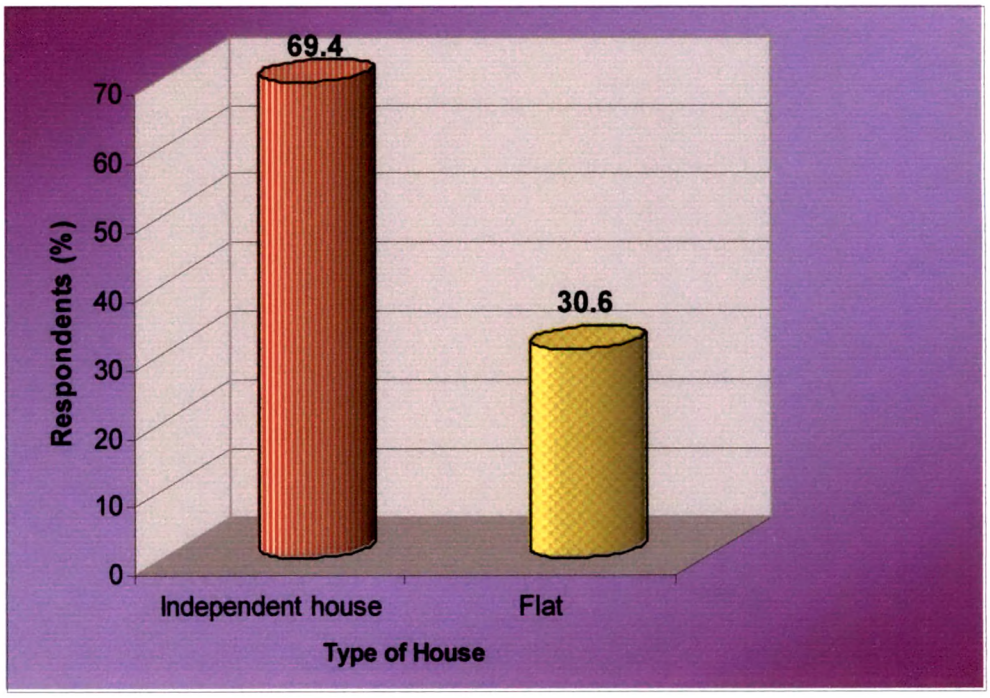


Fig 27. Type of house of the respondents

Table 6: Distribution of Respondents by Frequency of activities performed by them in kitchen (n=85)

Sr. No.	Activities	Frequency of performing activities and scores									
		Daily (5)		2/3 times in week (4)		Weekly (3)		Once in a month (2)		Never (1)	
		f	%	*f*	%	*f*	%	*f*	%	*f*	%
1	Preparation of Tea	83	97.6	2	2.4	-	-	-	-	-	-
2	Boiling of milk	82	96.5	3	3.5	-	-	-	-	-	-
3	Preparation of Breakfast	76	89.4	9	10.6	-	-	-	-	-	-
4	Filling of water bottles	41	48.2	42	49.4	-	-	-	-	2	2.4
5	Feeling/cutting of vegetables./fruit	40	47.1	45	52.9	-	-	-	-	-	-
6	Cleaning of grains	-	-	-	-	1	1.2	34	40	50	58.8
7	Cleaning leafy vegetable	14	16.5	69	81.2	2	2.4	-	-	-	-
8	Preparation Of Rice/Dal In Cooker	43	50.6	41	48.2	1	1.2	-	-	-	-
9	Preparation Of Chapatti/Paratha	39	45.9	46	54.1	-	-	-	-	-	-
10	Cooking vegetables	51	60	33	38.8	-	-	1	1.2	-	-
11	Churning curd	19	22.4	49	57.6	2	2.4	2	2.4	13	15.3
12	Arranging items in refrigerator	10	11.8	48	56.5	24	28.2	1	2.4	2	2.4
13	Cleaning utensils	-	-	27	31.8	-	-	1	1.2	57	67.1
14	Wiping utensils	4	4.7	22	25.9	-	-	1	1.2	58	68.2
15	Arranging utensils in rack	32	37.6	16	18.8	-	-	1	1.2	36	42.4
16	Sweeping/Mopping kitchen floor	1	1.2	30	35.3	-	-	1	1.2	53	62.4

kitchen activities as cleaning of grains (58.8 per cent), cleaning (67.1 per cent) & wiping (68.7 per cent) of utensils and sweeping/mopping floor (62.4 per cent) (Table.6). **Gowri et. al (2003)** studied the self perceived ability of elder women to do work and it was found that elderly females reporting capability of doing work were the largest in the age group 60-69 accounting for 88.7 per cent of them which declined sharply from 76.2 per cent in respect of the female elderly in their 70's and further sharply to 37.1 per cent in the case of female elderly aged 80 years and above.

Functional Capacity of Respondents: Extent of Activities performed by them in kitchen

The frequency of performing various activities in kitchen was scored as 5 for daily, 4 for 2/3 times in a week, 3 for weekly, 2 for once in a month, and 1 for never performing the activity. The respondents were performing 16 types of activities in kitchen (Table 6).

It was found that 60 percent respondents performed kitchen activities to medium extent whereas, 40 percent respondents perform kitchen activities to great extent (Table 7, Fig 28). Therefore on the basis of the above results it was concluded that maximum respondents have moderate level of functional capacity.

Table 7: Functional Capacity of Respondents: Extent of Activities performed by the Respondent in kitchen

Functional capacity	Range of scores	Respondents n= 85	
		f	%
Low	16-37	-	-
Moderate	38-59	51	60
High	60-80	34	40
	Total	85	100

Functional Capacity of Respondents: Extent of activities performed by the Respondents in Bedroom

The Table 8 depicts that activities such as making bed (83.5 per cent), keeping clothes in storage unit (75.3 per cent) doing puja (64.7 percent) and

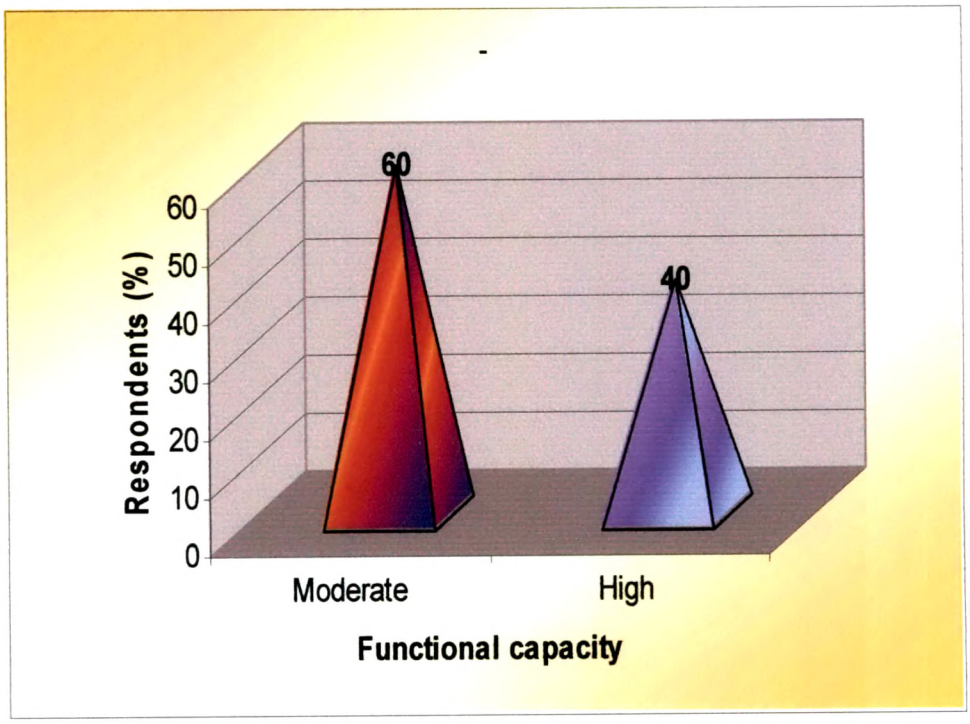


Fig 28. Extent of Functional capacity of the respondents in Kitchen

Table 8: Distribution of Respondents by Frequency of activities performed by them in Bedroom

Sr. No.	Activities performed	Frequency of performing activities and scores									
		Daily (5)		2/3 times in week (4)		Weekly (3)		Once in a month (2)		Never (1)	
		f	%	*f*	%	*f*	%	*f*	%	*f*	%
1	Cleaning re-arraigning the cupboard	-	-	2	2.4	27	31.8	56	65.9	-	-
2	Cleaning & re-arraigning the dressing table	-	-	4	4.7	34	40	47	55.3	-	-
3	Folding the clothes	53	62.4	30	35.3	2	2.4	-	-	-	-
4	Keeping the folded clothes in storage unit	64	75.3	21	24.7	-	-	-	-	-	
5	Making bed	71	83.5	13	15.3	-	-	-	-	1	1.2
6	Dusting the room	29	34.1	37	43.5	1	1.2	-	-	18	21.2
7	Sweeping/Mapping the room	-	-	29	34.1	-	-	-	-	56	65.9
8	Ironing	-	-	20	23.5	4	4.7	-	-	61	71.8
9	Reading	24	28.2	36	42.4	-	-	1	1.2	24	28.2
10	Writing	19	22.4	38	44.7	1	1.2	-	-	2.7	31.8
11	Keeping account	10	11.8	55	64.7	16	18.8	-	-	4	4.7
12	Doing puja	55	64.7	5	5.9	-	-	-	-	25	29.4

folding the clothes (62.4 per cent) were performed by maximum respondents on daily basis in bedroom. Whereas, maximum number of respondents never performed activities such as ironing (71.8 percent) and sweeping /mopping (65.9 per cent) of bedroom floor.

The frequency of performing various activities in bedroom was scored as 5 for daily, 4 for 2/3 times in a week, 3 for weekly, 2 for once in a month, and 1 for never performing the activity. The respondents performed 12 types of activities in bedroom (Table 8).

Table 9: Functional Capacity of Respondents: Extent of Activities performed by the Respondent in bedroom

Functional capacity	Range	Respondents n=85	
		f	%
Low	12-28	3	3.5
Moderate	29-44	52	61.7
High	45-60	30	35.3

Activities in bedroom were performed by more than 60 per cent of respondents up to medium extent, while around 35 per cent respondents performed activities in bedroom up to a great extent (Table 9, Fig 29). Thus, it was concluded that majority of the respondents had moderate level of functional capacity.

On the basis of the result regarding activities performed in kitchen and bedroom, it was concluded that respondents had moderate functional capacity.

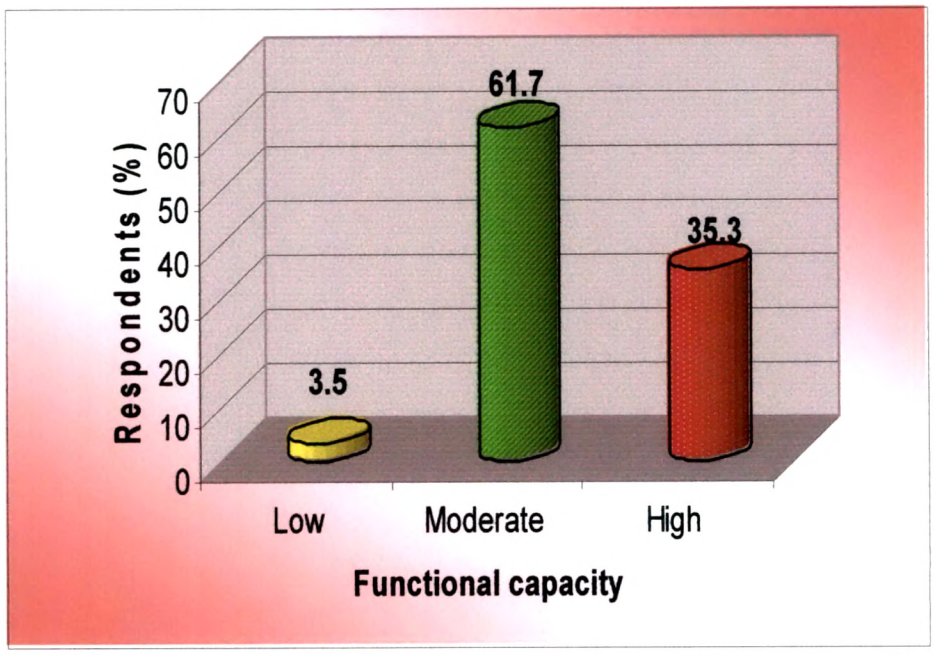


Fig 29. Extent of Functional capacity of the respondents in Bedroom

4.2.2 General health condition as perceived by the respondents

Health problems exist among human beings of all age groups, but rather range and frequency is more varied and intensive in old age. Ill health and diseases are more common among the elderly because of the degenerative changes in the human body making it more susceptible to diseases accompanied by low resistance. The information regarding general health status as perceived by the respondents in the present study was incorporated in this part.

Table 10: Perception of the Respondents for their own general health condition

Health condition	Respondents n = 85	
	f	%
Excellent	-	-
Appropriate for age	27	31.8
Fair enough	50	58.8
Poor	8	9.4
Total	85	100

It was found that more than fifty per cent respondents perceived their health fair enough, whereas around 32 per cent respondents perceived their health appropriate for age. According to 9 per cent respondents they had poor health condition (Table 10, Fig 30). Study conducted by **Rajan et.al. (1999)** on elder women revealed the information about their health status (self rated) and the study shows that majority (65.4 per cent) of the respondents rated themselves fairly all right, 24 per cent rated themselves healthy however only 10.6 per cent respondents stated that they were unhealthy.

Similar study was conducted by **Gowri et.al. (2003)** which shows steady decline in self perceived health status of elderly women with advancement in their age, thus confirming inverse relationship between them. Among the elderly the tendency to rate one's health status as poor is greater with increase in age.

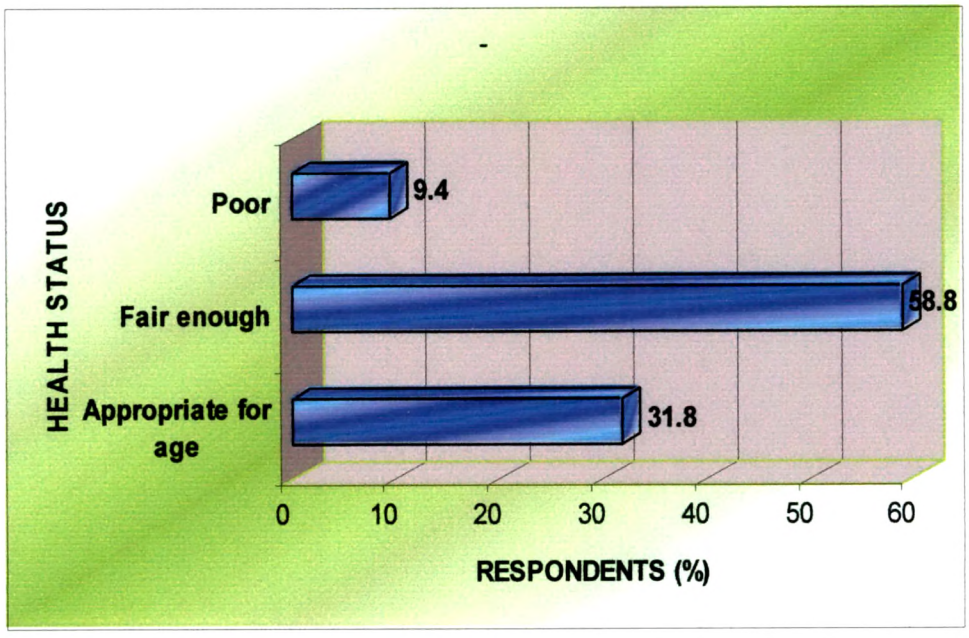


Fig 30. Perception of the Respondents for their own general health status

4.2.3 Status of body organs as perceived by respondents

This portion of the health section consists information with regard to status of the body organs as perceived by the respondents

Table 11: Distribution of Respondents as per Status of body organs as perceived by them

S. No.	Body Organs	Respondents n=85	
		f	%
1	**Eyes**		
	• Normal	27	31.8
	• Have cataract	15	17.6
	• Use spectacles	43	50.6
2	**Ears**		
	• Normal	49	57.6
	• Uses hearing aid	17	20
	• Not able to listen properly but do not use hearing aid	19	22.4
3	**Tongue**		
	• Normal	46	54.1
	• Poor liking for different taste	6	7.1
	• Cannot consume spicy food	20	23.5
	• Specific diet based	13	15.3
4	**Nose**		
	• Normal	70	82.4
	• Weak	15	17.6
5	**Limbs**		
	• Normal	81	95.3
	• Need stick support	4	4.7
6	**Sense**		
	• Good	85	100
	• Poor	0	0

As regards to status of body organ of the respondents, little more than 50 percent respondents used spectacles to see, 57 percent respondents could hear normally. All the respondents reported that they had good sensitivity whereas; around 95 percent respondents could walk properly without any support. It was found that more than 82 percent respondents had normal smelling sensation while, 54 percent respondents had normal taste for different food. Study done by **Rajan et.al. (1999)** on elder women reveals the information regarding types

of disability/impairment found among them and the study shows that 31.4 per cent respondents have poor eyesight, 10.9 per cent have hearing problem and 17.1 per cent respondent states problem in walking. Whereas it was found that 27 per cent of those having poor eyesight use spectacles and the same (aids) for those with hearing and walking handicap were 2.3 per cent and 8.6 per cent respectively.

4.2.4 Disease or ailment profile of the respondents

Old age brings with it several deleterious changes. As one ages the physiological system becomes increasingly less efficient and less resistant to diseases. This part comprises of information related to major/minor diseases among respondents. The respondents reported the presence of diseases from which they were suffering as well as severity of the disease that they had.

On the basis of respondent's medical reports & individual respondents responses it was revealed that about 56 per cent respondents were suffering from general weakness, around 41 percent respondents were suffering from diabetes mellitus and almost equal number of respondents were suffering from blood pressure (36.5 percent) and hypertension (35.3 percent). Very few respondents were suffering from Enlarged heart (2.4 percent) and Ischemic heart disease. Neither of the respondents was found to be suffering from Engina, Citica, Trembling of limbs, Neurological problems and Virtigo (Table 12). Study conducted by **Fallon et al. (2002)** on 300 elder people revealed that the most prevalent health concerns were arthritis (52.7 %), high blood pressure (40.3 %) and heart trouble (26.0 %). In another study conducted by **Kashyap (2007)** on elder male and female shows that majority of the respondents had minor problems like dental problems, diarrhea, constipation, body ache, general weakness and gaseous distension. Major diseases identified were hypertension, osteoporosis, heart disease and asthma in both sexes.

Table 12: Frequency and percentage distribution of Respondents as per their Disease or ailments Profile

		Respondents n=85				Extent of severity of Diseases/ailments					
		Not present		Present							
		Presence of disease/ailments				Mild		Moderate		severe	
		f	%	f	%	f	%	f	%	f	%
1	Ischemic heart disease	84	98.8	1	1.2	-	-	-	-	1	1.2
2	Engina	85	100	-	-	-	-	-	-	-	-
3	Enlarges heart	83	97.6	2	2.4	-	-	1	1.2	1	1.2
4	Weak heart	63	74.1	22	25.9	6	7.05	12	14.1	4	4.7
5	Hypertension	55	64.7	30	35.3	7	8.23	16	18.82	7	8.23
6	Blood pressure	54	63.5	31	36.5	10	11.76	15	17.64	6	7.05
7	Rheumatoid arthritis/osteoarthritis	62	72.9	23	27.1	2	2.35	13	15.3	1	1.2
8	Spondylities	69	81.2	16	18.8	2	2.35	13	15.3	1	1.2
9	Citica	85	100	-	-	-	-	-	-	-	-
10	Stiffness in bones	67	78.8	18	21.2	7	8.23	8	9.41	3	3.52
11	Stomach problem	58	68.2	27	31.8	6	7.05	13	15.3	8	9.41
12	Duodenal ulcer	71	83.5	14	16.5	3	3.52	8	9.41	3	3.52
13	Liner disease	72	84.7	13	15.3	4	4.7	8	9.41	1	1.2
14	Gynec/obstetric problem	58	68.2	27	31.8	9	10.53	13	15.3	5	5.9
15	Trembling Of Limbs	85	100	-	-	-	-	-	-	-	-
16	Respiratory problems/Asthma	67	78.8	18	21.2	11	12.94	5	5.9	2	2.4
17	Neurological Problem	85	100	-	-	-	-	-	-	-	-
18	Tuberculosis	79	92.9	6	7.1	2	2.4	3	3.52	1	1.2
19	Diabetes mellitus	50	58.8	35	41.2	16	18.82	13	15.29	6	7.05
20	Virtigo	85	100	-	-	-	-	-	-	-	-
21	Kidney problem	62	72.9	23	27.1	9	10.58	7	8.23	7	8.23
22	General weakness	37	43.7	48	56.5	12	14.11	23	27.05	13	15.3
23	Thyroidism	67	78.8	18	21.2	5	5.9	10	11.76	3	3.52

Extent of severe-ness of diseases/ailment

On the basis of the obtained scores, range was made to find out the extent of severity of diseases for which the respondents were suffering.

Table 13: Distribution of Respondents as per Extent of severity of diseases/ailments

Diseases	Range	Respondents n=85	
		f	%
Mild	23-30	74	87.05
Moderate	31-38	11	12.94
Severe	39-46	-	-
	Total	**85**	**100**

It was found that maximum number of respondents (87.05 percent) was suffering from mild health problems whereas; only 12 percent respondents were having health related problems up to moderate extent (Table 13, Fig 31). Due to less health problems the respondents can carry out daily living activities normally as well as were able to use storage units of the selected areas of the house.

4.2.5 Problems related to movement of various body parts

This part consists of information on problems in movement of various body parts and its severity. The respondents were asked to state whether they faced the problems related to movement of various body parts. If they faced, then they had to state the severity of the problem. Table 14 shows the various problems of the respondents in movement of body parts.

On assessing the problems in movement of body parts of the respondents it was revealed that, almost similar number of respondents were having problem in movement of both legs (57.6 percent) and doing task in squatting position (56.5 percent). Around 52 percent respondents were facing problem in getting up from the floor while, little more than 50 percent respondents reported that they face problem in re-standing from squatting position. It was found that least number of respondents were having problem in sitting down on chair (11.8 percent) and getting up from chair (11.8 percent).

Table 14 Frequency and percentage distribution of respondents as per the Problems in movement of body parts (n=85)

S. No.	Problems	Facing of problems				Severity of problems					
		Do not face problem		Face problem		Low extent		Somewhat		Great extent	
		f	%	f	%	f	%	f	%	f	%
1	Moving neck/head										
	a) Right	-	-	-	-	-	-	-	-	-	-
	b) Left	-	-	-	-	-	-	-	-	-	-
	c) Upward	-	-	-	-	-	-	-	-	-	-
	d) Downward	-	-	-	-	-	-	-	-	-	-
	e) All direction	61	71.8	24	28.2	2	2.4	12	14.1	10	11.8
2	Stretching arm to reach the things										
	a) Right arm	-	-	-		-	-	-	-	-	-
	b) Left arm	-	-	-	-	-	-	-	-	-	-
	c) Both arm	57	67.1	28	32.9	5	5.9	16	18.82	7	8.23
3	Lifting arm to shoulder height for picking/placing the articles										
	a) Right arm	-	-	-	-	-	-	-	-	-	-
	b) Left arm	-	-	-	-	-	-	-	-	-	-
	c) Both arm	51	60	34	40	6	7.05	21	24.70	7	8.23
4	Lifting and stretching arm overhead for picking/placing the articles										
	a) Right arm	-	-	-	-	-	-	-	-	-	-
	b) Left arm	-	-	-	-	-	-	-	-	-	-
	c) Both arm	51	60	34	40	6	7.05	21	24.70	7	8.23
5	Bending down back	55	64.7	30	35.3	7	8.23	16	18.82	7	8.23
6	Twisting waist	64	75.3	21	24.7	6	7.05	9	10.53	6	7.05
7	Moving wrist	67	78.8	18	21.2	3	3.52	13	15.3	2	2.4
8	Moving elbow	68	80	17	20	3	3.52	12	14.11	2	2.4

9	Movement of fingers	62	72.9	23	27.1	5	5.9	16	18.82	2	2.4
10	Grasping things in hand	69	81.2	16	18.8	4	4.7	10	11.8	2	2.4
11	Applying efforts in opening/closing the doors/Panels/drawers	73	85.9	12	14.1	3	3.52	9	10.53	-	-
12	Turning/holding knobs with fingers	70	82.4	15	17.6	3	3.52	12	14.11	-	-
13	Movement of legs a) Right leg b) Left leg c) Both leg	36	42.4	49	57.6	15	17.64	20	23.52	14	16.5
14	Bending knees	50	58.8	35	41.2	9	10.53	16	18.82	10	11.8
15	Sitting in squatting position	56	65.7	29	34.1	9	10.53	10	11.8	10	11.8
16	Doing task in squatting position	37	43.5	48	56.5	21	24.70	17	20	10	11.8
17	Re-standing from squatting position	42	49.5	43	50.6	18	21.2	15	17.64	10	11.8
18	Raising on toes to lift things	48	56.5	37	43.5	17	20	10	11.8	10	11.8
19	Not able to re-stand after sitting on surface of lower height	53	62.4	32	37.6	11	12.94	11	12.94	10	11.8
20	Pain in knees while climbing stairs	53	62.4	32	37.6	17	20	15	17.64	-	-
21	Pain in calf mules while climbing stairs	51	60	34	40	19	22.4	15	17.64	-	-
22	Pain in legs while climbing stairs	50	58.8	35	41.2	20	23.52	15	17.64	-	-
23	Increased breath/pulse rate while climbing stairs	55	64.7	30	35.3	14	16.5	14	16.5	2	2.4
24	Sitting down on chair	75	88.2	10	11.8	2	2.4	3	3.52	5	5.9
25	Getting up from chair	75	88.2	10	11.8	2	2.4	3	3.52	5	5.9
26	Sitting down on floor	58	68.2	27	31.8	8	9.41	10	11.8	9	10.5
27	Getting up from floor	40	47.1	45	52.9	20	23.52	16	18.82	9	10.5

Extent of problem faced in movement of body parts

The severity of problems perceived by the respondents was given a score of 3 to 1 for high to low extent. Each respondent had some or the other problem (Table 14).

On the basis of obtained scores range was formed to find out the extent of problems faced by the respondents in moving various body parts.

Table: 15 Distribution of Respondents as per Extent of Problem faced in movement of body parts

Extent of problems in movement	Range of scores	Respondents n = 85	
		f	%
Low	27-36	48	56.47
Moderate	37-45	37	43.52
High	46-54	-	-
	Total	**85**	**100**

The table 15 depicts that more than fifty percent (56.47 percent) of respondents were having low problems in movement of body parts; while around 43 percent respondents fell in the category of moderate problems. However not a single person was suffering from problems in movement of body parts to a high extent (Fig 32).

4.2.6 Body trouble experienced by the respondents

The information regarding trouble in body parts faced by the respondents were presented in this part. The NIOSH scale was modified for the present study. The respondents were asked to state whether they experience trouble in their body parts or not. Response of 'Yes' was assigned '2' and response of 'No' was given '1'. The higher the score more were the trouble in body of the respondents. The findings of this part of health status support the result of previous part (i.e problem in movement of body parts) of health status.

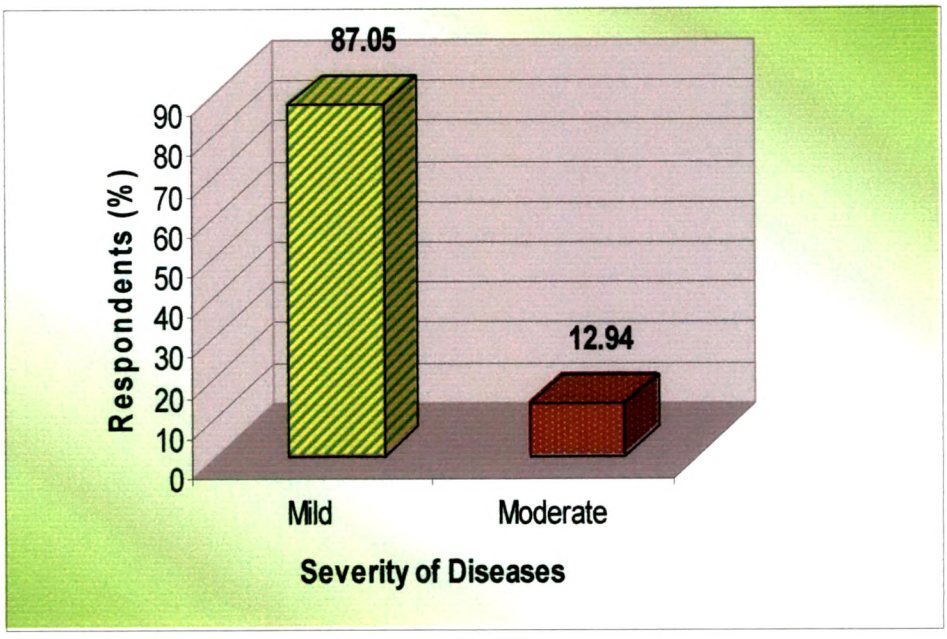


Fig 31. Extent of severity of diseases/ailments felt by the respondents

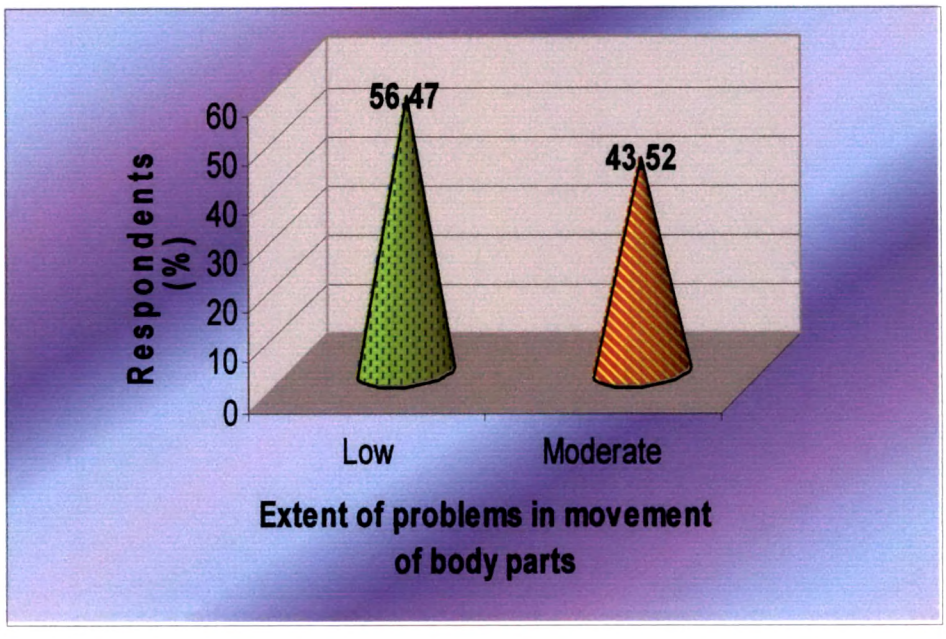


Fig 32. Extent of problems in movement of body parts felt by the respondents

As regard to trouble in body of the respondents, almost similar numbers of the respondents were having trouble in knees (48.2 percent) and hips/thighs or buttock (47.1 percent). It was found that least number of respondents was having trouble in neck (28.2 percent).

Table 16: Frequency and Percentage distribution of respondents according to trouble in body experienced by them.

Sr. No.	Body Parts	Respondents n=85			
		Do not experience trouble		Experience trouble	
		f	%	f	%
1	Neck	61	71.8	24	28.2
2	Shoulder				
	a) In right shoulder	-	-	-	-
	b) In left shoulder	-	-	-	-
	c) In both shoulder	51	60	34	40
3	Elbow				
	a) In right elbow	-	-	-	-
	b) In left elbow	-	-	-	-
	c) In both elbow	52	61.2	33	38.8
4	Wrists/hand				
	a) In right wrists/hand	-	-	-	-
	b) In left wrists/hand	-	-	-	-
	c) In both wrists/hand	60	70.6	25	29.4
5	Upper back	57	67.1	28	32.9
6	Lower back	54	63.5	31	36.5
7	One or Both hips/ thighs/ buttock	45	52.9	40	47.1
8	One or both knees	44	51.8	41	48.2
9	One or both ankles/feet	51	60	34	40

Extent of body trouble in various parts of the body

On the basis of possible scores, range was formed to find out the extent of body trouble faced by the respondents in various body parts.

Table 17: Extent of body trouble in various parts of the body

Extent of body trouble	Range of scores	Respondents n=85	
		f	%
Least	9-12	57	67.05
Somewhat	13-15	27	31.8
Great	16-18	1	1.2

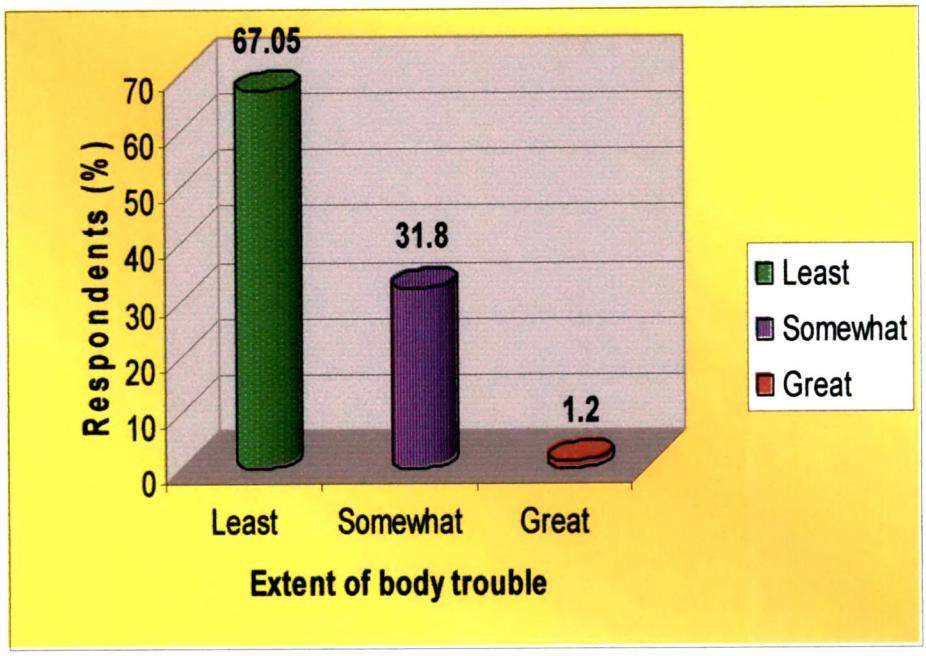


Fig 33. Extent of body Trouble faced by the respondents

Majority of (67.05 percent) of respondents were having least body trouble whereas; around 31 percent were some what suffering trouble in body. Only one respondent was facing body trouble to a great extent (Fig 33).

Inability of the respondents to carry out normal activities due to trouble in body

In this part the respondents were made to state that whether the various trouble in their body parts were making them in-able to carry out normal daily life activities or not.

Table 18: Frequency and Percentage distribution of respondents according to their inability to carry out normal activities due to trouble in body

Sr. No.	Body Parts	Respondents n=85			
		No problem		Inability due to trouble	
		f	%	f	%
1	Neck	84	98.8	1	1.2
2	Shoulder	83	97.6	2	2.4
3	Elbow	85	100	-	-
4	Wrists/hand	85	100	-	-
5	Upper back	84	98.8	1	1.2
6	Lower back	84	98.8	1	1.2
7	hips//thighs/buttock	82	96.5	3	3.5
8	knees	76	89.4	9	10.6
9	Ankles/feet	77	90.6	8	9.4

A wide majority of respondents did not face any problem in carrying out normal activities due to trouble in body. While, almost similar number of respondents faced problem in carrying out normal activities due to trouble in knees (10.6 percent) and Ankle/feet (9.4 percent). It was found that only one respondent was having problem in carrying out activities due to trouble in neck, upper back and lower back.

Section: 3

4.3 Anthropometric and reach measurements

4.3.1 Anthropometric Measurements:

Knowledge of anthropometric dimensions is an important requisite for the designing of work space, work place and equipment. Older populations

have different body measures compared to younger people. **Stoudt (1981)** found that 65-74 year old male subjects were on an average of 61 mm shorter than young subjects (aged 18-24 years). Elderly women were about 51 mm shorter than a younger group. Anthropometry of standing and sitting position of 85 elder women, aged between 60-70 years was studied. Anthropometric measurements of elderly were taken in both sitting and standing. Measurements were made with elderly people wearing light clothing with bare feet. An adequate description of the human body may require over 300 measurements **(Roebuck, Kromer and Thompson, 1975; Pheasant 1986).**

The scope of this study was limited to measuring those body dimensions that were considered important and useful for developing guidelines for storage space which are ergonomically appropriate for people in third age. In all 36 body dimensions were selected for measurements. 5^{th}, 50^{th} and 95^{th} percentiles as well as Standard deviation, average values are presented in Table 4.3.1. The detailed analysis of anthropometric measurements is presented in this section. Based on the obtained range of measurement for each body dimension, three-categories were formulated on the basis of equal interval to group the respondents as to having small, medium and large/ short, medium and tall body dimensions.

4.3.1.1 Heights

Normal Standing Height: The mean normal standing height of the women was found to be 154.5 cm. Maximum numbers of respondents were having medium height ranging from 152-159 cm (Table 19, Fig 34). Kashyap (2007) in her study on old age homes reported mean standing height of elder men and women as 154.2 and 141.6 cms, respectively.

Eye Level Height: More than 50 percent respondents belonged to medium eye level height, and the mean eye level height of the respondents was found to be 143.3 cms (Table 19, Fig 34).

Shoulder Height: The mean shoulder height of the respondents was 131.4 cms (5^{th}, 50th and 95^{th} percentile were found to be 122.6, 132 and 139 cms respectively) (Table 19, Fig 34).

Elbow Height: The mean elbow height of the respondents was found to be 98.6 cms, while majority of the respondents belonged to medium elbow height category (Table 19, Fig 34).

Abdominal Extension Height: The mean abdominal extension height of the respondents was 93.5 cms, (5^{th}, 50th and 95^{th} percentile were found to be 86.7, 94.5 and 99 cms respectively) More than 55 per cent respondents had tall abdominal extension height (Table 19, Fig 34).

Waist height: The mean waist height of the respondents was 96.9 cms. Around 55 per cent respondents fell in the category of tall waist height (Table 19, Fig 34).

Buttock Extension Height: The mean buttock extension height of the respondents was found to be 85.2 cms. While more than half of the respondents had medium buttock extension height (Table 19, Fig 34).

Knuckle Height: The mean knuckle height of the respondents was found to be 69.02 cms (Table 19, Fig 34).

Dactyl ion Height: The mean dactyl lion height of the respondents was 61.4 cms (5^{th}, 50^{th} and 95^{th} percentile of the respondents were found to be 57, 61, and 67.6 cms., respectively) (Table 19, Fig 34).

4.3.1.2 Breadths and Depths

Span: The mean span size of the respondents was 160.5 cms. It was found that around 54 per cent respondents were having medium size span (Table 19, Fig 35).

Span Akimbo: The mean span akimbo of the respondents was found to be 91.1 cms (5^{th}, 50^{th} and 95^{th} Percentile of the respondents were 86, 92 and 98 cms respectively). Around 47 per cent respondents were having medium span akimbo size (Table 19, Fig 35).

Maximum Body Breadth, Relaxed: The mean maximum body breath, relaxed was found to be 52.8 cms (Table 19, Fig 35).

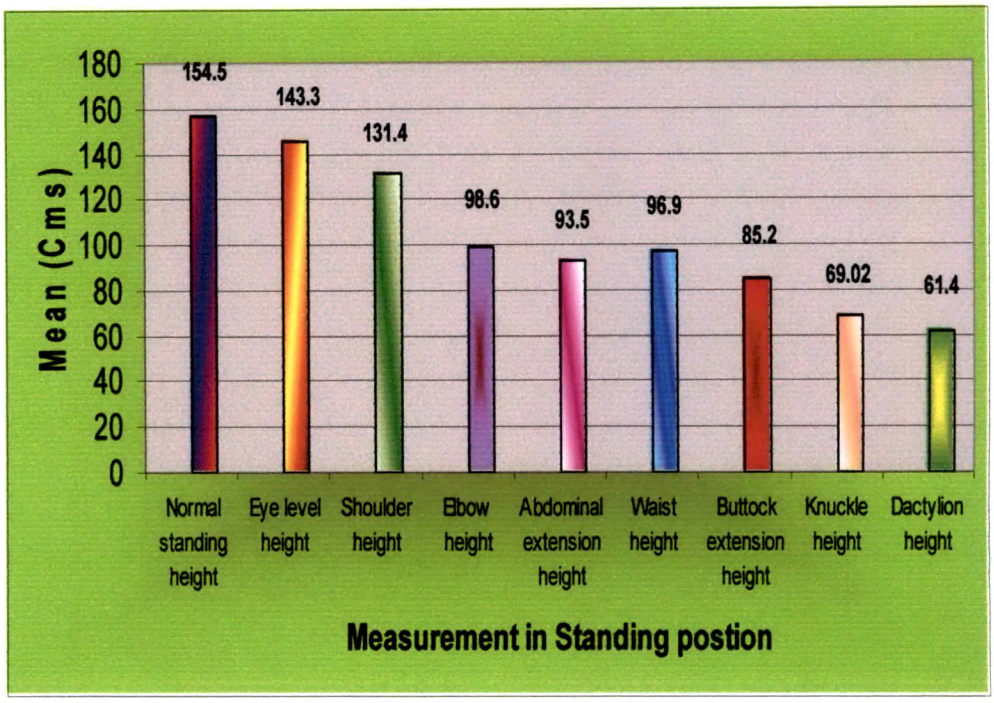


Fig 34. Anthropometric measurements of the respondents in Standing position

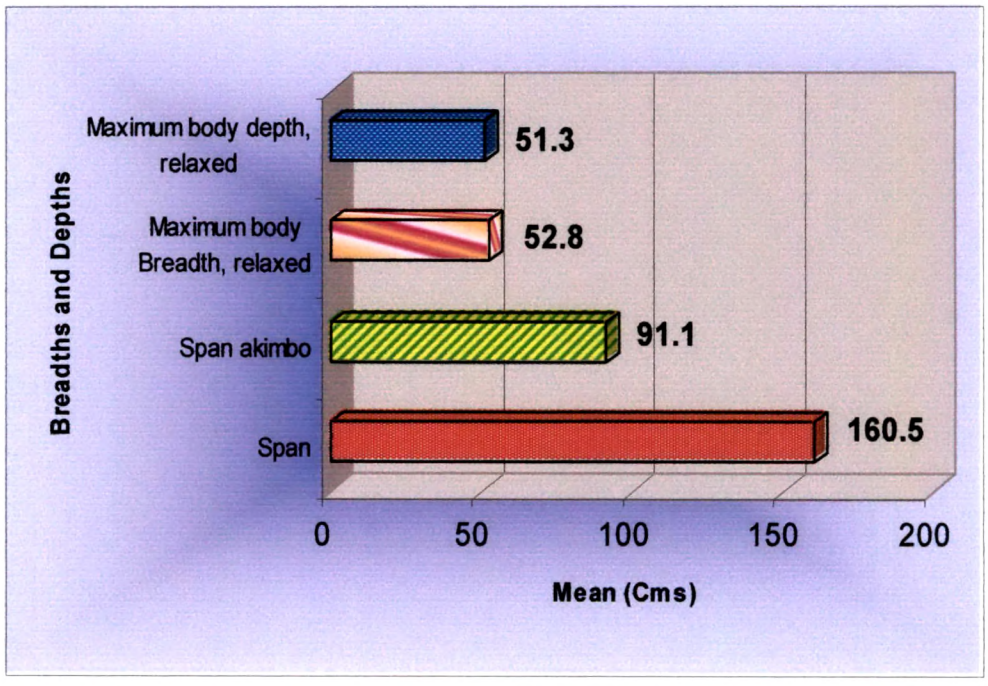


Fig 35. Breadths and Depth measurements of the respondents

Maximum Body Depth, Relaxed: The mean maximum body depth, relaxed was found 51.3 cms (5^{th}, 50^{th} and 95^{th} percentile of the respondents were found to be 44, 52 and 60 cms respectively) (Table 19, Fig 35).

4.3.1.3 Circumferences

Chest: The mean chest circumference of the respondents was found to be 93.3 cms. It was found that most (43.33 %) respondents were having small chest circumference.

Abdominal Extension: The mean abdominal extension circumference was 98.6 cms (5^{th}, 50^{th} and 95^{th} percentiles of the respondents were found to be 83.7, 99.5 and 117.8 cms respectively) (Fig 36).

Waist: The mean waist circumference of the respondents was found to be 85.5 cms, whereas, 40 per cent respondents belong to medium size waist circumference category ranging from 80 to 92 cms (Table 19, Fig 36).

Hip at Gluteal Extension: The mean hip at gluteal extension circumference was found to be 100.5 cms. Around 45 percent respondents were having medium size hip at gluteal extension circumference (Fig 36).

Wrist: The mean wrist circumference of the respondents was 16.1 cms. It was found that majority of the respondents (62.35 per cent) had medium size wrist circumference (Fig 36).

4.3.1.4 Arm Reach length and Height in standing:

Vertical upward arm reach, from floor: The mean vertical upward arm reach, from floor, of the respondents was 194.2 cm (5^{th}, 50^{th} and 95^{th} percentile was found to be 184.3, 195 an 210 cms, respectively), (Table 19, Fig 37).

Maximum vertical arm reach, body raised on toe: The maximum vertical arm reach body raised on toe was 201.5 cms. A little more than fifty percent respondents falls in medium reach category of maximum vertical arm reach, body raised on toe.

Comfortable vertical upward grasp reach from the floor: The mean comfortable vertical grasp reach from the floor of the respondent was found to be 187.2 cms. Maximum respondents (47.10 per cent) were having tall

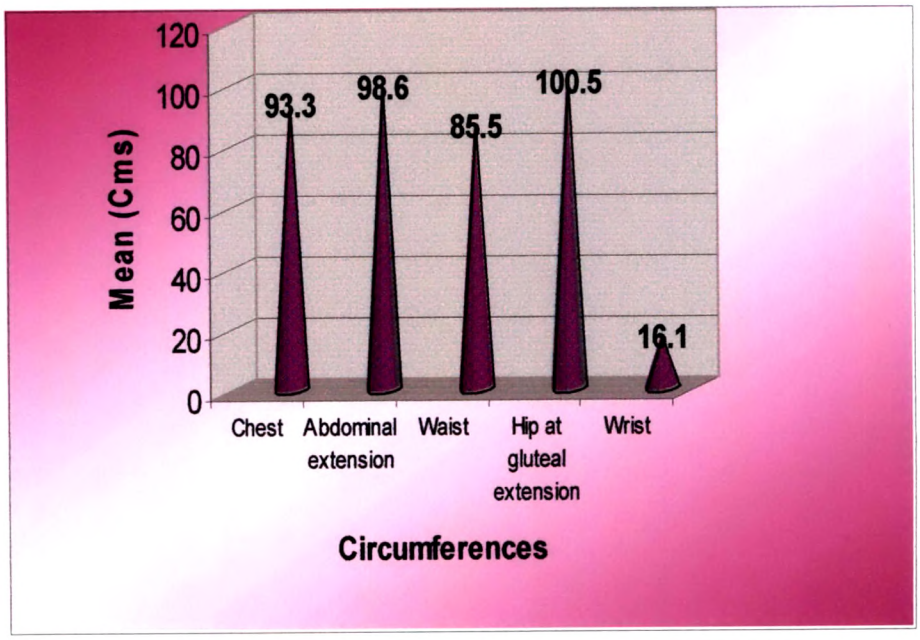


Fig 36. Circumference measurements of the respondents

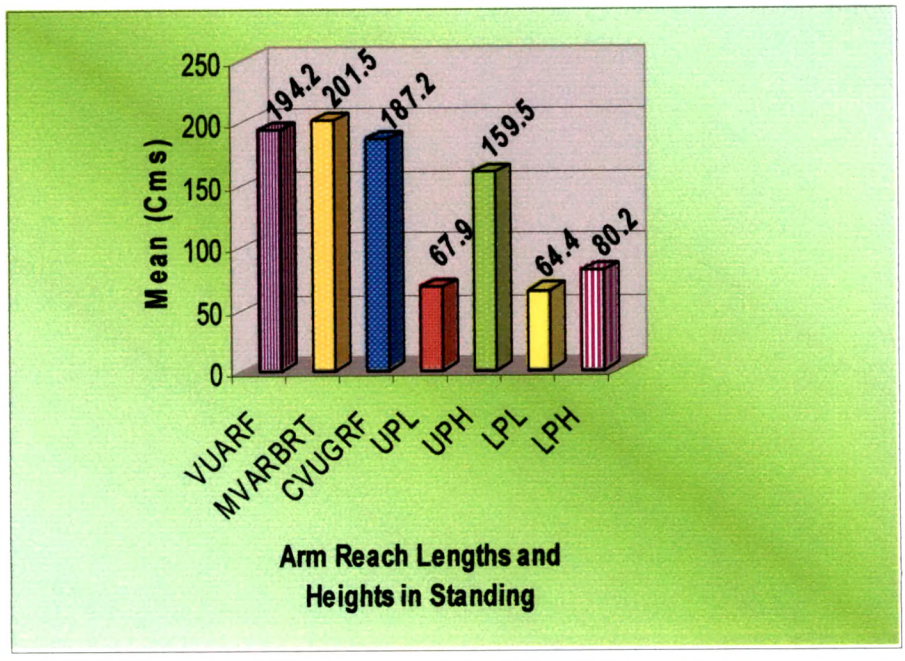


Fig 37. Arm reach lengths and Height measurements of the respondents in Standing position

VUARF: Vertical upward arm reach from floor
MVARBRT: Maximum vertical arm reach body raised on toes
CVUGRF: Comfortable vertical upward arm reach
UPL: Upper position length
UPH: Upper position height
LPL: Lower position length
LPH: Lower position height

comfortable vertical upward grasp reach from the floor ranging from 191-201 cms (Fig 37).

Upper position length: The mean upper position length of the respondents was 67.9 cms (5^{th}, 50^{th} and 95^{th} percentiles were found to be 58, 68 and 79.4 cms, respectively). Around 55 percent respondents were having medium upper position length ranging from 66-74 cms (Table 19, Fig 37).

Upper position height: The mean upper position height of the respondents was 159.5 cms, (5^{th}, 50^{th} and 95^{th} percentile was found to be 147.2, 160 and 173 cms, respectively). (Fig 37).

Lower position length: The mean lower position length of the respondents was 64.4 cms. Around 50 percent respondents were having medium size lower position length.

Lower position height: The mean lower position height of the respondents was 80.2 cms. More than fifty five percent respondents were having medium size lower position height (Fig 37).

4.3.1.5 In Leaning Position

Upper position length: The mean upper position length of the respondents was 88.9 cms (5^{th}, 50^{th} and 95^{th} percentiles were found to be 75, 90 and 99.5 cms, respectively). The upper position length in leaning position varied from 70 to 101 cms (Table 19, Fig 38).

Upper position height: The mean upper position height in leaning position of the respondents was 140.9 cms. Around 45 per cent respondents fell in the category of medium size upper position height (Fig 38).

Lower position length: The mean lower position length of the respondents was 71.4 cms. Around 55 per cent respondents were having medium size lower position length ranging from 64-78 cms (Fig 38).

Lower position height: The mean lower position height of the respondents was 34.2 cms. A little less than 45 per cent respondents were having medium size lower position height.

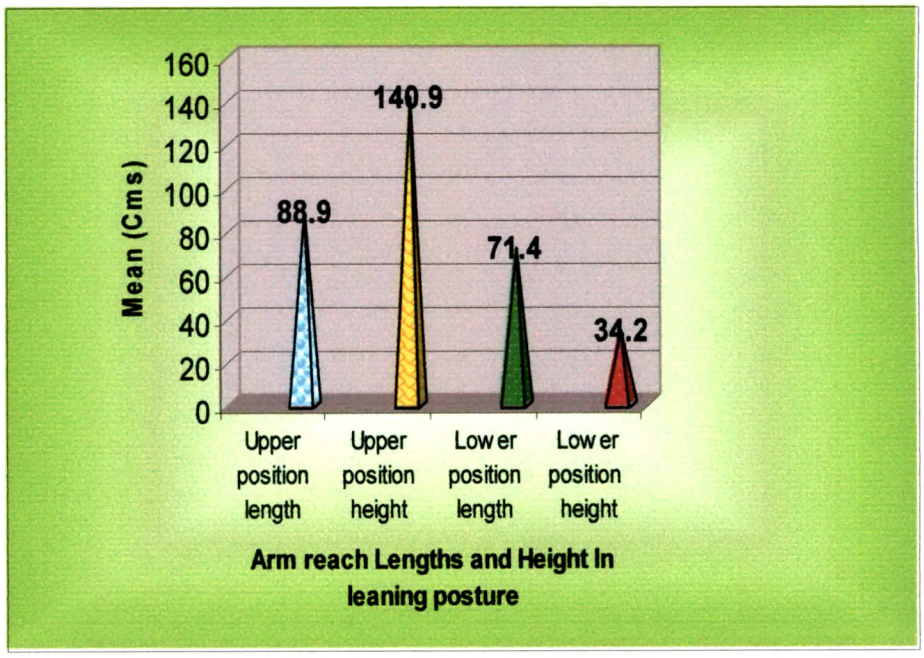


Fig 38. Arm reach lengths and Height measurements of the respondents in leaning position

Table 19: Dimension of Anthropometric variable of the respondents (cms)

Sr. No.	Variables Body Dimensions	Respondents n=85				Percentile			Minimum	Maximum
		f	%	Mean (cms)	S.D.	5th	50th	95th		
1	Normal standing height			154.5	5.4	147.5	154.8	165	144	167
	Short 144-151	20	23.53							
	Medium 152-159	42	49.41							
	Tall 160 -167	23	27.10							
2	Shoulder height			131.4	4.7	122.6	132	139	120	140
	Short 120-126	13	15.29							
	Medium 127-133	41	48.23							
	Tall 34-140	31	36.47							
3	Eye level height			143.3	5.3	136.7	143	153.7	131.5	155
	Short 131-139	9	10.59							
	Medium 140-147	44	51.76							
	Tall 148-155	32	37.65							
4	Elbow height			98.6	3.4	94.7	99	105	89.5	106
	Short 89-94	4	4.71							
	Medium 95-100	48	56.47							
	Tall 101-106	33	38.38							
5	Abdominal extension height			93.5	3.9	86.7	94.5	99	79.5	101
	Short 79-86	4	4.71							
	Medium 87-93	33	38.82							
	Tall 94-101	47	56.47							
6	Waist height			96.9	3.8	90.3	97	102.4	84.5	103
	Short 84-90	4	4.71							
	Medium 91-96	34	40							
	Tall 97-96	47	55.29							

7	Buttock extension height			85.2	4.1	79	85	92	76.5	100
	Short 76-84	39	45.88							
	Medium 85-92	44	51.76							
	Tall 93-100	2	2.35							
8	Knuckle height			69.02	4.7	63	69	76	57	89
	Short 57-67	30	35.29							
	Medium 68-78	53	62.35							
	Tall 79-89	2	2.35							
9	Dactylion height			61.4	3.04	57	61	67.6	55	69.8
	Short 55-60	36	42.35							
	Medium 61-65	41	48.23							
	Tall 66-70	8	9.41							
Breadths and Depths										
1	Span			160.5	5.3	151	159	169.7	148	170
	Small 148-155	14	16.47							
	Medium 156-162	46	54.12							
	Large 163 -170	25	29.41							
2	Span akimbo			91.1	3.9	86	92	98	82	100.5
	Small 82-89	30	35.29							
	Medium 90-95	40	47.16							
	Large 96-101	15	17.65							
3	Maximum body Breadth, relaxed			52.8	5.2	44	53	63.7	43	69
	Small 43-52	41	48.24							
	Medium 53-60	38	44.71							
	Large 61-69	6	7.06							
4	Maximum body depth, relaxed			51.3	4.6	44	52	60	39	60
	Small 39-46	17	20							
	Medium 47-53	39	45.88							
	Large 54-60	29	34.12							

Circumferences										
1	Chest			93.3	8.3	81	92	108.7	79	110
	Small 79-90	37	43.53							
	Medium 91-100	30	35.29							
	Large 101-110	18	21.18							
2	Abdominal extension			98.6	9.3	83.7	99.5	117.8	79	120
	Small 79-92	21	24.71							
	Medium 93-106	49	57.65							
	Large 107-120	15	17.65							
3	Waist			85.5	9.96	70	86	103.7	65	105
	Small 65-79	28	32.94							
	Medium 80-92	34	40							
	Large 93-105	23	27.10							
4	Hip at gluteal extension			100.5	7.9	88	102	115	85	120
	Small 85-97	34	40							
	Medium 98-108	39	45.88							
	Large 109-120	12	14.12							
5	Wrist			16.1	1.1	14	16	17	14	18.5
	Short 14-15	28	32.94							
	Medium 16-17	53	62.35							
	Large 18-19	4	4.71							
Arm Reach Lengths and Height in standing										
1	Vertical upward arm reach, from floor			194.2	8.2	184.3	195	210	176.5	219
	Short 176-191	23	27.10							
	Medium 192-205	48	56.47							
	Large 206-219	14	16.47							

2	Maximum vertical arm reach body raised on toe			201.5	9.03	189.9	200.5	216.7	182	225
	Short 182-197	23	27.10							
	Medium 198-211	44	51.76							
	Large 212-225	18	21.18							
3	Comfortable vertical upward grasp reach from the floor			187.2	7.1	177.6	188	200	169	201
	Short 169-180	9	10.59							
	Medium 181-180	36	42.35							
	Large 191-201	40	47.10							
4	Upper position length			67.9	6.4	58	68	79.4	55	84
	Short 55-65	27	31.76							
	Medium 66-74	47	55.29							
	Large 75-84	11	12.94							
5	Upper position height			159.5	7.7	147.2	160	173	145	174
	Short 145-155	26	30.59							
	Medium 156-164	39	45.88							
	Large 165-174	20	23.51							
6	Lower position length			64.4	5.8	54	63	74	51	80
	Short 51-61	29	34.12							
	Medium 62-70	43	50.59							
	Large 71-80	13	15.29							
7	Lower position height			80.2	6.1	68	80	89.9	64.8	96
	Short 64-75	20	23.51							
	Medium 76-85	50	58.82							
	Large 86-96	15	17.65							

In leaning posture										
1	Upper position length			88.9	6.95	75	89	99.5	70	101
	Short 70-81	12	14.12							
	Medium 82-91	43	50.59							
	Large 92-101	30	35.29							
2	Upper position height			140.9	12.4	115	141	159	112	164
	Short 112-130	18	21.18							
	Medium 131-147	39	45.88							
	Large 148-164	28	32.94							
3	Lower position length			71.4	9.8	54.3	72.5	90	48	93
	Short 48-63	18	21.18							
	Medium 64-78	47	55.29							
	Large 79-93	20	23.53							
4	Lower position height			34.2	6.6	23	34	44.5	21.5	48.5
	Short 21-31	32	37.65							
	Medium 32-40	37	43.53							
	Large 41-49	16	18.82							
In sitting										
1	Maximum horizontal reach			61.5	3.98	53.7	62	67.7	51	68
	Short 51-56	8	9.41							
	Medium 57-62	41	48.24							
	Large 63-68	36	42.35							
2	Minimum horizontal reach			34.07	2.2	30.5	34	38.4	29	39
	Short 29-32	21	24.71							
	Medium 33-36	52	61.18							
	Large 37-39	12	14.12							

Miscellaneous										
1	Inner arm length			63.2	3.9	58	64	71	56	71
	Short 56-61	23	27.10							
	Medium 62-66	36	42.35							
	Long 67-71	26	30.59							
2	Total arm length			67.5	3..6	64	66.5	74.9	62	75
	Short 62-66	17	20							
	Medium 67-71	35	41.18							
	Long 72-75	33	38.82							
3	Fore arm length			41.3	2.2	35	40.2	46	37	48
	Short 37-40	19	22.35							
	Medium 41-44	54	63.53							
	Long 45-48	12	14.14							
4	Hand length			17.8	0.94	16	18	19.4	16	20
	Short 16.0-17.3	27	31.76							
	Medium 17.4-18.7	44	51.76							
	Long 18.8-20	14	16.47							
5	Finger length			8.12	0.55	7.5	8	9	7	9
	Short 7.0-7.6	22	25.88							
	Medium 7.7-8.3	32	37.65							
	Long 8.4-9.0	31	36.47							
6	Elbow width			25.9	1.6	24	26	28.5	23	30
	Small 23-25	42	49.41							
	Medium 26-27	32	37.65							
	Large 28-30	11	12.94							

4.3.1.6 Measurements in Sitting Position

Maximum horizontal reach: The mean maximum horizontal reach of the respondents in sitting position was found to be 61.5 cms (5^{th}, 50^{th} and 95^{th} percentiles were found to be 53.7 62 and 67.7 cms respectively) (Table 19, Fig 39).

Minimum horizontal reach: The mean minimum horizontal reach of the respondents in sitting position was 34.07 cms. Majority of the respondents (61.18 per cent) were having medium size minimum horizontal reach (Fig 39).

4.3.1.7 Miscellaneous Measurements

Inner arm length: The mean inner arm length of the respondents was 63.2 cms. It was found that around 42 per cent respondents have medium size inner arm length (Table 19, Fig 40).

Total arm length: The mean total arm length of the respondents was 67.5 cms. (Fig 40).

Fore arm length: The mean fore arm length of the respondents was 41.3 cms. (Fig 40)

Hand Length: The mean palm length of the respondents was 17.8 cms. A little more than 50 per cent respondents had medium size hand length ranging from 17.4 – 18.7 cms. (Fig 40)

Finger length: The mean finger length of the respondents was 8.12 cms. Around 37 per cent respondents have medium size finger length.

Elbow Width: The mean elbow width of the respondents was 25.9 cms (5^{th},50^{th}, and 95^{th} percentile of the respondents were found to be 24, 26 and 28.5 cms, respectively) (Table 19, Fig 40).

Conclusion:

The data on various body dimensions revealed that more respondents fell into category of "medium" dimensions by and large, except a few respondents were either in large or small category.

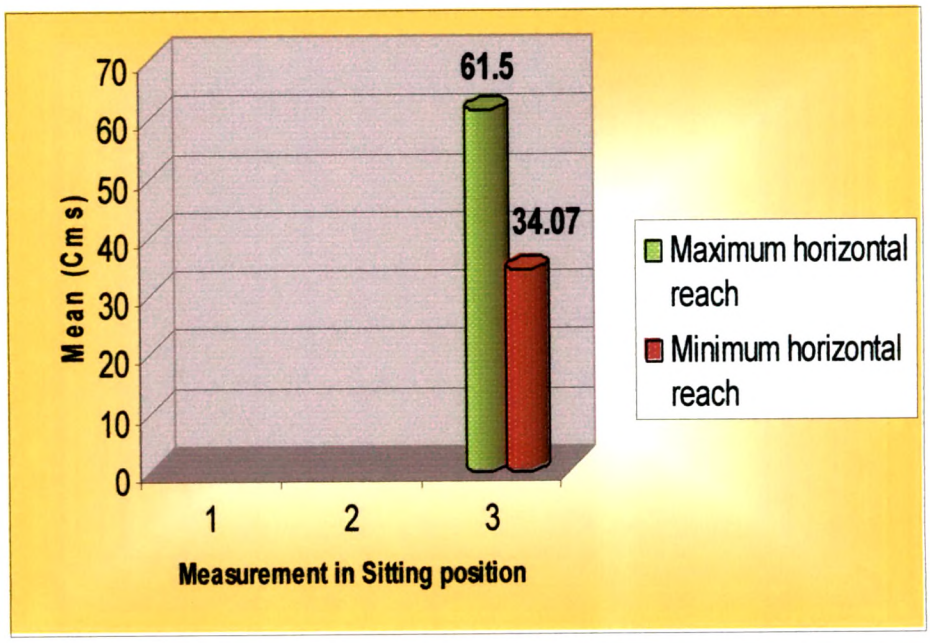


Fig 39. Anthropometric measurements of the respondents in Sitting position

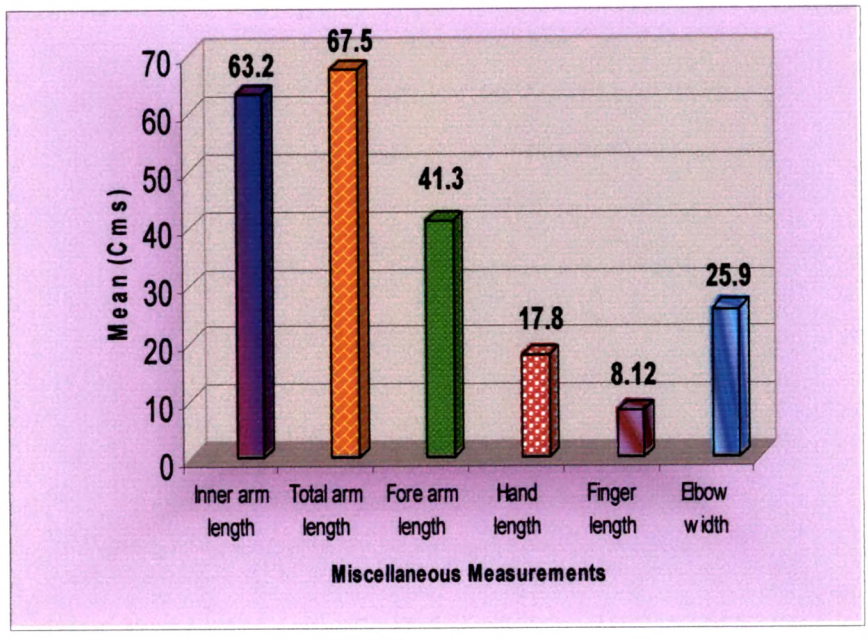


Fig 40. Miscellaneous measurements of the respondents

4.3.3 Comparison with other researches

An attempt was made in the present study to take measurements of various body dimensions so as to generate Data on one hand and to use this for developing guidelines for ergonomically appropriate kitchen, its storage and a storage unit for bedroom.

As review of literature revealed that some other researchers had also reported various body dimensions, it was considered appropriate to compare their findings with the findings of the present study. So as to cross validate the data of the present study. Those referred here are Sumangala (1995), Verma and Oberoi (2000) and Verma (2001). The comparison is presented in Table 20.

It was found that normal standing height was not taken by Sumangala (1995) and Verma and Oberoi (2000) had calculated its averages only. Verma (2001) had calculated its averages as well as 5^{th}, 50^{th} and 95^{th} percentile as it was done in the present study. It was envisaged that the average normal standing height, eye level height, shoulder height and elbow height of adult women was more than elder women. But the result differed in case of Sumangala (1995) as the dimensions of elder women were found more than that of adult women (Table 20). This difference may probably be due to the geographical region. The people from South Indian region are usually found shorter in dimensions than people from North India. The other standing heights such as abdominal extension height, knuckle height, and dactylion height were not measured by the other researchers except in the present study.

Except Sumangala (1995) the result of other studies showed that various heights such as normal standing height, eye level height, shoulder height and elbow height of elder women decreased with increasing age (Table 20).

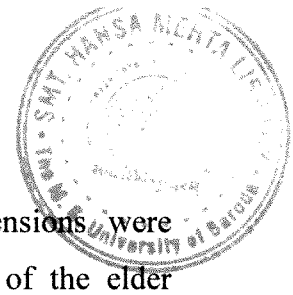
Similarly for measuring breadth and depth, only arm span was measured by Sumangala (1995) and present study while the other researchers have not done this exercise (Table 20). Difference was found between average span measurement of elder women and adult women, probably, due to geographical region.

Table 20: Comparison of dimension

Dimensions	Sumangala (1995)				Verma and Oberoi (2000)				Verma (2001)				Present Study			
	Mean	5th	50th	95th	Mean	5th	50th	95th	Mean	5th	50th	95th	Mean	5th	50th	95th
Standing heights																
Normal standing height	-	-	-	-	157.44	-	-	-	157.0	144.0	158.0	168.0	154.5	147.5	154.8	165
Stature height	152.33	137.54	147.85	152.85	-	-	-	-	-	-	-	-	-	-	-	-
Eyelevel height	141.39	130.36	139.17	149.77	145.91	-	-	-	146	135.1	148	155.2	143.3.	136.7	143	153.7
Shoulder height	-	-	-	-	132.50	-	-	-	129.8	120.1	131	140.3	131.4	122.6	132	139
Elbow height	93.89	87.20	93.90	101.67	112.89	-	-	-	99.2	91.5	98	110.1	98.6	94.7	99	105
Abdominal extension height	-	-	-	-	-	-	-	-	-	-	-	-	93.5	86.7	94.5	99
Waist height	-	-	-	-	-	-	-	-	-	-	-	-	96.9	90.3	97	102.4
Buttock extension height	-	-	-	-	-	-	-	-	-	-	-	-	85.2	79	85	92
Knuckle height	-	-	-	-	-	-	-	-	-	-	-	-	69.02	63	69	76
Dactylion height	-	-	-	-	-	-	-	-	-	-	-	-	61.4	57	61	67.6
Breadth and Depth																
Span	158.67	144.61	156.75	169.25	-	-	-	-	-	-	-	-	160.5	151	159	169.7
Span akimbo	-	-	-	-	-	-	-	-	-	-	-	-	91.1	86	92	98
Maximum, body Breath relaxed	-	-	-	-	-	-	-	-	-	-	-	-	52.8	44	53	63.7
Maximum body depth relaxed	-	-	-	-	-	-	-	-	-	-	-	-	51.3	44	52	60
Circumferences																
Chest	81.95	60.88	77.61	86.79	-	-	-	-	-	-	-	-	93.3	81	92	108.7
Abdominal extensions	86.53	63.71	81.19	101.87	-	-	-	-	-	-	-	-	98.6	83.7	99.5	117.8
Waist	70.91	49.49	65.85	84.04	-	-	-	-	-	-	-	-	85.5	70	86	103.7
Hip at Gluteal Extension	94.58	73	90.7	108.80	-	-	-	-	-	-	-	-	100.5	88	102	115
Wrist	-	-	-	-	-	-	-	-	-	-	-	-	16.1	14	16	17

Horizontal and Vertical reaches																
Vertical upward arm reach, from floor	186.61	-	-	-	193.73	-	-	-	-	-	-	-	194.2	184.3	195	210
Maximum vertical arm reach, body raised on toes	- -	-	-	-	-	-	- -	-	-	-	-	-	201.5	189.9	200.5	216.7
Comfortable vertical upward grasp reach from floor	-	-	-	-	-	-	-	-	-	-	-	-	187.2	177.6	188	200
Upper position length	-	-	-	-	-	-	-	-	-	-	-	-	67.9	58	68	79.4
Upper position height	-	-	-	-	-	-	-	-	-	-	-	-	159.5	147.2	160	173
Lower position length	-	-	-	-	-	-	-	-	-	-	-	-	64.4	54	63	74
Lower position height	-	-	-	-	-	-	-	-	-	-	-	-	80.2	68	80	89.9
In leaning position													88.9	75	89	99.5
Upper position length	-	-	-	-	-	-	-	-	-	-	-	-	140.9	115	141	159
Upper position height	-	-	-	-	-	-	-	-	-	-	-	-	34.2	23	34	44.5
Lower position height	-	-	-	-	-	-	-	-	-	-	-	-	71.4	54.3	72.5	90
Lower position length	-	-	-	-	-	-	-	-	-	-	-	-				

In sitting position																
Maximum horizontal reach	-	-	-	-	-	-	-	-	-	-	-	-	61.5	53.7	62	67.7
Minimum horizontal reach	-	-	-	-	-	-	-	-	-	-	-	-	34.07	30.5	34	38.4
Miscellaneous																
Inner arm length	-	-	-	-	64.69	-	-	-	-	-	-	-	63.2	58	64	71
Total arm length	-	-	-	-	71.56	-	-	-	68.1	57.0	69	75	67.5	64	66.5	74.9
Fore arm length	-	-	-	-	44.94	-	-	-	40.2	29.0	42	44.6	41.3	35	40.2	46
Palm length	-	-	-	-	18.07	-	-	-	-	-	-	-	17.8	16	18	19.4
Finger length	-	-	-	-	8.71	-	-	-	-	-	-	-	8.12	7.5	8	9
Elbow width	-	-	-	-	-	-	-	-	-	-	-	-	25.9	24	26	28.5



Except wrist measurement all the circumference dimensions were measured by Sumangala (1995). Circumference measurements of the elder women were found more than that of adult women. Hence, by the results of various research studies, it could be concluded that weight of elder women increased with increase in age (Table 20).

The horizontal and vertical reaches are considered as most important dimensions for designing storage heights and depths. It was found that except Verma (2001) vertical upward arm reach was taken by the remaining researchers. Beside this the researchers had not taken the dimensions as measured in the present study in standing, leaning as well as in sitting position which was very important for storage designing in kitchen and bedroom. Various miscellaneous dimensions were also measured in present study, which was also found shorter than other studies (Table 20).

Conclusion:

The comparison of data revealed that the measurements vary slightly which may be because of regional variation of difference in the life style, food habits, cultural values etc. of the selected respondents from all over the country.

Section: 4

4.4 Exiting storage facilities in Kitchen and Bedroom

This section consists of information regarding existing storage units in selected areas of the house. It is presented in detail with regard to (i) size of kitchen and bedroom, (ii) number of storage units, (iii) Age of the storage units, (iv) Material of storage units, (v) Lighting-Natural and artificial light inside storage unit, (vi) frequency of using storage units, and (vii) dimensions of existing storage units in kitchen and bedroom. The researcher herself observed and measured various aspects of storage units present in the houses of selected women in third age.

4.4.1 Existing storage units in Kitchen

Various type of storage units were found in kitchens of the respondents such as free-standing, built-in (upto6/7 feet), built-in wall cabinet, wall mounted cabinet, base cabinet, wall mounted rack, other rack, loft and built-in open shelves.

4.4.1.1 Size of Kitchen

The information regarding size of the kitchen of each respondent was gathered. The obtained range of minimum and maximum was divided into three categories having equal interval. Thus the size was decided as small, medium and large (Table 21).

Table 21: Information about Size of the kitchen

Dimension	Range (cms)	Respondents n= 85	
		f	%
Length			
Small	260-340	56	65.9
Medium	350-420	26	30.6
Large	430-500	3	3.5
Mean		328.24	
SD		48.65	
Breadth	250-304	35	41.2
Small	305-357	25	29.4
Medium	358-410	25	29.4
Large			
Mean		321.94	
SD		44.72	
Height	290-304	8	9.4
Small	305-317	14	16.5
Medium	318-330	63	74.1
Large			
Mean		321.76	
SD		10.60	

The mean dimensions i.e. length, breadth and depth of kitchen of the respondents were found to be 328.24 cms, 321.94 cms and 321.76 cms, respectively. However it was found that length and breadth of maximum kitchen fell into small dimension category on the obtained range.

4.4.1.2 Number and age of storage units in Kitchen:

Various types of storage units were found in the kitchen of the respondents. The storage units possessed by the respondents varied in number and age i.e. whether they were new or old.

Free-standing storage units were seen in 24 respondents' kitchen. Out of which majority of the respondents possessed only one free standing units in their kitchen. The mean age of the units was found to be 19.38 years (Table 22).

Built-in (6/7 feet) storage units were found in 23 respondent's house and from which around 95 per cent respondents had two single built in (6/7 feet) storage units in their kitchen. It was found that out of these more than 70 per cent built in (6/7 feet) storage units were 16 years and above old/obsolete, with mean age of 21.30 years.

Built-in wall cabinets were seen in kitchen of 27 respondents. Four built in wall cabinets were found in more than 40 per cent respondents' kitchen, with mean age of 17.04 years.

Wall mounted cabinets were possessed by 23 respondents. Three and five number of units was more prevalent as it was found in 26 percent respondents' kitchen respectively. More than 60 per cent wall mounted cabinets were 16 years or more old.

Base cabinets were found in 44 respondent's kitchen. Out of which around 34 per cent respondents had four numbers of base cabinets, with mean age of 17.11 years.

Wall mounted rack were possessed by 71 respondents. Majority of the respondents had only one wall mounted rack in their kitchen, with mean 18.76 years.

Other rack, a multipurpose type storage racks were possessed by 21 respondents. It was found that a little more than 50 per cent respondents had two number of other rack in their kitchen. The mean age of other rack was found as 12.62 years.

Plate 3: Free-Standing Storage Unit in Kitchen

Plate 4: Built-in (Upto 6/7 feet) Storage Unit in Kitchen

Plate 5: Built-in Wall Cabinet in Kitchen

Plate 6: Wall Mounted Cabinet in Kitchen

Plate 7: Base Cabinet in Kitchen

Plate 8: Wall Mounted Rack in Kitchen

Table 22: Frequency and percentage distribution of the respondents on the basis of Age and Number of storage units in Kitchen

Storage units	No. of units	Respondents		Age of the unit (in years)							
		f	%	1-5		6-10		11-15		16 & above	
				f	%	f	%	f	%	f	%
Free standing (n=24)	a. one	21	87.5	1	4.2	2	8.3	3	12.5	18	75
	b. Two	3	12.5								
	Mean			19.38							
	SD			7.57							
Built-in (upto 6/7) (n=23)	a. one	22	95.5	-	-	2	8.7	4	17.4	17	73.9
	b. Two	1	4.3								
	Mean			21.30							
	SD			7.96							
Built-in wall cabinet (n=27)	a. one	-	-	2	7.4	5	18.5	4	14.8	16	59.3
	b. Two	-	-								
	c. Three	3	11.1								
	d. Four	12	44.4								
	e. Five	7	25.9								
	f. Six	5	18.5								
	Mean			17.04							
	SD			7.88							

Wall mounted cabinet (=23)	a. one	1	4.3	2	8.7	3	13.0	3	13.0	15	65.2
	b. Two	-	-								
	c. Three	6	26.1								
	d. Four	4	17.4								
	e. Five	6	26.1								
	f. Six	5	21.7								
	g. Seven	1	4.3								
	Mean			17.30							
	SD			7.53							
Base cabinet (n=44)	a. one	-	-	3	6.8	8	18.2	7	15.9	26	59.1
	b. Two	-	-								
	c. Three	6	13.6								
	d. Four	15	34.1								
	e. Five	13	29.5								
	f. Six	9	20.5								
	g. Seven	1	2.3								
	Mean			17.11							
	SD			7.94							
Wall mounted rack (n=71)	a. one	67	94.4	-	-	12	16.9	13	18.3	46	64.8
	b. Two	4	5.6								
	Mean			18.76							
	SD			7.58							

Other rack (n=21)	a. One b. Two c. Three Mean SD	9 11 1	42.8 52.4 4.8	4 12.62 6.64	19.0	4	19.0	7	33.3	6	28.6
Loft (n=15)	a. One Mean SD	15	100	- 22.47 8.13	-	1	6.7	2	13.3	12	80
Built in Open shelves (n=35)	a. One b. Two Mean SD	- 35	- 100	- 22.86 5.94	-	-	-	4	11.4	31	88.6

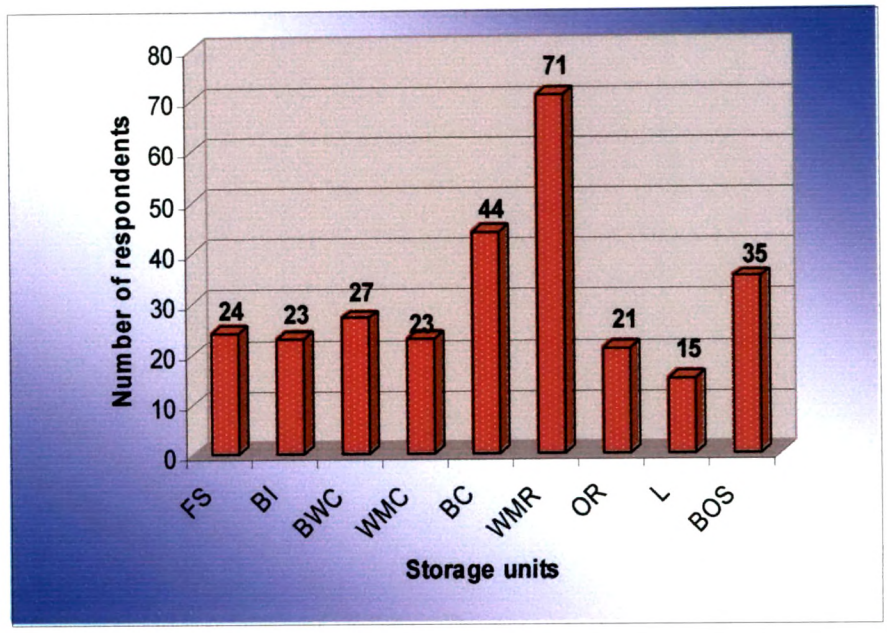


Fig 40 (a): Number of respondents possessing various kinds of storage units in kitchen

FS: Free standing storage unit
BI: Built-in (upto 6/7 feet) storage unit
BWC: Built-in wall cabinet
WMC: Wall mounted cabinet
BC: Base cabinet
WMR: Wall mounted rack
OR: Other rack
L: Loft
BOS: Open shelves

Loft was found in kitchen of 15 respondents and all of them had single loft in their kitchen. The mean age of loft was found as 22.47 years.

Built in open shelves were seen in 35 respondents kitchen. All of them possessed two built in open shelves in their kitchen, with mean age of 22.86 years.

On the basis of above results, it was concluded that majority of the respondents possessed only one free standing/built in (6/7 feet)/ wall mounted rack or loft in their kitchen, whereas, a large number of respondents had built-in wall cabinet/ wall mounted cabinets/base cabinets/other rack or built-in open shelves more than one in number in their kitchen. It was found that majority of the storage units possessed by the respondents were 16 years or older than that.

4.4.1.3 Material of storage units:

The various type of storage units found in kitchen's of the respondents were built/ constructed from different materials such as wood, iron, aluminum, steel, fiber plastic or simply they were open, finished with plaster.

Regarding material of the storage units it was found that majority of the free standing storage units were made of wood (Table 23), while very few free standing units seen in kitchen of the respondents were of iron (8.3 per cent) and fiber/plastic (12.5 per cent)

More than 50 per cent built in (up to 6/7 feet) storage units were constructed of wood, followed by open storage unit finished with plaster (34.8 per cent). Other material used in construction of built-in (up to 6/7 feet) storage unit was iron and fiber plastic.

Majority of the built-in wall cabinets, wall mounted cabinets and base cabinets were constructed from wood (74.1 per cent, 82.6 per cent and 81.8 per cent, respectively). The other material used in construction of these three types of storage units were fiber plastic (Table 23).

Most of the wall mounted rack found in kitchen of the respondents were made of steel (36.6 per cent), followed by iron (33.8 per cent). Wood and aluminum wall mounted rack were also seen in some kitchen of the respondents (14.1 percent and 15.5 per cent, respectively).

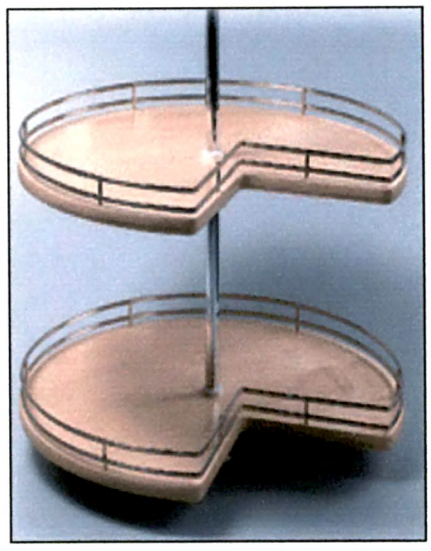


Plate 9: Other Rack in kitchen

Plate 10: Loft in Kitchen

Plate 11: Open Shelves in Kitchen

Table 23: Frequency and Percentage distribution of the Respondents on the basis of Material of storage units in Kitchen

Storage type	Material											
	Wood		Iron		Aluminum		Steel		Fiber/plastic		Open plastered	
	f	%	f	%	f	%	f	%	f	%	f	%
Free standing (n=24)	19	79.2	2	8.3	-	-	-	-	3	12.5	-	-
Built in (up to 6/7 feet) (n=23)	12	52.2	2	8.7	-	-	-	-	1	4.3	8	34.8
Built in Wall cabinet (n=27)	20	74.1	-	-	-	-	-	-	7	25.9		
Wall mounted cabinet (n=23)	19	82.6	-	-	-	-	-	-	4	17.4	-	-
Base cabinet (n=44)	36	81.8	-	-	-	-	-	-	8	18.2	-	-
Wall mounted rack (n=71)	10	14.1	24	33.8	11	15.5	26	36.6	-	-	-	-
Other rack (n=21)	1	4.8	11	52.4	-	-	3	14.3	6	28.5	-	-
Loft (n=15)	-	-	-	-	-	-	-	-	-	-	15	100
Built in open shelves (n=35)	-	-	-	-	-	-	-	-	-	-	35	100

Other rack made of iron was found in more than 50 per cent respondents' kitchen. The other materials seen were fiber plastic (28.5 per cent), steel (14.3 per cent) and wood (4.8 per cent)

All the loft and built-in open shelves found in kitchen of the respondents were open and finished with plaster and paint.

Overall it was concluded that wood was the most common material used for constructing storage units in kitchens' of the respondents.

4.4.1.4 Lighting inside storage units:

Good lighting is necessary if work is to be done well and in comfort. It must help people to see the details of their work with the greatest possible speed and clarity, it must provide safe and congenial working conditions and it must be easy to maintain and inexpensive to run **(Galer, 1987)**.

Vision is affected with age due to the natural physiological changes in the eye. The problems of decreased visual function with age relates to loss of accommodative power, absorption of light due to yellowing of lens, changes in the ocular media and losses of retinal transmission and sensitivity. With advancing age the vividness of blues and short blues becomes mutant and combined with scattering of light in the eyes light becomes less distinct. This results in colour distortion, and reduced sensitivity to contrast **(Rea, 1998).**

Due to age-related changes in the cells of the lens and retina, older adults require up to three times as much light as a 25 year old **(Faye & Stuen, 1995).** Elderly people need more light and at the same time are extremely sensitive to glare, thus the luminaries used should be properly shielded.

Daylight in building is becoming an increasingly popular choice in lighting design both because, with appropriate design, it offers low energy solutions, and for the (generally) pleasant environment it creates. Natural daylight penetrating into a room establishes contact with the world outside, giving a view of the surroundings and indicating the time of day and the state of the weather. Sunlight can produce positive emotional and aesthetic effects, provide a strong directional light for difficult visual tasks, and provide a close link with the outdoors if it is carefully controlled to prevent the negative effects. Level of natural light should be proper inside the storage units in kitchen so that elder people should be able to see the things clearly stored inside the storage units.

Natural light inside storage units in kitchen:

The natural and artificial light in the storage units in kitchen and bedroom were measured by the researcher in each of the storage units in each of the houses. The natural light was measured through lux metre. The instrument was kept at vertical plane while taking readings inside the storage units. The obtained range was divided into 3 categories having equal interval to determine the extent of light available in storage units.

The mean illumination level of natural light inside free standing storage unit was found to be 15.04 lux. Illumination level of natural light was found low in more than 50 per cent free standing storage units found in respondents' kitchen (Table 24, Fig 41).

Inside built in (up to 6/7 feet) storage units the mean illumination level of natural light was found as 14.74 lux, (Table 24, Fig 41).

Natural light was found low inside 60 per cent built in wall cabinets, while the mean illumination level of natural light inside built-in wall cabinet was found to be 13.26 lux. More than 45 per cent of wall mounted cabinets received medium level of natural light and the mean illumination level of natural light inside the cabinets was found as 14.30 lux.

On an average base cabinet received 10.27 lux natural light inside the cabinets, however 60 per cent base cabinets falls in low illumination category

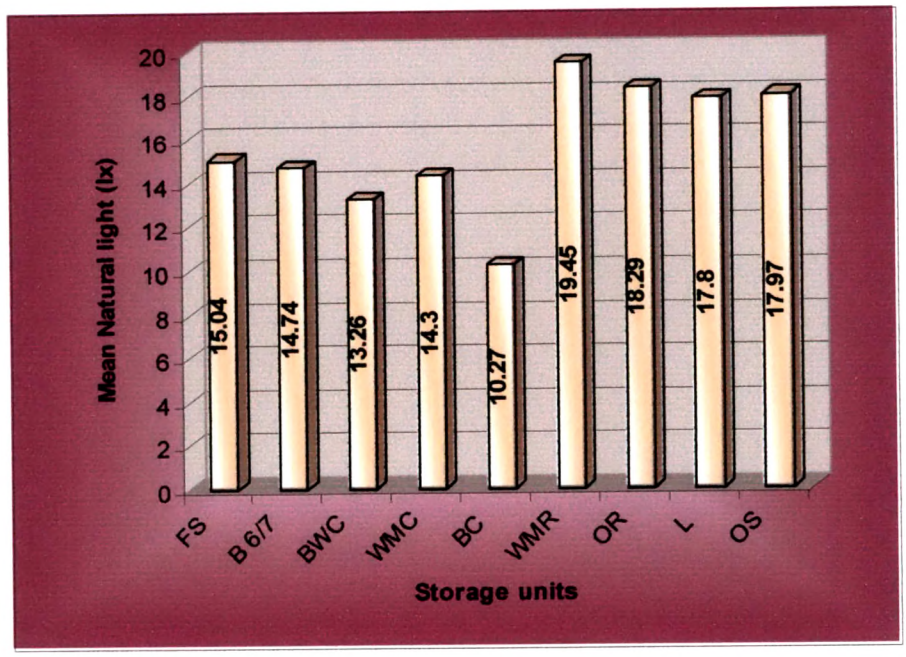


Fig 41: Mean illumination level (lux) of Natural light inside storage units in Kitchen

FS: Free standing storage unit
B 6/7: Built-in (upto 6/7 feet) storage unit
BWC: Built-in wall cabinet
WMC: Wall mounted cabinet
BC: Base cabinet
WMR: Wall mounted rack
OR: Other rack
L: Loft
OS: Open shelves

(Table 24, Fig 41). The mean natural light found inside wall mounted rack was 19.45 lux, whereas a little more than 50 per cent wall mounted racks received moderate natural light. On the other hand more than 45 per cent other rack get low level of natural light inside the unit with mean illumination of 18.29 lux. Lofts' received 17.8 lux mean natural light in kitchen whereas, most of the loft falls in low level of illumination category.

More than 70 per cent open shelves received low level of natural light and the mean illumination level of natural light was found as 17.97 lux (Table 24, Fig 41).

It was concluded that wall mounted racks received more amount of natural light as compared to other storage units. The illumination level varied in storage units due to some reasons such as placement and direction of kitchen in house, number of doors and windows and their direction as well as placement of storage units in kitchen.

Table 24: Frequency and Percentage distribution of the Respondents on the basis of Natural light inside existing storage units in Kitchen

Storage type	Range (lux)	Mean (lux)	SD	Respondents (n=85)	
				f	%
Free standing (n=24)		15.04	5.59		
Low	7-14			13	54.2
Medium	15-21			8	33.3
High	22-28			3	3.5
Built-in (upto6/7 feet) (n=23)		14.74	6.19		
Low	5-13			11	47.8
Medium	14-22			9	39.1
High	23-31			3	13.1
Built-in wall cabinet (n=27)		13.26	4.70		
Low	6-13			16	59.3
Medium	14-21			10	37.0
High	22-29			1	3.7

Wall mounted cabinet(n=23)		14.30	4.58		
Low	7-12			9	39.1
Medium	13-18			11	47.8
High	19-24			3	13.1
Base cabinet(n=44)		10.27	4.21		
Low	5-10			28	63.6
Medium	11-15			9	20.5
High	16-21			7	15.9
Wall mounted rack (n=71)		19.45	12.75		
Low	6-15			24	33.8
Medium	16-25			37	52.1
High	26-35			10	14.1
Other rack (n=21)		18.29	8.23		
Low	6-16			10	47.6
Medium	17-27			9	42.9
High	28-38			2	9.5
Loft (n=15)		17.8	5.86		
Low	8-16			7	46.7
Medium	17-24			6	40
High	25-32			2	13.3
Open shelves (n=35)		17.97	7.16		
Low	8-18			25	71.4
Medium	19-28			7	20
High	29-39			3	8.6

Artificial Light inside Storage units in Kitchen:

Artificial lighting is an integral component of modern life. Even during daytime, when plenty of natural daylight is available outdoor, artificial light supplements inadequate daylight indoors. Light permits visibility in darkness making it possible to perceive and mentally organize diverse elements of the environment. In other words, light is central to all visual experience and sensitivity. There must be proper arrangement of artificial light inside or out side the storage units for proper visibility of things stored in the storage units.

In this part level of artificial light found inside the existing storage units in kitchen were divided into three categories i.e. Low, Medium and High, on the basis of equal interval. The natural light was measured through lux metre. The instrument was kept at vertical plane while taking reading inside the storage units.

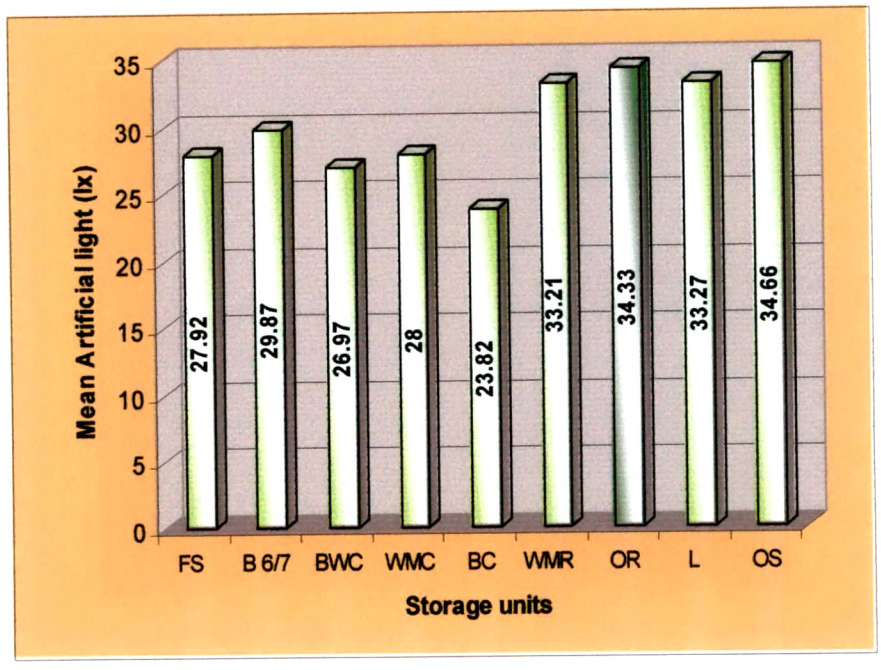


Fig 42: Mean illumination level (lux) of artificial light inside storage units in Kitchen

FS: Free standing storage unit
B 6/7: Built-in (upto 6/7 feet) storage unit
BWC: Built-in wall cabinet
WMC: Wall mounted cabinet
BC: Base cabinet
WMR: Wall mounted rack
OR: Other rack
L: Loft
OS: Open shelves

As regard to level of artificial light received by storage units in kitchen, the mean amount of artificial light present in free standing storage units in kitchen was found to be 27.92 lux, whereas, around 45 per cent free standing storage units received moderate level of artificial light inside the units (Table 25, Fig 42).

Around 40 per cent built-in (upto 6/7 feet) storage units got moderate level of illumination inside storage units and the mean artificial light present in built in (up to 6/7 feet) storage unit was 29.87 lux.

The mean artificial light found in built-in wall cabinets was 26.97 lux and a little more than 50 per cent built-in wall cabinets fell in low level illumination inside storage unit, ranging from 18-26 lux (Table 25, Fig 42).Around 39 per cent wall mounted cabinet get moderate level of artificial light with mean illumination level found as 28 lux.

The mean artificial light found in base cabinets was 23.82 lux. More than 45 per cent wall mounted racks get moderate level of artificial light with mean level of illumination found as 33.21 lux (Table 25, Fig 42).

The minimum amount of light found in other rack was 22 lux and maximum was 54 lux, whereas, most of the other rack received artificial light ranged between 22 lux to 32 lux. The mean artificial light inside other rack was found to be 34.33 lux.

The mean artificial light received by loft was 33.27 lux, whereas, 60 per cent loft get artificial light between 23-31 lux. Built in open shelves received 34.66 lux mean artificial light however around 50 per cent open shelves get artificial light between 32 lux to 45 lux (Table 25, Fig 42).

Table 25: Frequency and Percentage distribution of the Respondents on the basis of Artificial light inside existing storage units in Kitchen

Storage type	Range (lux)	Mean (lux)	SD	Respondents (n=85)	
				f	%
Free standing (n=24)		27.92	6.37		
Low	16-24			6	25
Medium	25-31			11	45.8
High	32-38			7	29.2

Built-in (upto6/7 feet) (n=23)		29.87	6.32		
Low	14-24			6	26.1
Medium	25-35			9	39.1
High	36-46			8	4.8
Built-in wall cabinet (n=27)		26.97	5.69		
Low	18-26			14	51.8
Medium	27-34			10	37.0
High	35-42			3	11.1
Wall mounted cabinet(n=23)		28	7.46		
Low	15-24			8	34.8
Medium	25-33			9	39.1
High	34-42			6	26.1
Base cabinet(n=44)		23.82	6.55		
Low	15-24			27	61.4
Medium	25-33			12	27.3
High	34-42			5	11.4
Wall mounted rack (n=71)		33.21	7.43		
Low	18-30			27	38.0
Medium	31-42			34	47.9
High	43-54			10	14.1
Other rack (n=21)		34.33	7.43		
Low	22-32			10	47.6
Medium	33-43			8	38.1
High	44-54			3	14.3
Loft (n=15)		33.27	6.47		
Low	23-31			9	60
Medium	32-39			3	20
High	40-48			3	20
Open shelves (n=35)		34.66	8.86		
Low	17-31			14	40
Medium	32-45			18	51.4
High	46-60			3	8.6

It was concluded that built in open shelves received more artificial light as compared to other storage units. The level of artificial light inside storage units varied due to some reasons such as design and placement of storage units, number of light and their placement in the kitchen.

4.4.1.5 Frequency of using storage units in kitchen:

This part deals with the frequency with which the respondents' were using their existing storage units in kitchen. The respondents were asked to state the frequency with which they use the storage units during morning, afternoon, evening and night.

It was found that more than 50 percent respondents were using free standing storage units 4-6 times in the morning, around 45 per cent used the unit 7-9 times in afternoon, and almost 41 percent and 45 per cent used the unit 4-6 times in the evening as well as in the night, respectively (Table 26).

It was found that more (56 percent) respondents used built-in (up to 6/7 feet) storage unit in the morning i.e. 7-9 times, followed by around 47 percent respondents in the evening and 4-6 times by 60 per cent respondents at night.

Maximum respondents (55.6 percent) used built in wall cabinets in afternoon and in the evening up to 7-9 times, followed by same number of respondents using cabinets 4-6 times at night.

Wall mounted cabinets were used by the respondents (52.2 percent) more in the morning i.e 7- 9 times followed by around 45 per cent respondents using the cabinet 7-9 times in the evening and 4-6 times at night by more than 40 per cent respondents (Table 26).

Around 55 per cent respondents used base cabinets up to 7-9 times in afternoon and 4-6 times at night, whereas 50 per cent respondents were using base cabinets up to 7-9 times in evening.

It was found that more than 50 per cent respondent's used the wall mounted rack in the morning, afternoon and in the evening up to 7-9 times.
Other racks' were used by the respondents 7-9 times in afternoon and in the evening. However open shelves were used by more than 60 per cent respondents up to 7-9 times in the morning as well as same times by around 50 per cent respondents in afternoon (Table 26).
It was concluded that frequency of using storage units by the respondents was high i.e 7-9 times in morning, afternoon as well as in the evening. However, at night most of the respondents were using storage units up to 4-6 times.

Extent of using storage units in Kitchen

The scores were assigned to frequencies i.e. score of 1 for use of 1-3 times; 2 for 4-6 times; 3 for 7-9 times and 4 for 10 and more times.

Table 26: Frequency and Percentage distribution of the Respondents on the basis of using existing storage units in Kitchen

Storage type	Morning								Afternoon							
	1-3		4-6		7-9		10 & above		1-3		4-6		7-9		10 & above	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Free standing (n=24)	1	4.2	13	54.2	6	25	4	16.7	1	4.2	9	37.5	11	45.8	3	12.5
Built in (upto6/7 feet) (n=23)	-	-	7	30.4	13	56.5	3	13.0	2	8.7	9	39.1	8	34.8	4	17.4
Built in wall cabinet (n=27)	-	-	4	14.8	12	44.4	11	40.7	1	3.7	6	22.2	15	55.6	5	18.5
Wall mounted cabinet (n=23)	-	-	6	26.1	12	52.2	5	21.7	-	-	7	30.4	8	34.8	8	34.8
Base cabinet (n=44)	-	-	12	27.3	17	38.6	15	34.1	1	2.3	7	15.9	24	54.5	12	27.3
Wall mounted rack (n=71)	-	-	15	21.1	36	50.7	20	28.2	2	2.8	16	22.5	39	54.9	14	19.7
Other rack (n=21)	-	-	6	28.6	10	47.6	5	23.6	1	4.8	4	19.0	12	57.1	4	19.0
Loft (n=15)																
Open shelves (n=35)			1	2.9	23	65.7	11	31.4	-	-	8	22.9	18	51.4	9	25.7

Storage type	Evening								Night							
	1-3		4-6		7-9		10 & above		1-3		4-6		7-9		10 & above	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Free standing (n=24)	-	-	10	41.7	7	29.2	7	29.2	6	25	11	45.8	7	29.2	-	-
Built in (upto6/7 feet) (n=23)	1	4.3	6	26.1	11	47.8	5	21.7	4	17.4	14	60.9	4	17.4	1	4.3
Built in wall cabinet (n=27)	1	3.7	2	7.4	15	55.6	9	33.3	6	22.2	15	55.6	4	14.8	2	7.4
Wall mounted cabinet (n=23)	-	-	5	21.7	11	47.8	7	30.4	7	30.4	10	43.5	6	26.1	-	-
Base cabinet (n=44)	1	2.3	6	13.6	22	50	15	34.1	10	22.7	24	54.5	9	20.5	1	2.3
Wall mounted rack (n=71)	2	2.8	12	16.9	37	52.1	20	28.2	14	19.7	35	49.3	19	26.8	3	4.2
Other rack (n=21)	1	4.76	2	9.5	11	52.4	7	33.3	6	28.6	9	42.9	7	33.3	-	-
Loft (n=15)																-
Open shelves (n=35)	-	-	2	5.7	17	48.6	16	45.7	7	20	18	51.4	10	28.6	-	-

The minimum possible score was 4 and maximum was 16. The range was divided into 3 categories having equal interval to determine the extent of use of each of the storage unit. Higher scores indicated higher extent of use.

It was found that more than 60 percent respondents were using free standing storage unit to moderate extent, whereas, built in (up to 6/7 feet) and Built in wall cabinets storage unit was used to moderate extent by more than 75 percent respondents and 62 percent respondents, respectively. It was found that remaining storage units i.e. wall mounted cabinet (65.2 per cent), base cabinet (63.6 per cent), wall mounted rack (67.6 per cent), other rack (71.4 per cent) and open shelves (71.4 per cent) were also used by the respondents to moderate extent.

Table 27: Distribution of respondents' by extent of using storage unit

Storage type	Extent of use	Range	Respondents	
			f	%
Free standing (n=24)	Low	4-7	3	12.5
	Moderate	8-12	16	66.7
	High	13-16	5	20.8
Built-in (upto6/7 feet) (n=23)	Low	4-7	1	4.3
	Moderate	8-12	18	78.3
	High	13-16	4	17.4
Built-in wall cabinet (n=27)	Low	4-7	1	3.7
	Moderate	8-12	17	62.9
	High	13-16	9	33.3
Wall mounted cabinet(n=23)	Low	4-7	-	-
	Moderate	8-12	15	65.2
	High	13-16	8	34.8
Base cabinet(n=44)	Low	4-7	1	2.3
	Moderate	8-12	28	63.6
	High	13-16	15	34.1
Wall mounted rack (n=71)	Low	4-7	3	4.2
	Moderate	8-12	48	67.6
	High	13-16	20	28.2
Other rack (n=21)	Low	4-7	1	4.8
	Moderate	8-12	15	71.4
	High	13-16	5	23.8
Open shelves (n=35)	Low	4-7	-	-
	Moderate	8-12	25	71.4
	High	13-16	10	28.6

4.4.1.6 Dimensions of Existing Storage units in Kitchen:

This part comprises of various dimensions of storage units such as total dimensions, shelf's dimensions and drawer's dimensions. The obtained range of various dimensions was divided into 3 categories on the basis of equal interval as to small, medium and large/high. The total dimensions of the storage unit were operationally defined as the height, width and depth measured from the outer surfaces of the storage unit itself.

(i) Free standing storage unit in kitchen: Dimensions

Free standing storage units in various dimensions, were found in 24 respondents' kitchen. The mean total height, total width and total depth of free standing storage units were found to be 103.88 cms, 54.17 cms and 34.54cms respectively (Table 28).

Table 28: Dimension of free standing unit in Kitchen (cms) (n=24)

Dimension	Range (cms)		Respondents (n=24)		Mean (cms)	SD
			f	%		
Total Height	Small	72-93	7	29.2	103.9	18.74
	Medium	94-114	10	41.7		
	Large	115-136	7	21.2		
Total width	Small	35-60	18	75	54.2	18.28
	Medium	61-85	4	16.7		
	Large	86-110	2	8.3		
Total Depth	Small	24-32	10	41.7	34.5	7.87
	Medium	33-40	9	37.5		
	Large	41-48	5	20.8		
Top shelf Height (From floor)	Small	42-62	7	29.2	72.7	18.89
	Medium	63-83	10	41.7		
	Large	84-104	7	29.2		
Middle shelf Height (from floor) (n=18)	Small	34-47	10	41.7	47.7	9.55
	Medium	48-60	6	25		
	Large	61-73	2	8.3		
Lower shelf Height (from floor)	Small	6-15	17	70.8	13.33	5.72
	Medium	16-24	6	25		
	Large	25-34	1	4.2		
Shelf width	Small	35-62	19	79.2	53.83	19.0
	Medium	63-89	3	12.5		
	Large	90-117	2	8.3		

Shelf depth	Small	21-29	9	37.5	32.29	8.11
	Medium	30-38	10	41.7		
	Large	39-47	5	20.8		

Further, data on width and depth measurement indicated that the width and depth of the shelves ranged from 35-117 cm and 21-47 cm, respectively. Whereas, the mean width was 53.83 cm and mean depth was 32.29 cms (Table 28).

Almost all the free standing storage units found in respondents' kitchens were small in height ranging from 1-3 feet. Probably, due to which, they had to kneel down on legs/bend their back and as well as rigorous and frequent movements of neck to reach the articles which might have led to pain/discomfort in body parts as reported by them while expressing physiological problems faced by the respondents while using storage units.

(ii) Built-in (Up to 6/7 feet) storage unit in kitchen: Dimensions

In more than one fourth of the respondents' kitchens (27 percent) built-in (up to 6/7 feet) storage units was present. The mean of total height of the storage units was 183.09 cm with a range of 146-218 cm. The mean of total width and depth of the storage units was 88.61 cms and 42.43 cm, respectively (Table 29). An examination of top shelves height from floor revealed the mean height was 143.35 cm. While, investigating the availability of number of middle shelves, the data revealed that in all the storage units there was one middle shelf and second middle shelf (Called as upper middle shelf) was found only in 15 storage units. The mean height of the upper middle and middle shelves were recorded as 107.85 and 68.74 cms. Measurement of the lower shelf (Bottom shelf) revealed the mean height of 15.26 cm the range being 10-28 cms .

Table 29: Dimensions of existing Built-in (upto 6/7 feet) storage unit in kitchen (n=23)

Dimension (n=23)	Range (cms)	f	%	Mean (cms)	SD
Total Height	146-170	7	30.4	183.09	19.37
	171-194	10	43.5		
	195-218	6	26		

Total width	70-81 82-93 94-105	5 11 7	21.7 47.8 30.4	88.61	8.71
Total Depth	30-36 37-43 44-50	5 5	21.7 21.7 56.5	42.43	5.94
Top shelf Height (from floor)	111-131 132-151 152-171	8 6 9	34.8 26.1 39.1	143.35	17.64
Top middle shelf height (n=13) (from floor)	90-101 102-112 113-123	3 5 5	23.0 38.5 38.5	107.8	11.6
Middle shelf Height (from floor)	51-72 73-94 95-116	19 1 3	82.6 4.3 13.0	68.74	15.83
Lower shelf height (from floor)	10-16 17-22 23-28	16 5 2	69.6 21.7 8.7	15.26	4.42
Shelf width	70-81 82-93 94-105	5 11 7	21.7 47.8 30.4	87.96	8.59
Shelf depth	28-34 35-41 42-48	5 8 10	21.7 34.8 43.5	39.69	5.84
Drawer's height (from floor) (n=3)	73 74 76	1 1 1	4.3 4.3 4.3	74.33	1.53
Drawer's width	42 44 46	1 1 1	4.3 4.3 4.3	44	2
Drawer's depth	41 44 46	1 1 1	4.3 4.3 4.3	43.67	2.52

Severe pain was expressed by respondents in one or both legs/ankle/ feet, moderate in knees and hips (Wide section 4.5.1.1). This might be because of very low shelf of such storage unit. Frequent kneeling/squatting/sitting might have caused such pain. The height of first shelf was about 5 feet on an average, this had probably created moderate pain in neck (3.00 out of 5.00; Table 52), as the respondents had to look up for quite some time in order to use upper shelf.

(iii) Built-in wall cabinet in kitchen: Dimensions

Built-in wall cabinet was found in 27 kitchens of the respondents. The mean of total height of the built-in wall cabinets was found to be 68.48 cm with a range of 45 to 77 cm. After analyzing the data, the top shelves height of cabinets from floor revealed a range of 156-220 cm, however the mean height was 188.22 cm. The mean height of lower shelves was 154.19 cm from the floor (Table 30).

Built-in wall cabinet was found in varied sizes in respondents' kitchen. These cabinets were built-in the wall above work counters and the mean height of top shelf from floor was found to be 188.22 cm due to which respondent had to stand for long hours and probably they had to raise on their toes and support themselves with something for using storage cabinets which might had led to pain in their lower body parts as reported by the respondents while expressing physiological problems faced by them while using storage units (Wide section 4.5.1.1, Table 53).

Table 30: Dimensions of Built in wall cabinet in kitchen (n=27)

Dimension	Range (n=27) (cms)	f	%	Mean (cms)	SD
Total Height	45-55	9	33.3	68.5	9.80
	56-66	9	33.3		
	67-77	9	33.3		
Total width	40-50	7	25.9	56.9	8.31
	51-61	12	44.4		
	62-72	8	29.6		
Total Depth	32-39	8	29.6	43.5	6.69
	40-46	9	33.3		
	47-54	10	37.03		
Top self Height (from floor)	156-166	4	14.8	188.22	14.71
	178-198	18	66.7		
	199-220	5	18.5		
Middle shelf Height (from floor) (n=11)	151-166	4	14.8	174	14.35
	167-182	4	14.8		
	183-198	3	11.1		
Lower self depth (from floor)	127-143	6	22.2	154.19	13.50
	144-159	10	37.0		
	160-176	11	40.7		

Shelf width	40-50 51-61 62-72	8 12 7	29.6 44.4 25.9	56.37	8.13
Shelf depth	30-37 38-44 45-52	9 8 10	33.3 29.6 37.0	40.89	6.42

(iv) Wall mounted cabinet in kitchen: Dimensions

Wall mounted cabinets were seen in 23 respondents kitchens. The mean total height, total width and total depth of wall mounted cabinets were found to be 56.35 cm, 56.52 cm and 43.17 cm respectively. The mean height of the top shelves was 178.74 cm.

Table 31: Dimensions of Wall mounted cabinet in kitchen (n=23)

Dimension	Range (cms)	f	%	Mean (cms)	SD
Total Height	42-53 54-64 65-75	10 8 5	43.5 34.8 21.7	56.35	9.72
Total width	35-60 61-85 86-110	17 5 1	73.9 21.7 4.3	56.52	14.53
Total Depth	30-37 38-44 45-52	3 10 10	13 43.5 43.5	43.17	5.76
Top shelf Height (from floor)	148-165 166-182 183-200	3 11 9	13.0 47.8 39.1	178.74	12.73
Middle shelf Height (from floor) (n=2)	164 174	1 1	4.3 4.3	169	7.07
Lower shelf Height (from floor)	120-134 135-149 150-164	3 6 14	13 26.1 60.9	149.87	12.89
Shelf width	35-60 61-85 86-110	17 5 1	73.9 21.7 4.3	55.96	14.53
Shelf Depth	26-33 34-41 42-49	2 11 10	8.7 47.8 43.5	40.26	5.46

Wall mounted cabinet were found in various sizes in respondents' kitchen and placed on wall above work counter. The respondents expressed severe pain in one or both hips/thighs/buttock and one or both legs/ankle/feet (3.8 out of 5.00, Table 54) while using existing wall mounted cabinets as expressed by them (Section 4.5.1.4). This may be due to height at which the storage units were placed. The top shelf of such units was 178.74 cms high from the floor. Probably this made the respondents to raise themselves on toes and hence gave pain in legs.

They felt moderate pain in neck (3.5 out of 5.00, Table 54) probably they had to stretch their neck to use the wall mounted cabinet as high as 120 to 200 cms.

Kirvesoja et.al (2000) conducted study on female elderly and they suggested various storage and working heights suitable for elder women.

According to them 1600 mm seems to be a good recommendation for the top shelf of the upper cupboard, as it suits almost all the elderly selected for the study. As well as the work surface heights of both 800 and 900 mm were considered to be quite suitable. The lowest kettle shelf in the base unit could be considered to be good at 300 mm, but not lower for the elderly.

(v) Base cabinet in kitchen: Dimensions

Base cabinet (the cabinets below platform/work counter in the kitchen) were seen in 44 respondents' kitchen. The mean of total height of base cabinets was found to be 80.48 cm with a range of 68-92 cm. The mean of total width of base cabinet was 57.14 cm. and the mean of total depth was 47.86 cm (Table32). An examination of top shelf height revealed a range of 29-70 cm. however, the mean top shelf height was 49.70 cms. The middle shelf was found only in 18 base cabinets, and the mean height of was 35.56 cm with a range of 29-40cms. Lower shelves ranged from 6-22 cm with a mean height of 10.86 cm. The mean width of shelves was 56.55 cm and mean depth was 45.02 cm (Table32).

The base cabinets had drawers. Top drawers were found in 29 base cabinets (65.9 percent), their height from floor ranged from 48-75 cm and the

mean height was 63.17 cm. The height of lower drawers' ranged from 6-66 cm and the mean height of lower drawer was 21.5 cm. Data on width and depth measurement of drawers, indicated that the mean width of drawers was found to be 37.28 cm and mean depth was 46.76 cm .

Table 32: Dimensions of Base cabinet in kitchen (n=44)

Dimension	Range (cms)	f	%	Mean (cms)	SD
Total Height	68-76	13	29.5	80.48	6.10
	77-84	20	45.5		
	85-92	11	2.5		
Total width	35-47	4	9.1	57.14	7.49
	48-59	24	54.5		
	60-72	16	36.4		
Total Depth	35-42	6	13.6	49.70	11.62
	43-49	20	45.5		
	50-56	18	40.9		
Top shelf Height (from floor)	29-43	16	36.4	49.70	11.62
	44-58	14	31.8		
	59-73	14	31.8		
Middle shelf Height (n=18) (from floor)	29-32	4	9.1	35.56	3.42
	33-36	4	9.1		
	37-40	10	22.7		
Lower shelf height (from floor)	6-11	29	65.9	10.86	3.76
	12-16	13	29.5		
	17-22	2	4.5		
Shelf width	35-47	4	9.1	56.66	7.41
	48-59	26	59.1		
	60-72	14	31.8		
Shelf depth	33-40	9	20.5	45.02	5.18
	41-47	22	50		
	48-55	13	29.5		
Top Drawer's height (n=29) (from floor)	48-57	8	27.6	63.17	8.56
	58-66	7	24.1		
	67-75	14	48.3		
Middle Drawer's height (n=7) (from floor)	29-32	3	42.9	34.71	4.68
	33-36	1	14.2		
	37-40	3	42.9		
Lower drawer height (n=14) (from floor)	6-26	11	78.6	21.5	22.79
	27-46	-	-		
	47-66	3	21.4		

Drawer's width (n=29)	24-32 33-41 42-50	12 6 11	41.4 20.7 37.9	37.28	8.18
Drawer's depth	38-43 44-49 50-55	6 15 8	13.6 34.1 18.2	46.76	4.21

Base cabinets were built under the work counter of kitchen. Frequent bending and twisting of body give rise to awkward posture while using cabinets which might have led to pain/discomfort in body parts especially hips/thighs/buttocks (3.8 out of 5.00, Table 55) as reported by the respondents while expressing physiological problems faced by them while using storage units.

(vi) Wall mounted rack in kitchen: Dimensions

Wall mounted rack were found in various sizes and of various materials in the kitchens of the respondents. Wall mounted rack are placed on the walls of kitchen at different heights from the floor.

Wall mounted racks were found in 71 respondents (83.5 percent) kitchens. The mean of total height was found to be 79.21 cm with a range of 55-110 cm. The mean of total width of wall mounted racks was recorded as 74.18 cms. and the mean total depth was 29.55 cm (Table 33). The mean top shelf height was found to be 180.63 cm from floor. It was revealed that top middle shelf was present only in 30 (42.3 percent) wall mounted racks at 164.3 cm and the middle shelf at 145 cms was found in 69 (97.2 percent) wall mounted racks. (Table 33).

Probably wrong placement, prolonged standing posture, raising on toes to lift things from the rack and reiterative poor body movements might have led to severe pain in knees (3.8/5.00) and pain in thighs (3.33/5.00) and neck (3.05/5.00) as revealed in Table 56.

Table 33: Dimensions of Wall mounted rack in kitchen (n=71)

Dimension	Range (n=71) (cms)	f	%	Mean (cms)	SD
Total Height	55-73	24	33.8	79.21	13.18
	74-91	30	42.3		
	92-110	17	23.9		
Total width	32-63	20	28.2	74.18	16.73
	64-94	42	59.2		
	95-126	9	12.7		
Total Depth	22-26	13	18.3	29.55	3.17
	27-30	35	49.3		
	31-35	23	32.4		
Top shelf Height	138-166	17	23.9	180.63	18.07
	167-194	40	56.4		
	195-224	14	19.7		
Top middle shelf Height (n=30)	134-156	8	26.7	164.3	18.23
	157-178	16	53.3		
	179-201	6	20		
Middle shelf Height (n=69)	112-137	19	27.5	145	16.66
	138-162	43	62.3		
	163-187	7	10.2		
Lower shelf height	86-111	16	22.5	122.79	16.62
	112-137	44	61.9		
	138-163	11	15.6		
Shelf width	32-63	20	28.2	73.73	16.58
	64-94	42	59.2		
	95-126	9	12.6		
Shelf depth	22-27	12	16.9	30.27	3.32
	28-32	40	56.3		
	33-38	19	26.8		

(vii) Other rack in kitchen: Dimensions

Other rack or multi-purpose racks was found in different sizes and placed on work counter/ on floor/ mounted on walls of kitchens of the respondents'.

Other rack were found in 21 respondents' kitchen (24.7 percent). The mean total height of other rack was found to be 51.43 cm, mean total width was 33.76 and the mean total depth was 25.86 cm (Table 34). The mean heights of top, middle and lower shelves were recorded as 99.2 cm, 50.6 cm and 66 cm

respectively. The mean width and mean depth of shelf was found to be 34.4 cm and 26.53 cm respectively (Table 34).

The respondents felt severe pain in neck and hips/thighs/buttock (3.8 out of 5.00, Table 57) as these racks were found to be low (mean of top shelves height was 99.2 cms). Frequent use of neck in searching items from such low shelves might have led to pain in neck.

Table 34: Dimensions of Other rack in kitchen (n=21)

Dimension	Range (n=21) (cms)	f	%	Mean (cms)	SD
Total Height	20-45	10	47.6	51.43	21.15
	46-71	7	33.33		
	72-97	4	19		
Total width	15.26	3	14.3	33.76	7.33
	27-37	13	61.9		
	38-48	5	23.8		
Total Depth	15-23	8	38.1	25.86	6.05
	24-31	10	47.6		
	32-39	3	14.3		
Top shelf Height (from floor) (n=15)	56-83	4	26.7	99.2	24.99
	84-110	6	40.0		
	111-137	5	33.3		
Middle shelf Height (from floor) (n=5)	32-58	4	80	50.6	33.31
	59-84	-	-		
	85-110	1	20		
Lower shelf height (from floor) (n=15)	7-42	4	26.6	66	37.2
	43-77	1	6.7		
	78-112	10	66.7		
Shelf width	25-32	6	40	34.4	6.54
	33-39	5	33.3		
	40-47	4	26.7		
Shelf depth	19-25	7	46.7	26.53	5.50
	26-31	6	40.0		
	32-38	2	13.3		
Top Drawer's height (from floor) (n=6)	93-101	2	33.3	106.17	10.72
	102-109	1	16.7		
	110-118	3	50		
Middle Drawer's height (n=4)	93-96	2	50	97	4.32
	97-99	1	25		
	100-103	1	25		
Lower drawer height (n=6)	76-81	4	66.7	81.83	5.91
	82-86	-	-		
	87-91	2	33.3		

Drawer's width (n=6)	12-20 21-29 30-38	1 - 5	16.7 - 83.3	30.33	9.58
Drawer's depth (n=6)	14-19 20-24 25-30	2 2 2	33.3 33.3 33.3	21.83	6.01

(viii) Built in open shelves in kitchen: Dimensions

Open shelves are built in wall above or below work counter. Built in open shelves were seen in 41.2 percent respondents kitchen. The mean top shelf height was found to be 160 cms. Whereas, the mean width and mean depth of top shelf were found to be 129.8 cm and 27.89 cm, respectively.

Further, the mean height of lower shelf was 36.49 cms. Whereas, the mean width of lower shelf was 120.31 cm and mean depth was 32.74 cms.

Table 35: Dimensions of Open shelf in kitchen (n=35):

Dimension	Range (cms)	f	%	Mean (cms)	SD
Top shelf Height (from floor)	145-158 159-171 172-184	16 16 3	45.7 45.7 8.6	160	8.45
Top shelf width	97-124 125-152 153-180	14 18 3	40 51.4 8.6	129.8	17.22
Top shelf depth	22-29 30-37 38-45	23 11 1	65.7 31.7 2.9	27.89	5.03
Lower shelf height (from floor)	24-34 35-44 45-55	15 16 4	42.9 45.7 11.4	36.49	7.29
Lower shelf width	92-110 111-128 129-147	9 17 9	25.7 48.6 25.7	120.31	13.14
Lower shelf depth	22-29 30-36 37-44	10 18 7	28.6 51.4 20	32.74	5.74

The wrong placement of shelves was at unsuitable height of 160 cms on average hence things stored on shelves were not visible and easy to reach, therefore respondents had to rise on their toes or kneel down/ squat to lift things stored on shelves. This led to poor posture which might have led to pain/

discomfort in various body parts as reported by the respondents while expressing physiological problems faced by them while using storage units. They experienced severe pain in knees and legs/ankle/feet (Table 59).

(ix) Loft in kitchen: Dimensions

Loft was found in few respondents' kitchens. The mean total height of loft was found to be 243.07 cms from the floor. The mean total width and the mean total depth of loft were 189.67 cms and 39.27 cms, respectively.

Table 36: Dimensions of loft in kitchen (n=15)

Dimension	Range (n=15) (cms)	f	%	Mean (cms)	SD
Total Height (from floor)	228-236	3	20	243.07	7.45
	237-244	5	33.3		
	245-253	7	46.7		
Total width	145-175	5	33.3	189.67	30.08
	176-205	4	26.7		
	206-236	6	40		
Total depth	28-35	4	26.7	39.27	5.56
	36-2	7	46.7		
	43-49	4	26.7		

Loft were placed at unsuitable heights in kitchen i.e. not easy to reach and store articles on them. Respondents have to use stool or something else to reach the things stored on loft. Due to reduced mobility and capacity respondents faced problem and adopted awkward posture, which might have led to pain/discomfort in body parts as reported by the respondents while expressing physiological problems faced by them while using storage units (Wide section....). They expressed severe pain in arms/elbow and hips/thighs/buttocks. Moderate pain was experienced in back, wrist, neck and shoulder (Table 58).

4.4.2 Exiting storage units in Bedroom

Various type of storage units were found in bedrooms of the respondents such as free-standing, built-in floor to ceiling, built-in (upto6/7 feet), Chest of drawers, wall storage unit, base storage unit and box bed. This part includes size of the bedroom, number of storage units, age, material, Lighting-Natural

and artificial light inside storage unit, frequency of using storage units, dimensions and hardware used in existing storage units.

4.4.2.1 Size of the Storage units:

The length, width and breadth were measured for the bedroom. The obtained minimum and maximum dimensions were divided into 3 categories on the basis of equal interval so as to group the rooms into small, medium and large size.

Table 37: Size of Bedroom

Dimension	Range (cms)	*f*	%	Mean	S.D
Length				420.65	76.84
Small	290-397	43	50.6		
Medium	398-503	27	31.8		
Large	504-610	15	17.6		
Breadth				391.00	61.24
Small	260-347	19	22.4		
Medium	348-433	42	49.4		
Large	434-520	24	28.2		
Height Small				321.76	10.60
Medium	290-304	8	9.4		
Large	305-317	14	16.5		
	318-330	63	74.1		

The mean dimensions i.e. length, breadth and depth of bedroom of the respondents were found to be 420.65 cms, 391 cms and 321.76 cms, respectively. However it was found that length of around 50 per cent bedroom fell into small dimension category.

4.4.2.2 Number and age of storage unit in Bedroom:

Various types of storage were found in the Bedroom of the respondents. They varied in number and age i.e. old or new.

Free standing storage units were seen in 43 respondents' bedroom; out of which majority of the respondents possessed only one free standing unit which were 23.53 years old on an average (Table 38).

Built in floor to ceiling storage units were possessed by around 25 percent respondents and from which a little less than 55 percent respondents

Plate12: Free-Standing Storage Unit in Bedroom

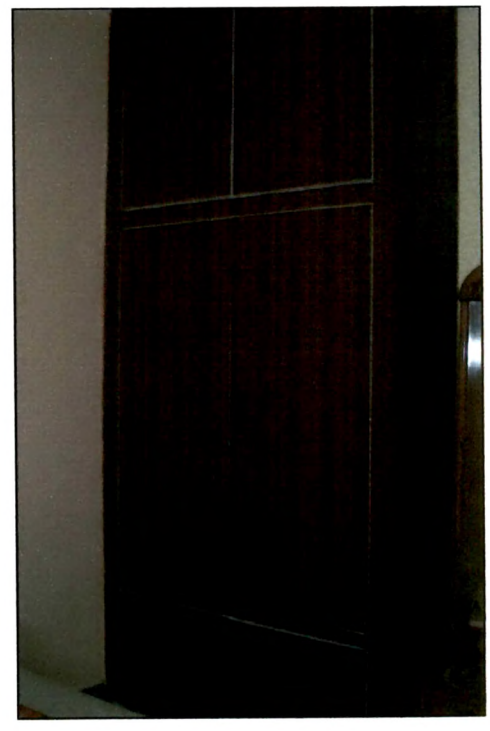


Plate 13: Built-in Floor to Ceiling in Bedroom

had two built-in floor to ceiling storage units in their bedroom, with mean age of 21.59 years. It was found that around 70 percent floor to ceiling storage units were 16 years and above old (Table 38).

Built-in (up to 6/7 feet) storage units were seen in bedrooms of 27 respondents. One built-in (up to 6/7 feet) storage unit was found in more than 50 percent respondents' bedroom; they were 21.15 years old on an average.

Around 24 percent respondents possess chest of drawers in their bedroom. It was found that a little more than 50 percent respondents had one chest of drawers in their bedroom. However, around three-fourth chest of drawers were 16 years and above old.

Wall storage units were seen in only 12 percent respondents' bedroom. Out of which almost 36 percent respondents had two number of wall storage units in their bedroom. The mean age of the wall storage unit was 18.64 years.

Around 36 percent respondents possessed base storage unit in their bedroom. Out of which, around 40 percent respondents have two base storage units in their bedroom. The mean age of the base storage unit was found to be 17.80 years.

Box bed was observed in 30 respondents' bedroom and all the respondents have one box bed in their bedroom. A little more than 40 percent respondent's posses box bed of 16 years and above age.

To conclude the overall result it was found that maximum respondents possessed by one free standing/built in (up to 6/7 feet)/chest of drawers or box bed in their bedroom, where as, more than one floor to ceiling/ wall storage unit/ base storage unit was seen in large number of respondents' bedroom. It was found that majority of the storage units possessed by the respondents were 16 years & above old.

4.4.2.3 Material of the storage units:

The storage units seen in bedroom of the respondents were made of different material. The commonly observed materials were wood, iron, fiber plastic or simply they were open, finished with plaster (Table 39).

Plate 14: Built-in (Upto 6/7 feet) in Bedroom

Plate 15: Chest of Drawers in Bedroom

Plate 16: Wall Storage Unit in Bedroom

Plate 17: Base Storage Unit in Bedroom

Plate 18: Box bed in Bedroom

Table 38: Frequency and percentage distribution of the respondents on the basis of Number and Age of storage units in Bedroom

Storage unit	No. of units	Respondnets		Age of the units (In years)							
		f	%	1-5		6-10		11-15		16 & above	
				f	%	f	%	f	%	f	%
Free standing (n=43)	a. one	36	83.7		-	3	6.9	6	13.9	34	79.2
	b. Two	7	17.3								
	Mean			23.53							
	SD			7.84							
Floor to ceiling (n=22)	a. one	10	45.5		-	1	4.5	5	22.7	16	72.7
	b. Two	12	54.5								
	Mean			21.59							
	SD			6.99							
Built in (upto6/7 feet) (n=27)	a. one	15	55.6		-	3	11.1	4	14.8	20	74.1
	b. Two	12	8.04								
	Mean			21.15							
	SD			8.04							
Chest of drawers (n=21)	a. one	11	52.4		-	2	9.5	5	23.8	14	66.7
	b. Two	9	42.9								
	c. Three	1	4.8								
	Mean			20							
	SD			6.82							

Wall storage (n=11)	a. one b. Two c. Three d. Four Mean SD	3 4 3 1	27.3 36.4 27.3 9.1	- 18.64 5.73	-	1	9.1	3	27.3	7	63.3
Base storage (n=31)	a. one b. Two c. Three d. Four Mean SD	7 13 6 5	22.6 41.9 19.4 16.1	- 17.80 6.16	-	5	16.1	8	25.8	18	58.1
Box bed (n=30)	a. One Mean SD	30	100	1 14.53 4.67	3.3	7	23.3	9	30	13	43.3

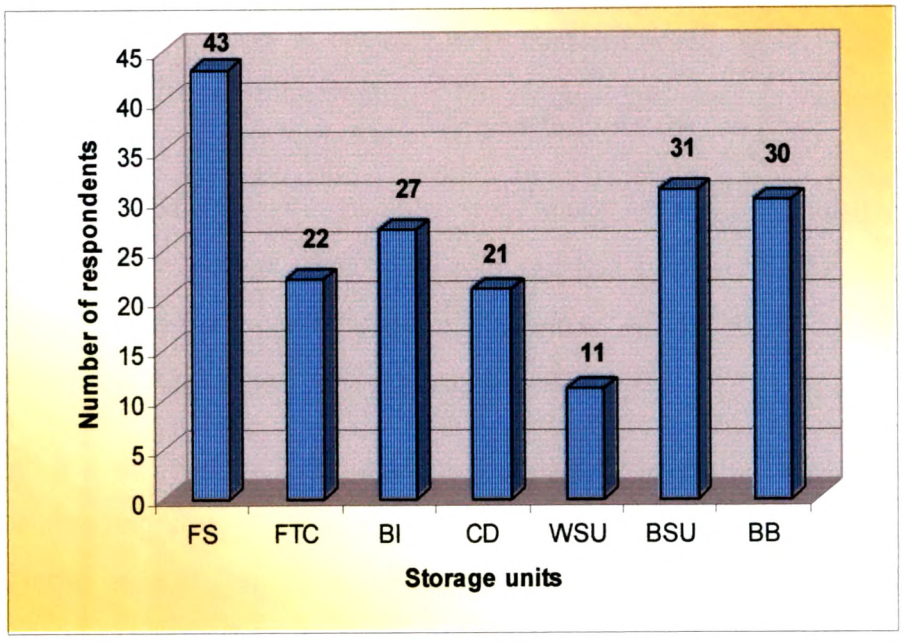


Fig 40(b): Number of respondents possessing various kinds of storage units in bedroom

FS: Free standing storage unit
FTC: Floor to ceiling storage unit
BI: Built-in (upto 6/7 feet) storage unit
CD: Chest of drawers
WSU: Wall storage unit
BSU: Base storage unit
BB: Box bed

As regard to material of the storage units it was found that all the free standing storage units were made of iron, whereas, majority of the built in floor to ceiling storage units were finished with wood.

A little less than 60 percent built in(up to 6/7 feet) storage units were made of wood, while the other material used in finishing of storage units were iron, fiber plastic or open storage units finished with plaster.

Almost 60 percent chest of drawers were made of wood, whereas, few chest of drawers found in the bedroom of the respondents were constructed from either iron or fiber plastic.

Maximum of the wall storage units were made of wood, as well as almost 50 percent base storage units were also finished by wood. The other preferred material for making base storage unit was iron. All the box bed found in the bedroom of the respondents was made of wood.

Overall it could be concluded that iron was solely used in construction of entire free standing storage units whereas wood was found to be the most preferred material used in construction/finishing of other storage units seen in the bedroom of respondents'.

4.4.2.4 Natural Light inside existing storage units of bedroom:

Light is an essential element to see the things clearly. For accessibility of natural light a room must have sufficient number of windows and they must be placed accurately. This part consists of level of natural light found inside various storage units in bedroom. The light was measured through lux metre. The instrument was kept at vertical plane while taking reading inside the storage units except box bed in which measurement was taken at horizontal plane.

Table 39: Frequency and percentage distribution of the respondents on the basis of Material of storage units in Bedroom

Storage type	Material											
	Wood		Iron		Aluminum		Steel		Fiber./ Plastic		Open plastered	
	f	%	f	%	f	%	f	%	f	%	f	%
Free standing (n=43)	-	-	43	100	-	-	-	-	-	-	-	-
Floor to ceiling (n=22)	18	81.1	4	18.2	-	-	-	-	-	-	-	-
Built in (up to 6/7feet) (n=27)	16	59.3	8	29.6	-	-	-	-	1	3.7	2	7.4
Chest in of drawers (n=21)	13	61.9	6	28.6	-	-	-	-	2	9.5	-	-
Wall storage unit (n=11)	8	72.7	1	9.1	-	-	-	-	2	18.2	-	-
Base storage unit (n=31)	16	51.6	10	32.3	-	-	-	-	1	3.2	4	12.9
Box bed (n=30)	30	100	-	-	-	-	-	-	-	-	-	-

Table 40: Frequency and Percentage distribution of the Respondents on the basis of Natural light inside existing storage units in Bedroom

Storage type	Range (lux)		Mean	SD	Respondents (n=85)	
					f	%
Free standing (n=43)	Low	7-13	14.8	5.28	19	44.2
	Medium	14-20			16	37.2
	High	21-27			8	18.6
Floor to ceiling (n=22)	Low	6-14	14.2	6.40	11	50.0
	Medium	15-23			10	45.5
	High	24-32			1	4.5
Built-in (upto 6/7 feet) (n=27)	Low	5-12	13.8	5.83	13	48.1
	Medium	13-20			11	40.7
	High	21-28			3	11.1
Chest of drawers (n=21)	Low	5-12	14.2	6.07	11	52.4
	Medium	13-19			5	23.8
	High	21-27			5	23.8
Wall storage (n=11)	Low	8-15	14.5	6.09	8	72.7
	Medium	16-22			2	18.2
	High	23-29			1	9.1
Base storage (n=31)	Low	5-13	14.9	5.70	13	41.9
	Medium	14-22			15	48.4
	High	23-31			3	9.7
Box bed (n=30)	Low	6-16	15.2	7.47	17	56.7
	Medium	17-26			11	36.7
	High	27-37			2	6.6

The mean illumination level of natural light inside free standing storage unit in bedroom was found to be 14.79 lux, however illumination level of natural light was low ranging from 7-13 lux inside forty four percent storage units (Table 40).

Inside floor to ceiling storage unit the mean illumination level of natural light was 14.18 lux. It was found that fifty percent floor to ceiling storage units received natural light ranged between 6-14 lux.

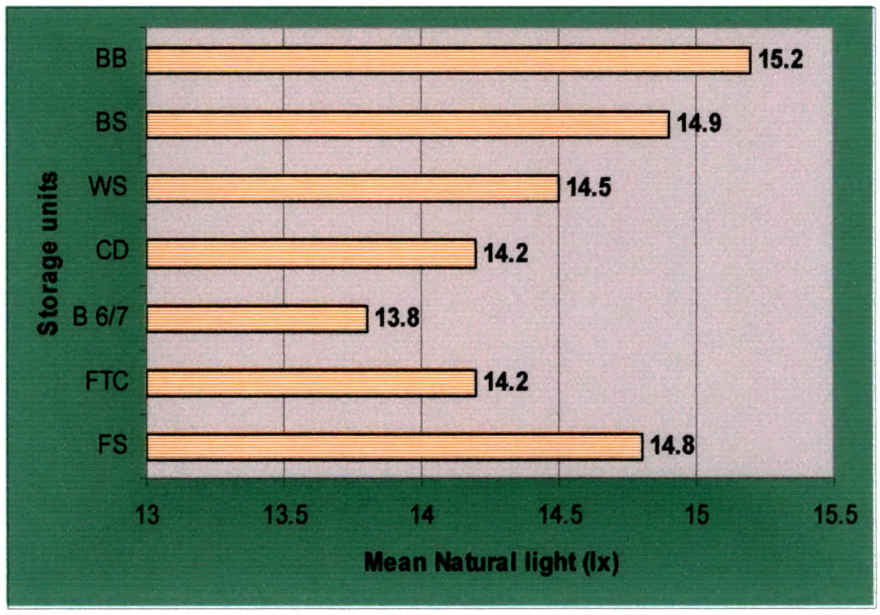


Fig 43 : Mean illumination level (lux) of Natural light inside storage units in Bedroom

FS: Free standing storage unit
FTC: Floor to ceiling storage unit
B 6/7: Built-in (upto 6/7 feet) storage unit
CD: Chest of drawers
WS: Wall storage unit
BS: Base storage unit
BB: Box bed

Natural light received inside 48 percent built in (up to 6/7 feet) storage units was found low ranging from 5-12 lux. The mean illumination level was found to be 13.78 lux (Table 40).

More than 50 percent chest of drawers received natural light ranging from 5-12 lux, whereas, the mean natural light inside chest of drawers was found to be 14.24 lux.

On an average wall storage units received 14.55 lux natural light, as well as it was found that a little more than 70 percent wall storage unit received low level of natural light ranged from 8-15 lux (Table 40).

The mean natural light found inside base storage unit was 14.87 lux, whereas, a little less than 50 percent base storage units received moderate level of natural light ranging from 14 -22 lux.

On the other hand more than 55 percent box bed received low level of natural light ranging from 6-16 lux and the mean illumination level was found to be 15.23 lux (Table 40).

To conclude the above results it was found that box bed receives more amount of natural light than other storage units. The illumination level inside storage units varies due to some reasons such as placement and direction of bedroom in house, number of doors, windows and their directions as well as placement of storage units in bedroom.

4.4.2.5 Artificial Light inside storage units in Bedroom:

The level of artificial light found inside the existing storage units in bedroom were divided into three categories i.e. Low, Medium and High. The light was measured through lux metre. The instrument was kept at vertical plane while taking reading inside the storage units.

Table 41: Frequency and Percentage distribution of the Respondents on the basis of Artificial light inside existing storage units in Bedroom

Storage type	Range (lux)		Mean	SD	Respondents (n=85)	
					f	%
Free standing (n=43)	Low	15-25	29.2	7.59	14	32.6
	Medium	26-35			21	48.8
	High	36-46			8	18.6

Floor to ceiling (n=22)	Low Medium High	17-26 27-35 36-45	28.1	7.59	11 7 4	50 31.8 18.2
Built-in (upto 6/7 feet) (n=27)	Low Medium High	16-24 25-32 33-40	27.8	6.69	10 11 6	37.0 40.7 22.2
Chest of drawers (n=21)	Low Medium High	16-27 28-39 40-51	29.6	9.57	10 8 3	47.6 38.1 14.3
Wall storage (n=11)	Low Medium High	17-26 27-35 36-44	28.8	8.02	4 5 2	36.4 45.4 18.2
Base storage (n=31)	Low Medium High	16-26 27-36 37-46	28.5	7.81	11 16 4	35.5 51.6 12.9
Box bed (n=30)	Low Medium High	15-28 29-44 45-55	30.2	9.77	13 15 2	43.3 50 6.7

As regard to level of artificial light received by storage units in bedroom, the mean amount of artificial light present in free standing storage units in bedroom was found to be 29.16 lux. It was found that more than 45 percent free standing storage units received moderate level of artificial light ranged between 26-35 lux (Table 41).

Around 30 percent floor to ceiling storage units got low level of artificial light ranging from 17-26 lux. The mean artificial light found inside floor to ceiling storage unit was 28.09 lux.

The mean artificial light found in built in (up to 6/7 feet) storage unit was 27.81 lux and around 40 percent built in (up to 6/7 feet) storage units fell in moderate level illumination inside storage unit, ranged between 25-32 lux (Table 41).

Around 47 percent chest of drawers got low level of artificial light ranging from 16-27 lux while the mean amount of artificial light inside storage unit was found as 29.62 lux.

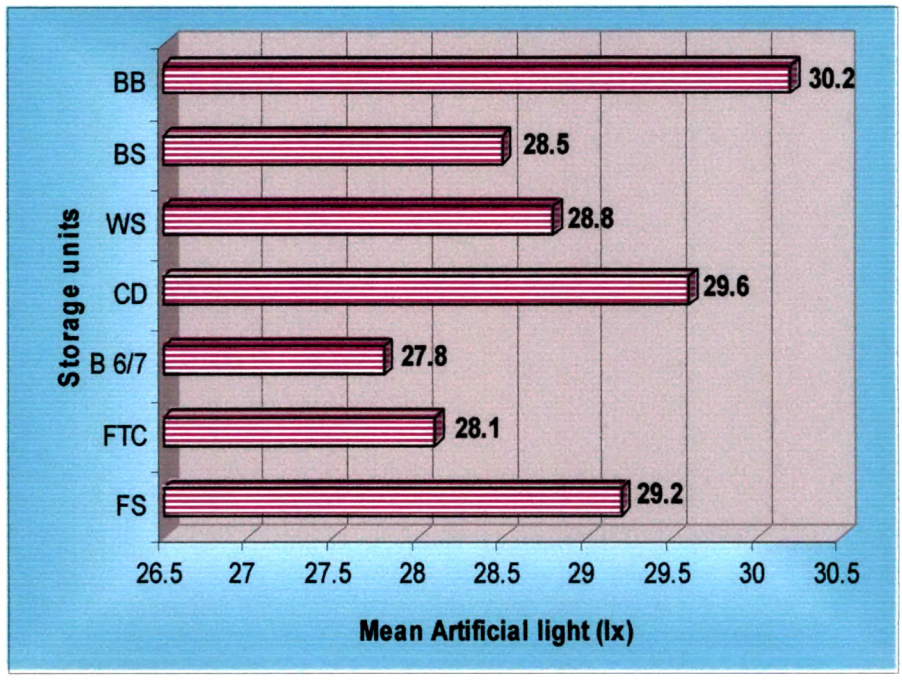


Fig 44: Mean illumination level (lux) of artificial light inside storage units in Bedroom

FS: Free standing storage unit
FTC: Floor to ceiling storage unit
B 6/7: Built-in (upto 6/7 feet) storage unit
CD: Chest of drawers
WS: Wall storage unit
BS: Base storage unit
BB: Box bed

The minimum amount of artificial light found in wall storage unit was 17 lux and maximum was 44 lux, whereas, most of the wall storage unit received artificial light ranged between 27-35 lux. The mean artificial light inside wall storage unit was found as 28.82 lux (Table 41).

More than 50 percent base storage units got hold of moderate level of artificial inside storage unit ranging from 27-36 lux, while the mean illumination level found as 28.48 lux.

Box bed received 30.17 lux mean artificial light, however 50 percent box bed got hold of moderate level of artificial light ranged from 29-44 lux (Table 41).

It was concluded that box bed received more amount of artificial light as compared to other storage units. The level of artificial light inside storage units varied due to various reasons such as design of storage units and their placement in bedroom.

4.4.2.5 Frequency of Using storage units in Bedroom:

This part deals with the frequency with which the respondents' were using their existing storage units in bedroom. The scores assigned to frequencies were: 1 for 1-3 times; 2 for 4-6 times; 3 for 7-9 times and 4 for 10 and more times. Further extent of using existing storage unit was calculated.

Regarding the use of storage units in bedroom, it was found that around 65 percent respondents were using free standing storage unit up to 4-6 times in the morning as well as in afternoon and in evening more than 50 percent and 60 percent respondents, respectively used the storage unit similar number of times as in the morning. However around 50 percent respondents were using the storage unit only 1-3 times at night (Table 42).

It was found that more number of respondents were using floor to ceiling storage unit 4-6 times in the morning (72.7 percent), after noon (59.1 percent) in evening (63.3 percent) whereas equal number of respondents (50 percent) were using the storage unit 1-3 times and 4-6 times at night.

Maximum respondents used the built in (up to 6/7 feet) storage unit up to 4-6 times in the morning (70.4 percent), afternoon (55.6 percent) and at night

(55.6 percent) while a little less than 45 percent respondents were using the storage unit 7-9 times in afternoon (Table 42).

Chest of drawers was used 4-6 times by more respondents in the morning (70.4 percent), as well as in afternoon (47.6 percent), evening (61.9 percent) and at night (38.1 percent).

It was found that more than 60 percent respondents were using wall storage unit 4-6 times in the morning, followed by around 45 percent respondents, 54 percent respondents and 63 percent respondents using the storage unit 4-6 times in afternoon, evening and at night respectively.

Base storage units were used 7-9 times by more than 45 percent respondents in the evening, however, the storage units were used 4-6 times by more respondents in the morning, afternoon and at night.

Frequency of using box bed was categorized in three parts i.e. daily, weekly and monthly; it was found that equal number of respondents (33.3 percent) was using box bed daily, weekly & monthly (Table 42).

After analyzing the above results it was concluded that except box bed, the other storage units were mostly used 4-6 times in a day, especially in the morning.

Extent of using storage units in Bedroom:

The frequency of use of the storage units was ascribed scores. The minimum and maximum possible scores were divided into 3 categories on the basis of equal interval to determine low, moderate and high extent of use. Higher scores indicated higher extent of use.

Table 43: Distribution of respondents by extent of using storage unit in bedroom

Storage type		Range	Respondents (n=85)	
			f	%
Free standing (n=43)	Low	4-7	14	32.6
	Moderate	8-12	28	65.1
	High	13-16	1	2.3
Built-in floor to ceiling (n=22)	Low	4-7	7	31.8
	Moderate	8-12	14	63.6
	High	13-16	1	4.5

Built in (upto6/7 feet) (n=27)	Low	4-7	6	22.2
	Moderate	8-12	19	70.4
	High	13-16	2	7.4
Chest of drawers (n=21)	Low	4-7	8	38.1
	Moderate	8-12	11	52.4
	High	13-16	2	9.5
Wall storage (n=11)	Low	4-7	2	18.2
	Moderate	8-12	8	72.7
	High	13-16	1	9.1
Base storage (n=31)	Low	4-7	6	19.4
	Moderate	8-12	22	70.9
	High	13-16	3	9.7

It was found that all the storage units viz. Free-standing (65.1 per cent), Built-in floor to ceiling (63.6 per cent), Built-in (upto 6/7 feet), Chest of drawers (52. per cent), Wall storage unit (72.7 per cent) and Base storage unit (70.9 per cent) found in the bedrooms were used by the respondents upto moderate extent (Table 43).

4.4.2.6 Dimensions of Existing Storage units in Bedroom:

This part comprised of various dimensions of storage units such as total dimensions, shelf's dimensions and drawer's dimensions of existing storage units in bedroom.

(i) Free standing storage unit in bedroom: Dimensions

Free standing storage units found in bedrooms' of the respondents' varied in number of shelves and in their measurements. Free standing storage unit was found in 43 respondents' bedroom. The mean total height, total width and total depth were found to be 197.18 cms, 97.77cms and 51.28 cms, respectively (Table 44). The mean top shelf height was 159.93 cms (from the floor), and the range varied from 141-183 cms. The top middle shelf was found only in 27 storage units. The mean height of the top middle and middle shelves were recorded as 83.78 cm and 50.42 cm (from the floor). Measurement of lower shelf (bottom shelf) revealed the mean height of 13.05 cms (from the floor) and the range being 9-18 cms.

The mean width of shelves was 97.14 cms and mean depth was 47.60 cms.

Table 42: Frequency and Percentage distribution of the Respondents on the basis of using existing storage units in Bedroom

Storage type	Morning								Afternoon							
	1-3		4-6		7-9		10 & above		1-3		4-6		7-9		10 & above	
	f		f		f		f		f		f		f		f	
Free standing (n=43)	-	-	28	65.1	15	34.9	-	-	4	9.3	23	53.5	15	34.5	1	2.3
Floor to ceiling (n=22)	-	-	16	72.7	6	27.3	-	-	2	9.1	13	59.1	4	18.2	3	13.6
Built in (upto6/7 feet) (n=27)	2	7.4	19	70.4	6	22.2	-	-	1	3.7	11	40.7	12	44.4	3	11.1
Chest of drawers (n=21)	2	9.5	15	71.4	3	14.3	1	4.8	2	9.5	10	47.6	7	33.3	2	9.5
Wall storage (n=11)	-	-	7	63.6	4	36.4	-	-	-	-	5	45.5	4	36.4	2	18.2
Base storage (n=31)	1	3.2	17	54.8	12	38.7	1	3.2	1	3.2	15	48.4	10	32.3	5	16.1
Box bed (n=30) Daily 10 33.3 Weekly10 33.3 Monthly 10 33.3																

Storage type	Evening								Night							
	1-3		4-6		7-9		10 & above		1-3		4-6		7-9		10 & above	
	f		f		f		f		f		f		f		f	
Free standing (n=43)	1	23.2	26	60.5	14	32.6	2	4.6	22	51.2	19	44.2	2	4.6	-	-
Floor to ceiling (n=22)	1	4.5	14	63.6	4	18.2	3	13.6	11	50	11	50	-	-	-	-
Built in (upto6/7 feet) (n=27)	1	3.7	15	55.6	8	29.6	3	11.1	12	44.4	15	55.6	-	-	-	-
Chest of drawers (n=21)	-	-	13	61.9	6	28.6	2	9.5	8	38.1	8	38.1	5	23.8	-	-
Wall storage (n=11)	-	-	6	54.5	3	27.3	4	36.4	3	27.3	7	63.3	1	9.01	-	-
Base storage (n=31)	-	-	12	38.7	15	48.4	4	12.9	8	25.8	13	41.9	10	32.3	-	-

Drawers were found only in 8 free standing units of bedroom. The mean height of the drawer was found as 43.5 cm (from the floor) and the range being 37-49 cms. The mean width and mean depth of the drawer were 44.9 cms and 46.9 cms, respectively (Table 44).

Probably unreachable height of shelves and inadequate depth of shelves gave rise to pain in body parts as reported by the respondents while expressing physiological problems faced by them while using storage units (Wide section 4.5.1.2;Table 61).

Table 44: Dimensions of Free standing storage unit in Bedroom

Dimension (n=43)	Range	f	%	Mean	SD
Total Height	183-195 196-207 208-220	21 16 6	48.8 37.2 13.9	197.18	8.35
Total width	87-94 95-102 103-110	11 23 9	25.6 53.5 20.9	97.77	5.49
Total Depth	45-48 49-52 53-56	11 17 15	25.6 39.5 34.9	51.28	2.86
Top shelf Height (from floor)	141-155 156-169 170-183	14 21 8	32.6 48.8 18.6	159.93	10.06
Upper middle shelf Height (n=27) (from floor)	60-85 86-110 111-136	19 3 5	70.4 11.1 18.5	83.78	24.49
Middle shelf Height (from floor)	36-48 49-60 61-73	20 16 7	46.5 37.2 16.3	50.42	11.01
Lower shelf height (from floor)	9-12 13-15 16-18	18 19 6	41.9 44.2 13.9	13.05	2.15
Shelf width	87-94 95-101 102-108	12 23 8	27.9 53.5 18.6	97.14	5.04
Shelf depth	42-46 47-50 51-54	17 19 7	39.5 44.2 16.3	47.60	2.90

Top drawer's height (n=8) (From floor)	37-41 42-45 46-49	2 3 3	25 37.5 37.5	43.5	4.47
Drawer's Width	43-45 46-47	5 5	62.5 37.5	44.9	1.64
Drawer's Depth	43-46 47-50	3 5	37.5 62.5	46.9	2.8

(ii) Built-in floor to ceiling storage unit in bedroom: Dimensions

In more than 25 per cent of the respondents' bedroom floor to ceiling storage unit was present. The mean total height of the storage units was 309.82 cms. The mean total width of the storage units was 96.64 cms. and the mean total depth of the storage units was 50.95 cms (Table 45). An examination of top shelves height revealed a range of 220-285 cms, however, the mean height was 251.5 cms (from the floor). While, investigating the availability of number of middle shelves, the data revealed that three types of middle shelves i.e. top middle, middle and lower middle shelves were seen in built-in floor to ceiling storage unit with mean height of 195.7, 145.6, 66.9 cm respectively. Whereas, the mean height of lower shelf was 14.05 cms. The mean width and mean depth of shelves were found to be 96.2 cm and 47.6 cm respectively.

Drawers were found in only six storage units and the mean height, mean width and mean depth of drawers being 41 cms, 47 cms and 47 cms, respectively.

To conclude it was found that respondents had to use stools or stand at same heights and had to support themselves with hand to reach the top most shelf of the storage units creating a risk of fall and injury and as well as adoption of awkward posture while using storage unit, which gave rise to pain and discomfort in body parts. Unsuitable height and depth of top, middle and lower shelf might had also led to pain in body parts as reported by the respondents while expressing physiological problems faced by them while using storage units (Wide section 4.5.1.2; Table 63).

Table 45: Dimensions of Built-in Floor to ceiling storage unit in Bedroom

Dimension	Range	f	%	Mean	SD
Total Height (n=22)	290-300	6	27.3	309.82	8.98
	301-310	4	18.2		
	311-320	12	54.5		
Total width	82-94	10	45.5	96.64	9.98
	95-107	10	45.5		
	108-120	2	9.0		
Total Depth	44-48	7	31.8	50.95	3.98
	49-53	9	40.9		
	54-58	6	27.3		
Top shelf Height (from floor)	220-241	8	36.4	251.5	19.36
	242-263	6	27.3		
	264-285	8	36.4		
Top middle shelf Height (from floor)	152-181	8	36.4	195.7	21.55
	182-210	9	40.9		
	211-240	5	22.7		
Middle shelf Height (n=15) (from floor)	76-109	1	6.7	145.6	22.35
	110-142	4	26.7		
	143-176	10	66.7		
Lower middle shelf height	39-54	4	18.2	66.9	12.66
	55-70	9	40.9		
	71-86	9	40.9		
Lower shelf height (from floor)	10-13	11	50	14.05	2.72
	14-16	7	31.8		
	17-20	4	18.2		
Shelf width	82-94	11	50	96.2	9.93
	95-107	9	40.9		
	108-120	2	9.1		
Shelf depth	40-45	6	27.3	47.6	3.99
	46-51	13	59.1		
	52-57	3	13.6		
Drawer's height (n=6) (From floor)	31-38	4	66.7	41	10.55
	39-46	-	-		
	47-54	2	33.3		
Drawer's Width	45-46	4	66.7	47	2.37
	47-48	-	-		
	49-50	2	33.3		
Drawer's Depth	40-43	1	16.7	47	4.29
	44-47	1	16.7		
	48-51	4	66.7		

(iii) Built in (up to 6/7 feet) storage unit in bedroom: Dimensions

Built in wall cabinet was found in 27 respondents' bedroom. The mean of total height was found to be 200.41cms, with a range of 186-220 cms. The mean total width of the storage units was 93.37 cms with a range being 88-115 cms. Whereas, the mean total depth of the storage units was found as 51.37 cms and the range varied from 42-58 cms (Table 46). After analyzing the data, the top shelves height of the storage units revealed range of 146-199 cms, however the mean height was 165.18 cms. The mean height of middle shelves and top middle shelves were found to be 55.15 cms and 95.24 cms respectively. Measurement the lower shelf (bottom shelf) revealed the mean height of 13.76 cms, the range being 9-20 cms.

Overall it was concluded that storage unit were found in different sizes and probably due to unreachable height of shelves, unsuitable depth of shelves caused severe pain in neck (3.8 out of 5.00, Table 62). Prolonged standing, frequent changes in posture and wrong placements of storage units led to pain in body parts as reported by the respondents while expressing physiological problems faced by them while using storage units (Wide section 4.5.1.2).

Table 46: Dimensions of Built in (6/7 feet) storage unit in Bedroom

Dimension	Range	f	%	Mean	SD
Total Height (n=27)	186-197	12	44.4	200.41	10.24
	198-208	8	29.6		
	209-220	7	25.9		
Total width	88-97	16	59.3	98.37	8.14
	98-106	5	18		
	107-115	6	22.2		
Total Depth	42-47	7	25.9	51.37	4.42
	48-52	9	33.3		
	53-58	11	40.7		
Top shelf Height (from floor)	146-163	13	48.1	165.18	12.44
	164-181	10	37.1		
	182-199	4	14.8		
Top middle shelf Height (n=17) (from floor)	61-89	9	52.9	95.24	26.37
	90-117	3	17.6		
	118-146	5	29.5		

Middle shelf Height (from floor)	39-57 58-76 77-95	17 7 3	62.9 25.9 11.2	55.15	14.53
Lower shelf height (from floor)	9-12 13-16 17-20	9 14 4	33.3 51.9 14.8	13.78	2.60
Shelf width	88-97 98-106 107-115	17 6 4	62.9 22.2 14.8	97.9	7.68
Shelf depth	40-44 45-49 50-54	7 7 13	25.9 25.9 48.2	48.04	4.28
Top drawer's height (n=5) (from floor)	42-52 53-62 63-73	2 2 1	40 40 20	53.2	12.48
Lower drawer's height (n=1) (From floor)	51	1	100		
Drawer's Width	40-58 59-76 77-94	4 - 1	80 - 20	56.8	21.49
Drawer's Depth	40-44 45-48 49-53	1 2 2	20 40 40	47.2	5.36

(iv) Chest of drawers: Dimensions

Chest of drawers was observed in 21 bedrooms of the respondents. The mean total height of chest of drawers was found as 85.67 cms with a range being 48-136 cms. The mean total width was recorded as 56.48 cms and the mean depth was 38.33 cms (Table 47). After analyzing data on drawers' height from floor, the mean top drawer's height was found to be 59.52 cms with a range of 27-105 cms. The mean heights of the top middle and middle drawers were recorded as 67.5 cms and 37.87 cms, respectively (from the floor) (Table 47). Measurement of lower drawer (bottom drawer) revealed the mean height of 10.57 cms. from the floor, and range being 6-16 cms. The depth of the drawers ranged from 25-50 cms, and the mean depth was 36 cms (Table 47). This has probably given rise to pain in neck as respondents had to bend down to search for the things stored.

If was found that respondents reported severe pain in neck and legs/ankle/ feet parts as reported by the respondents while expressing physiological problems faced by them while using chest of drawers (Wide section 4.5.1.2;Table 64). This, probably, may be due to adoption of frequent bending/squatting posture to lift articles from the drawers and rigorous movement of neck to catch sight of things stored in chest of drawers, as the height of drawers was quite low. The lower most drawer's height was found to be 10 cms on an average.

Table 47: Dimensions of Chest of Drawers in Bedroom

Dimension	Range (n=21)	f	%	Mean	SD
Total Height	48-77	8	38.1	85.67	25.29
	78-106	7	33.3		
	107-136	6	28.6		
Total width	30-56	12	57.1	56.48	23.04
	57-83	6	28.6		
	84-110	3	14.3		
Total Depth	28-37	12	57.1	38.33	7.70
	38-46	6	28.6		
	47-55	3	14.3		
Top drawers height (From floor)	27-53	8	38.1	59.52	23.56
	54-79	9	42.9		
	80-105	4	19.0		
Top middle drawers Height (n=4) (From floor)	64-67	3	75	67.5	4.43
	68-70	-	25		
	71-74	1	-		
Middle drawers Height (n=15) (From floor)	27-32	2	13.3	37.87	4.98
	33-38	6	40		
	39-44	7	46.7		
Lower drawers height (From floor)	6-9	9	42.9	10.57	3.53
	10-12	7	33.3		
	13-16	5	23.8		
Drawer's Width	30-55	13	61.9	53.05	21.08
	56-81	6	28.6		
	82-107	2	9.5		
Drawer's Depth	25-33	8	38.1	36	7.04
	34-41	7	33.3		
	42-50	6	28.6		

(v) Wall storage unit in bedroom: Dimensions

Wall storage unit was found in 11 respondents' bedroom (12.9 percent). The mean total height of wall storage unit itself was found to be 67.90 cms,

with a range being 52-81 cms. The mean total width of the storage units was found to be 55.73 and the mean total depth was 26.82 cms (Table 48). The mean height of the top shelf from floor was recorded as 150.09 cms with a range being 130-177 cms. It was found that a middle shelf was found only in 7 wall storage units. The mean height of the middle shelf was 127.71 cms and the mean height of lower shelf from floor was 109.73 cms. The mean width of shelves was 55.27 cms and mean depth was 23.91 cms (Table 48).

Table 48: Dimensions of Wall Storage Unit in Bedroom

Dimension	Range (n=11)	f	%	Mean	SD
Total Height	52-61	3	27.2	67.90	9.25
	62-71	4	36.4		
	72-81	4	36.4		
Total width	28-60	8	72.7	55.73	30.26
	61-92	1	9.1		
	93-125	2	18.2		
Total Depth	28-37	12	57.1	38.33	7.70
	38-46	6	28.6		
	47-55	3	14.3		
Top shelf height (from floor)	130-145	3	27.2	150.09	13.64
	146-161	6	54.6		
	162-177	2	18.2		
Middle shelf Height (n=7) (from floor)	105-121	3	42.8	127.71	17.92
	122-138	2	28.6		
	139-155	2	28.6		
Lower shelf height (from floor)	78-96	3	27.2	109.73	18.12
	97-114	2	18.2		
	115-133	6	54.6		
Shelf width	28-60	8	72.7	55.27	30.45
	61-92	1	9.1		
	93-125	2	18.2		
Shelf depth	20-23	6	54.6	23.91	3.27
	24-26	2	18.2		
	27-30	3	27.2		
Drawer's height (From floor)	88	1	100	-	-
Drawer's Width	22	1	100	-	-
Drawer's Depth	20	1	100	-	-

The wall storage units were found in varying sizes with different dimensions of shelf's height, width and depth. Probably shelf's height (150 cms from floor) was not suitable for the respondents which gave rise to frequent movement of neck leading to severe pain in neck as reported by the respondents while expressing physiological problems faced by them while using storage units (Wide section 4.5.1.2; Table 65).

(vi) Base storage unit in bedroom: Dimensions

Base storage units were found in 31 respondents' bedroom. Generally they were placed below window sill. The mean total height of the base storage unit was found as 76.19 cms, and the mean total width was 59.48 cms. The range obtained for total depth varies from 22-40 cms with a mean of 30.68 cms (Table 49). The mean height of the top shelf and middle shelf from the floor were found as 53.24 cms and 40 cms, respectively. The lower shelves ranged from 4-24 cms and the mean height of lower shelves was 12.84 cms. The mean width of shelves was 58.26 cms and mean depth of shelves was 28.39 cms.

Base storage unit found in bedrooms' of the respondents differed in types, size, number of shelves and measurements. It may be possible that adoption of repetitive bending, squatting or kneeling postures to lift things from this low storage unit led to severe pain in lower body parts as reported by the respondents while expressing physiological problems faced by them while using storage units (Wide section 4.5.1.2, Table 66).

Table 49: Dimensions of Base storage Unit in Bedroom (n=31)

Dimension	Range	f	%	Mean	SD
Total Height	48-71	13	41.9	76.19	16.69
	72-94	13	41.9		
	95-118	5	16.2		
Total width	29-60	20	64.5	59.48	28.68
	61-91	5	16.2		
	92-123	6	19.3		
Total Depth	22-28	11	35.5	30.68	4.70
	29-34	12	38.7		
	35-40	8	25.8		

Top shelf height (n=29) (from floor)	26.49 50-73 74-97	12 14 3	41.4 48.3 10.3	53.24	16.64
Middle shelf Height (n=12) (from floor)	31-40 41-49 50-58	8 3 1	66.7 25 8.3	40	7.71
Lower shelf height (from floor)	4-10 11-17 18-24	11 13 7	35.5 41.9 22.6	12.84	4.67
Shelf width	29-60 61-91 92-123	21 5 5	67.8 16.1 16.1	58.26	28.35
Shelf depth	20-26 27-33 34-40	14 14 3	45.2 45.2 9.6	28.39	4.67
Drawer's height (From floor)	50 54	1 1	50 50	52	2.83
Drawer's Width	29	2	100		
Drawer's Depth	31	2	100		

(vii) Box bed in bedroom: Dimensions

The box bed was found in 30 respondents' bedroom. The mean total length of box bed was found as 200.93 cms and range varied from 192-218 cms. The mean total width of box bed found to be 186.97 cms and range being 175-195 cms. The range obtained for total depth varied from 34-52 cms, and the mean total depth was 43.13 cms (Table 50). An examination of data revealed that mean length of storage space available in box bed was 197.5 cms, with a range being 189-212 cms. The range of storage space width of box bed varied from 172-190 cms and the mean storage space width was 183.77 cms. Whereas, the mean storage space depth was 40.77cms and the range varied from 31-48 cms (Table 50).

Table 50: Dimensions of Box bed in Bedroom (n=30)

Dimension	Range (n=30)	f	%	Mean	SD
Total length	192-200 201-209 210-218	15 13 2	50 43.3 6.7	200.93	5.49

Total width	175-181 182-188 189-195	6 10 14	20 33.3 46.7	186.97	5.79
Total Depth	34-40 41-46 47-52	12 9 9	40 30 30	43.13	5.02
Storage space length	189-196 197-204 205-212	13 16 1	43.3 53.3 3.3	197.5	4.89
Storage space width	172-178 179-184 185-190	8 5 17	26.7 16.7 56.6	183.77	5.43
Storage space depth	31-36 37-42 43-48	6 12 12	20 40 40	40.77	4.53

It was observed that box bed was not used by the respondents frequently. The box beds seen in bedroom of respondents' were deep enough due to which stored articles were not easily visible. The respondents usually bend or squat or kneel down to use box bed available in their bedroom. It may be likely due to adoption of such awkward postures which gives caused severe pain in lower parts of the body i.e. hips/thighs/buttocks, knees, legs/ankle/feet (3.8/5.00) as reported by the respondents while expressing physiological problems faced by them while using storage units (Wide section 4.5.1.2; Table 67).

Section: 5

4.5 Extent of Problems Experienced with Existing Storage Units:

This section includes various scales to assess the problems felt by the respondents while using existing storage units. Information regarding following problems are presented in this section:

1. Physiological problems faced by the respondents while using storage units in selected areas,
2. Problems regarding physical characteristics of the storage units
3. Problems faced by the respondents while using storage units, and
4. Postures adopted by the respondents while using storage units

The information will help in reducing the physiological problems faced by the respondents and to improve body postures adopted by them while using existing storage units in selected areas. It will also help in providing better and improved/modified designs for existing storage units, which can reduce the problems of the respondents related to physical characteristics of the storage units.

4.5.1 Physiological problems faced by the respondents while using storage units in selected area of the house viz. kitchen and bedroom

Physiological problems felt by respondents while using storage unit were assessed by the severity of pain felt by the respondents in various parts of the body while using the various storage units in kitchen and in the bed room. The respondents were provided with a body map in which they located the severity of pain felt by them in different parts of body by using various colours assigned to each type of extent and scores were given by the researcher to each colour. The colours and scores used were as follows:

Colour	Severity of Pain	Score
Red	Very server	5
Pink	Server	4
Blue	Moderate	3
Brown	Mild	2
Green	Very Mild	1

The respondents indicated the extent of severity of experiencing pain in neck, shoulder, elbow, wrist/hands, upper back, lower back, one or both hips/ thighs/ buttocks, one or both knees and one or both ankles. The range of possible score of 1 to 5 was divided into 3 categories having equal interval so as to describe severity of pain.

The findings are presented for kitchen and thereafter for bedroom. For making the presentation systematic, the findings are grouped as per the storage unit.

4.5.1.1 Extent of physiological problems faced by the respondents while using storage units in kitchen

This portion comprise of severity of pain/discomfort felt by the respondents in various parts of the body while using the various storage unit in

kitchen, viz. free standing storage unit, built-in (up to 6/7 feet), built in wall cabinet, wall mounted cabinet, Base cabinet, wall mounted rack, other rack and built-in open shelves in kitchen. The weighted mean scores were calculated to find out the extent of pain/ discomfort felt by the respondents while using various storage units and was shown through the body maps.

(i) Free standing storage unit in kitchen: Pain felt

It was found that respondents felt severe pain in neck while using free standing storage unit. Moderate pain was felt in other body parts therefore, it was concluded that more movement of neck leads to high pain as compared to rest of the body parts. Body map gives a clear picture of pain/discomfort felt by the elder women in various body parts while using free standing storage unit (Table 51, Fig 43 (i).

Table 51: Extent of pain felt by elder women while using existing free standing storage unit in kitchen

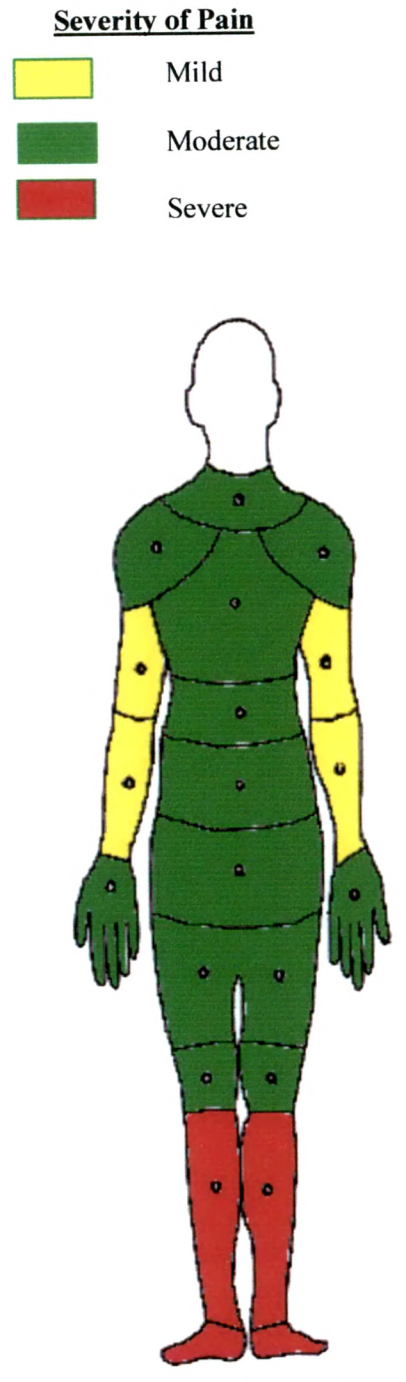
Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	-	3.8
2	Shoulder	-	3.08	-
3	Arms/Elbow	-	2.88	-
4	Wrist/hand	-	2.88	-
5	Upper back	-	2.83	-
6	Lower back	-	2.85	-
7	One or both hips/thighs/buttock	-	2.45	-
8	One or both knees	-	2.78	-
9	One or both legs/ankle/ feet	-	3.00	-

(ii). Built-in (up to 6/7 feet) Storage Unit in kitchen: Pain felt

It was found that respondents complained severe pain in one or both legs/ankle/ feet, whereas mild pain was detected in elbow as well as moderate pain was felt in rest of the body parts while using built in (up to 6/7 feet) storage unit. This reveals that more use of ankle/feet such as raising on toes, sitting, squatting to lift the things from lower shelf, while using built-in (up to 6/7 feet) storage unit leads to pain in the ankle/feet. The mean of lowest shelf was 15.26 cms which is quite low. The mean of top shelf was 143.35 cms.

Fig 43: Extent of pain felt by elder women while using existing storage units in kitchen: Free standing and Built-in (upto 6/7 feet)

Free standing
Fig. (i)



Built-in (upto 6/7 feet)
Fig. (ii)

Body map shows the extent of pain/discomfort felt by the elder women while using built in ((up to 6/7 feet) storage unit (Table 52, Fig.(ii).

Table 52: Extent of pain felt by elder women while using built in (up to 6/7 feet) Storage Unit in kitchen:

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8 -5.0)
1	Neck	-	3.00	-
2	Shoulder	-	2.71	-
3	Arms/Elbow	2.2	-	-
4	Wrist/hand	-	2.4	-
5	Upper back	-	2.43	-
6	Lower back	-	2. 5	-
7	One or both hips/thighs/buttock	-	3.0	-
8	One or both knees	-	3.14	-
9	One or both legs/ankle/feet	-	-	3.8

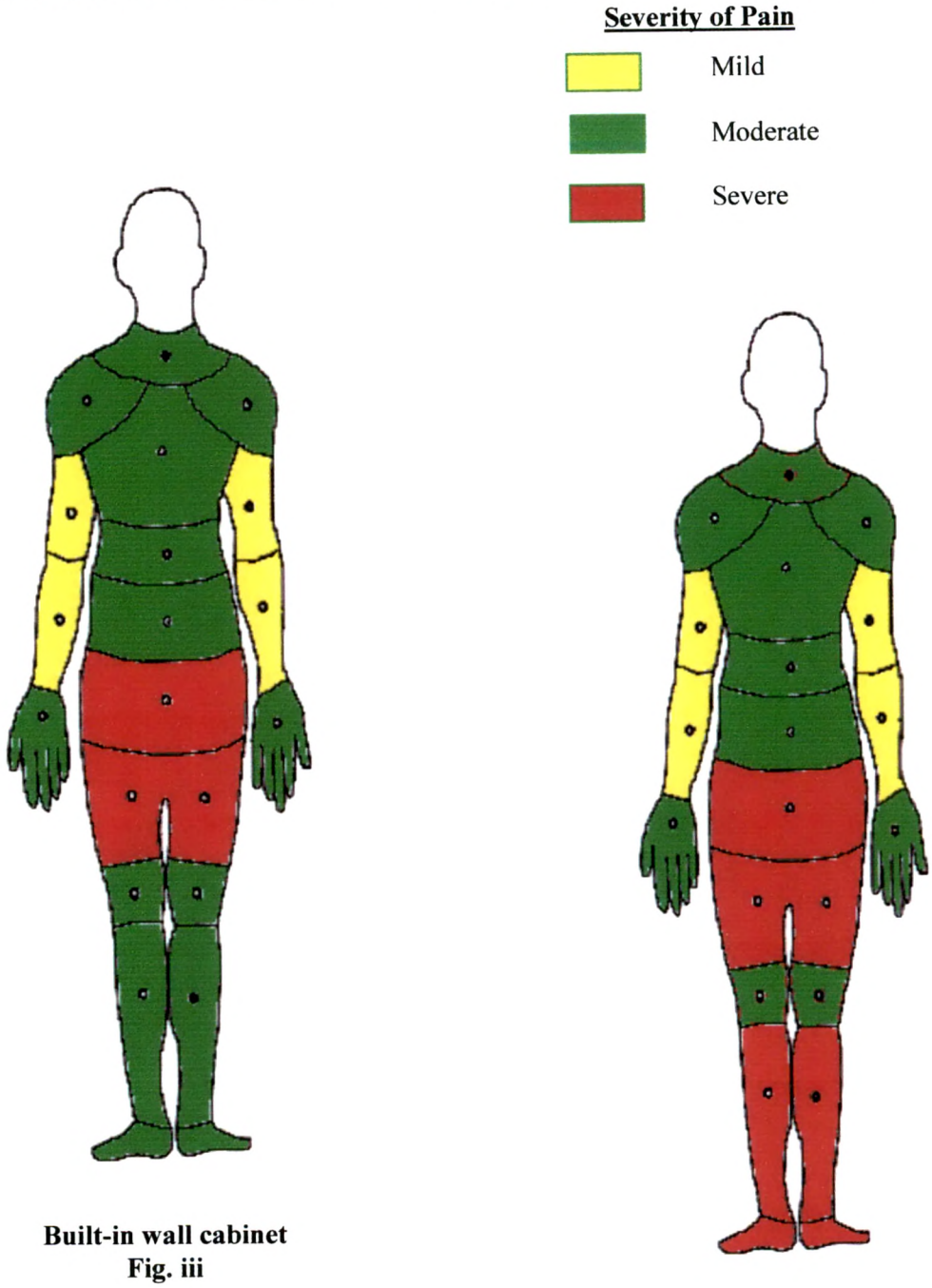
(iii) Built-in wall cabinet in kitchen: Pain felt

The respondents reported severe pain in one or both hips/thighs/buttocks, while mild pain was complained in arms/elbow however; moderate pain was felt in other body parts while using built in wall cabinet. The body map shows the extent of pain felt by the respondents in various parts of body while using built in wall cabinet (Table 53, Fig iii).

Table 53: Extent of pain felt by elder women while using existing built-in wall cabinet:

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8 -5.0)
1	Neck	-	2.67	-
2	Shoulder	-	2.77	-
3	Arms/Elbow	2.2		-
4	Wrist/hand	-	2.75	-
5	Upper back	-	2.73	-
6	Lower back	-	3.15	-
7	One or both hips/thighs/buttock	-	-	3.8
8	One or both knees	-	2.92	-
9	One or both legs/ankle/feet	-	3.3	-

Fig 44: Extent of pain felt by elder women while using existing storage units in kitchen: Built-in wall cabinet and Wall mounted cabinet



Built-in wall cabinet
Fig. iii

Wall mounted cabinet
Fig. iv

(iv) Wall Mounted Cabinet in kitchen: Pain felt

It was found that respondents reported severe pain in one or both hips/thighs/buttocks and one or both legs/ankle/feet. This may be due to reason that they "had to straighten their ankle to extreme to use the upper shelves of these unit" (Intensity index 1.52/2.00, Appendix Table 3) as revealed through the problem scale.. Mild pain was felt in arms/elbow while moderate pain was felt in rest of the body parts while using wall mounted cabinet.

Table 54: Extent of pain felt by elder women while using existing wall mounted cabinet:

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	3.5	
2	Shoulder	-	2.8	-
3	Arms/Elbow	-	2.86	-
4	Wrist/hand	-	2.83	-
5	Upper back	2.2		-
6	Lower back	-	2.4	-
7	One or both hips/thighs/buttock	-	-	3.8
8	One or both knees	-	3.5	
9	One or both legs/ankle/feet	-	-	3.8

This reveals that shelves of the existing storage cabinets were not at suitable height, which gives rise to improper movements of neck and other body parts leading to pain/discomfort. At the same time poor placement of cabinets increases more walking while using storage units leading to pain in whole legs. Probably the respondents had to raise their body on their toes to reach the height of wall mounted cabinet (The mean of height of top shelf was found to be 178.74 cms from the floor), which led to pain in the legs/ankle/feet. They felt pain in neck also probably because the height of top shelf of wall mounted cabinet ranging from 148-200 cms from floor. The depth of the shelves was 40 cms on an average. To peep into shelves they had to probably stretch their neck hence felt pain in neck. The body map gives a clear picture of extent of pain felt by the respondents while using wall mounted cabinet (Table 54, Fig iv).

(v) Base Cabinet in kitchen: Pain felt

It was found that severe pain was felt by the respondents in one or both hips/thighs/buttocks whereas moderate pain was experienced by the respondents in other body parts while using base cabinet. The lower most shelf of base cabinets ranged from 6 to 22 cms, mean being 10.86 cms which is quite low. It could be concluded that probably due to the use of lower portion of body such as bending, kneeling, squatting to lift things from base cabinets led to pain in hips/thighs/buttocks. This is reflected in the body map (Table 55, Fig.v).

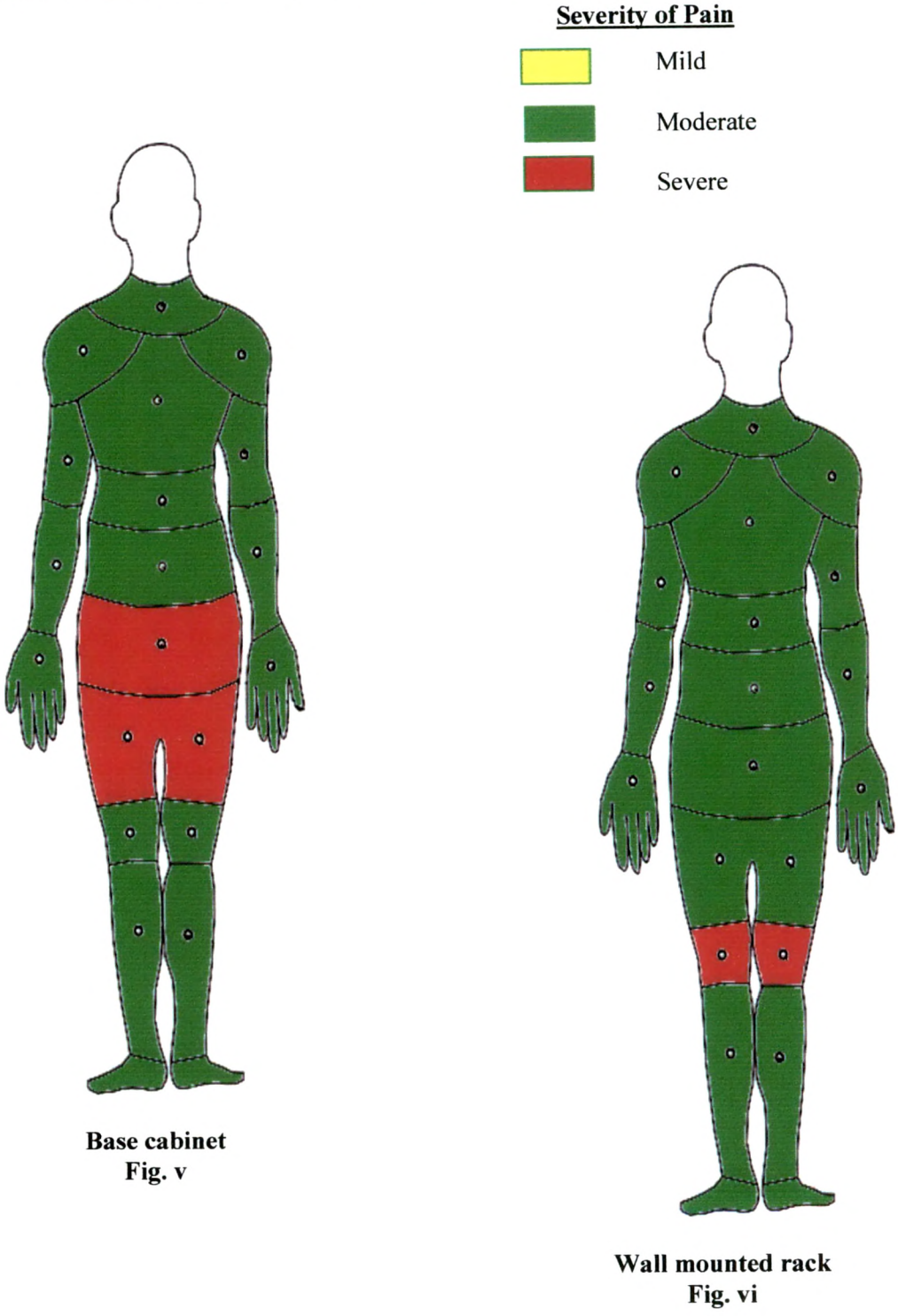
Table 55: Extent of pain felt by elder women while using existing base cabinet in kitchen:

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	2.83	-
2	Shoulder	-	2.71	-
3	Arms/Elbow	-	2.44	-
4	Wrist/hand	-	2.67	-
5	Upper back	-	2.69	-
6	Lower back	-	3.06	-
7	One or both hips/thighs/buttock	-	-	3.8
8	One or both knees	-	2.95	-
9	One or both legs/ankle/feet	-	3.22	-

(vi) Wall mounted Rack in kitchen: Pain felt

The respondents' experienced severe pain in knees, while moderate pain was complained by the respondents in remaining body parts while using wall mounted rack. Thus it was revealed that continuous standing posture while using wall mounted rack might have led to severe pain in knees as the mean height of the top shelf was found to be 180 cms (Table 33). Body map shows the extent of pain felt by the respondents while using existing wall mounted rack (Table 56, Fig vi).

Fig 45: Extent of pain felt by elder women while using existing storage units in kitchen: Base cabinet and Wall mounted rack



Base cabinet
Fig. v

Wall mounted rack
Fig. vi

Table 56: Extent of pain felt by elder women while using existing wall mounted rack in kitchen:

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	3.05	-
2	Shoulder	-	2.81	-
3	Arms/Elbow	-	2.59	-
4	Wrist/hand	-	2.55	-
5	Upper back	-	2.55	-
6	Lower back	-	2.79	-
7	One or both hips/thighs/buttock	-	3.33	-
8	One or both knees	-	-	3.8
9	One or both legs/ankle/feet	-	3.39	-

(vii) Other rack in kitchen: Pain felt

It was found that the respondents reported severe pain in neck and one or both hips/thighs/buttocks. The mean height of the top shelf of other racks was found to be 99 cms and of lower shelf was 66 cms. So to use these low shelves they felt pain in neck and thighs. Moderate pain was complained in rest of the body parts of the respondents while using other racks (Table 57). It may be possible that due to wrong placement and poor design of existing units in kitchen led to pain in body parts. The body map in Fig vii shows the extent of pain felt by the elder women in various body parts while using other rack.

Table 57: Extent of pain felt by elder women while using other rack in kitchen

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	-	3.8
2	Shoulder	-	3.11	-
3	Arms/Elbow	-	2.8	-
4	Wrist/hand	2.00	-	-
5	Upper back	-	2.78	-
6	Lower back	-	2.89	-
7	One or both hips/thighs/buttock	-	-	3.8
8	One or both knees	-	3.4	-
9	One or both legs/ankle/feet	-	3.4	-

(viii) Loft in kitchen: Pain felt

It was found that the respondents were suffering from severe pain in elbow and one or both hips/thighs/buttocks, however moderate pain was reported by the respondents in other body parts while using loft. The body map shows the extent of pain felt in various body parts by the respondents while using loft (Table 58, Fig viii). Since the loft is placed very high in the wall (243 cms from floor on an average, Table 36), the respondents had to stretch their arms and body to operate the unit. This might have led to severe pain in various body parts.

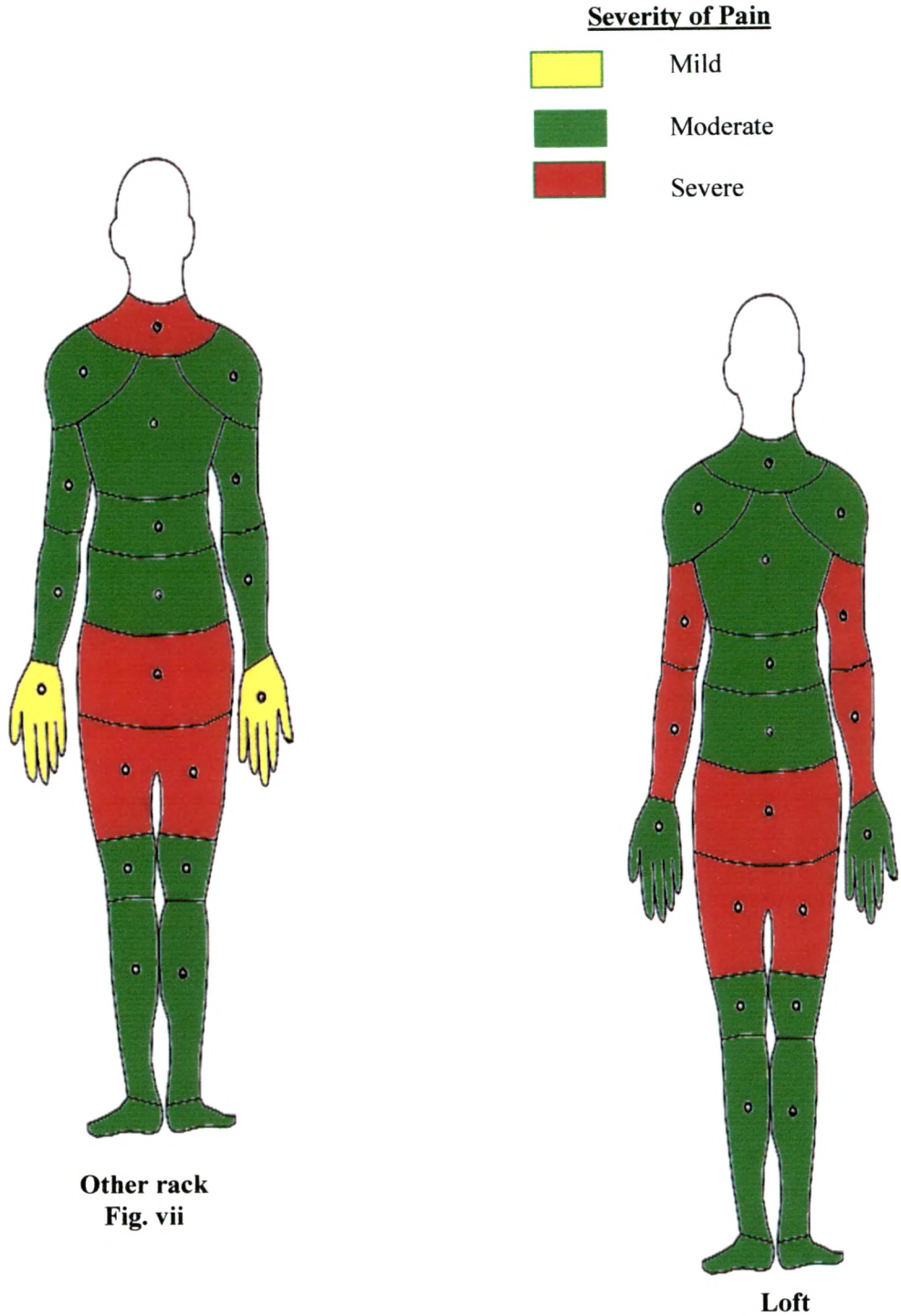
Table 58: Extent of pain felt by elder women while using existing loft in kitchen

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck		3.00	-
2	Shoulder		3.00	-
3	Arms/Elbow		-	4.00
4	Wrist/hand		3.3	-
5	Upper back		3.25	-
6	Lower back		3.25	-
7	One or both hips/thighs/buttock	-	-	3.8
8	One or both knees		2.8	-
9	One or both legs/ankle/feet		2.88	-

(ix) Open shelves in kitchen: Pain felt

The respondents reported severe pain in one or both hips/thighs/buttocks, one or both knees and one or both ankle/feet, whereas moderate pain was experienced in other body parts while using open shelves. It was revealed that lower part of the body was most affected due to standing, bending, squatting, raising on toes while using open shelves as the mean height of the top and lower shelf was found to be at 160 cms and 36 cms, from floor which was quite high and low, respectively. Extent of pain felt by elder women was shown through body map (Table 59, Fig ix).

Fig 46: Extent of pain felt by elder women while using existing storage units in kitchen: Other rack and Loft



Other rack
Fig. vii

Loft
Fig. viii

Table 59: Extent of pain felt by elder women while using existing open shelves in kitchen

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	3.22	-
2	Shoulder	-	3.00	-
3	Arms/Elbow	-	2.73	-
4	Wrist/hand	-	2.4	-
5	Upper back	-	2.6	-
6	Lower back	-	2.71	-
7	One or both hips/thighs/buttock	-	3.4	-
8	One or both knees	-	-	3.8
9	One or both legs/ ankle/feet	-	-	3.83

Conclusion

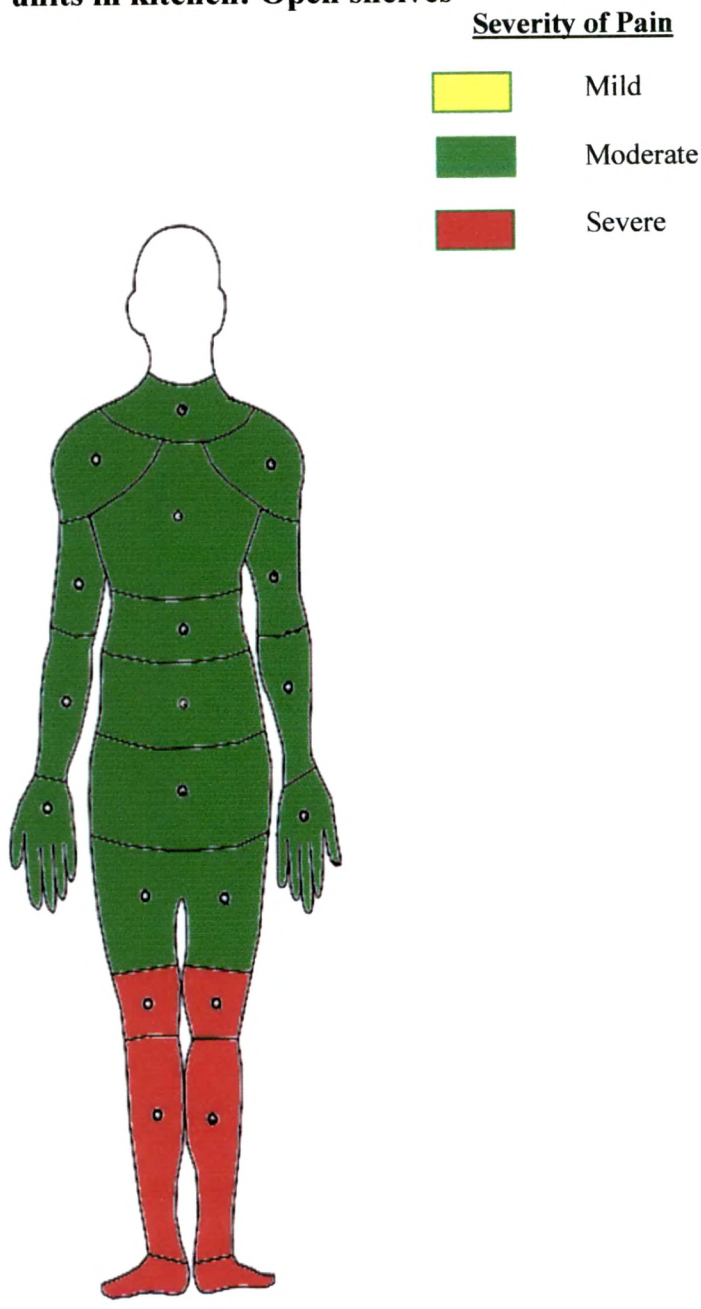
The total weighted mean score for individual storage unit in kitchen was calculated by adding up the weighted mean scores of extent of pain in the body parts of each storage unit and dividing the total score by number of body parts i.e.9. This gave a comparative view about the extent of pain felt while using various storage units in kitchen.

Table 60: Extent of pain felt by elder women while using existing storage units in Kitchen

Sr. No.	Storage units	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Free-standing	-	2.95	-
2	Built-in (upto 6/7 feet)	-	2.79	-
3	Built-in wall cabinet	-	2.92	-
4	Wall mounted cabinet	-	3.07	-
5	Base cabinet	-	2.93	-
6	Wall mounted rack	-	2.98	-
7	Other rack	-	3.10	-
8	Loft	-	3.25	-
9	Built-in open shelves	-	3.07	-

After analyzing the data of storage units it was found that the elder women felt moderate pain while using storage units in kitchen but further comparison of figures revealed that more pain/discomfort was felt by the

Fig 47: Extent of pain felt by elder women while using existing storage units in kitchen: Open shelves



Built-in open shelves
Fig. ix

respondents while using Loft, other rack, wall mounted cabinet, and built-in open shelves. The worst affected body parts were neck, one or both hips/thighs/buttocks, one or both knees and one or both legs/ankle/feet. Therefore, it may be concluded that probably the wrong placement/poor design/unsuitable dimensions of storage units gave rise to frequent changes in body movements and hence frequent changes in postures led to pain and discomfort in body parts.

4.5.1.2 Physiological problems faced by the respondents while using storage units in bedroom:

This section incorporate severity of pain felt by the respondents in various parts of the body while using various storage units, viz. free standing storage unit, built in (up to 6/7 felt), built-in floor to ceiling, chest of drawers, wall storage unit, base storage unit and box bed in bedroom. The weighted mean scores were calculated to find out the extent of pain/ discomfort felt by the respondents while using various storage units and was shown through the body maps.

(i) Free standing in bedroom: Pain felt

It was found that the respondents reported moderate pain in various body parts while using free standing storage units in bedroom (Table 61). The body map shows the extent of pain felt by the elder women in various body parts while using existing free standing units in bedroom (Fig x).

Table 61: Extent of pain felt by elder women while using existing free standing storage unit in Bedroom

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8 -5.0)
1	Neck	-	2.68	-
2	Shoulder	-	2.95	-
3	Arms/Elbow	-	2.65	-
4	Wrist/hand	-	2.64	-
5	Upper back	-	2.42	-
6	Lower back	-	2. 5	-
7	One or both hips/thighs/buttock	-	3.21	-
8	One or both knees	-	2.81	-
9	One or both legs/ankle/feet	-	2.89	-

(ii). Built in (up to 6/7 feet) Storage Unit in bedroom: Pain felt

The respondents reported severe pain in neck, whereas, moderate pain was felt by the respondents in rest of the body parts while using built in (up to 6/7 feet) storage unit. It could be concluded that higher and frequent movement of neck in all the directions while using various shelves of the storage unit led to more pain (Table 62). The body map shows the extent of pain felt by the elder women while using built in (up to 6/7 feet) storage unit (Fig xi).

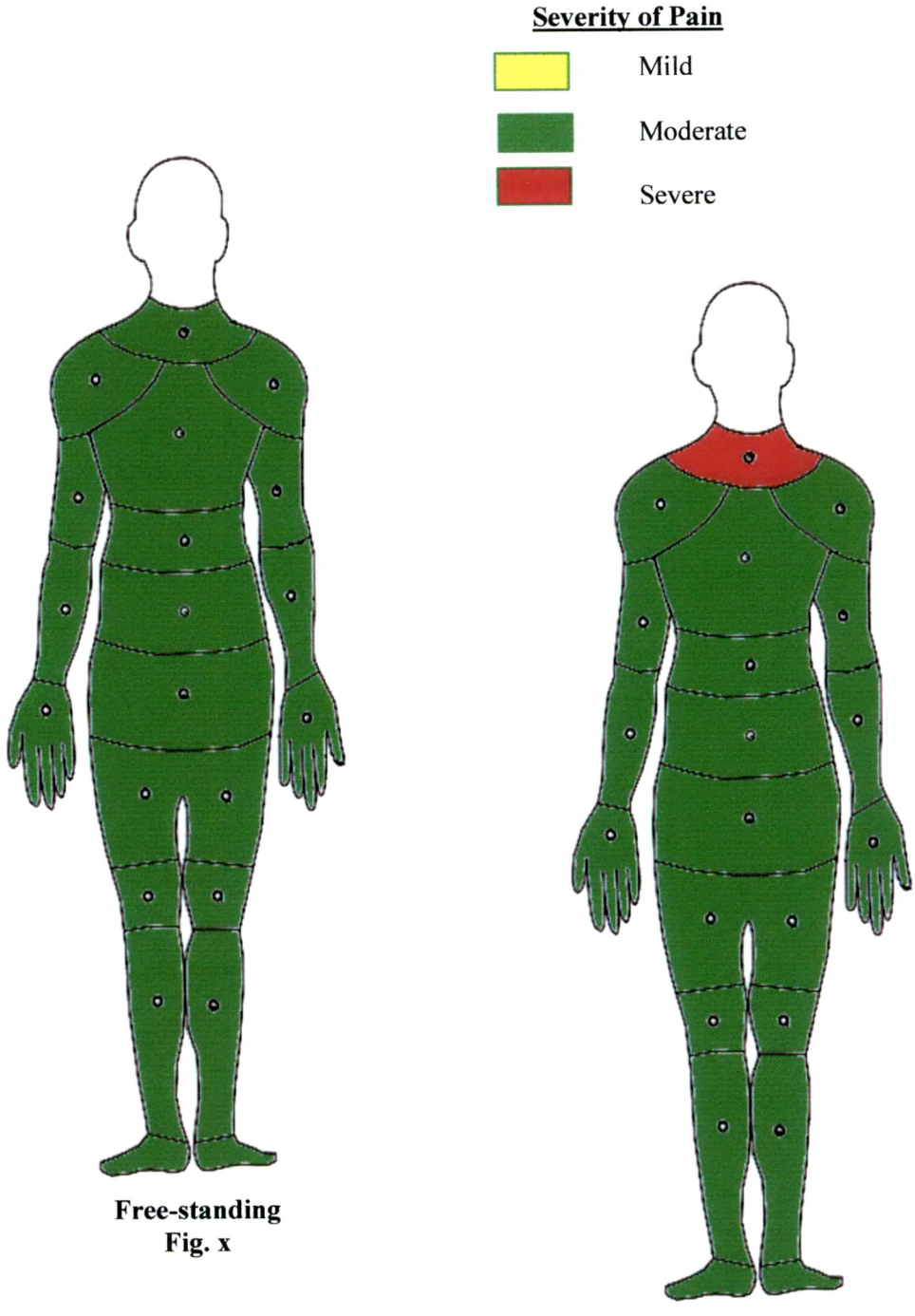
Table 62: Extent of pain felt by elder women while using built in (up to 6/7 feet) Storage Unit in Bed room:

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	-	3.8
2	Shoulder	-	2.8	-
3	Arms/Elbow	-	2.56	-
4	Wrist/hand	-	2.5	-
5	Upper back	-	2.91	-
6	Lower back	-	2. 92	-
7	One or both hips/thighs/buttock	-	2.94	-
8	One or both knees	-	2.75	-
9	One or both legs/ankle/feet	-	3.00	-

(iii). Built-in Floor to ceiling storage unit in bedroom: Pain felt

The respondents reported severe pain in lower back, one or both hips/thighs/buttocks, one or both knees and one or both ankle/feet, while mild pain was experienced in neck however, moderate pain was felt by the respondents in rest of the body parts while using floor to ceiling storage. It was revealed that excessive use of lower body parts for bending, squatting, kneeling, raising on toes etc to reach the articles led to pain and discomfort (Table 63). The body map shows the extent of pain felt by the respondents in various body parts while using built-in floor to ceiling storage unit in bedroom (Fig xii).

Fig 48: Extent of pain felt by elder women while using existing storage units in bedroom: Free-standing and built-in (upto 6/7)



Free-standing
Fig. x

Built-in (upto 6/7 feet)
Fig. xi

Table 63: Extent of pain felt by elder women while using existing built in floor to ceiling storage unit in bedroom:

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	2.00	-	-
2	Shoulder	-	2.5	-
3	Arms/Elbow	-	2.5	-
4	Wrist/hand	-	2.5	-
5	Upper back	-	3.00	-
6	Lower back	-	-	3.8
7	One or both hips/thighs/buttock	-	-	3.9
8	One or both knees	-	-	3.8
9	One or both legs/ankle/feet	-	-	4.00

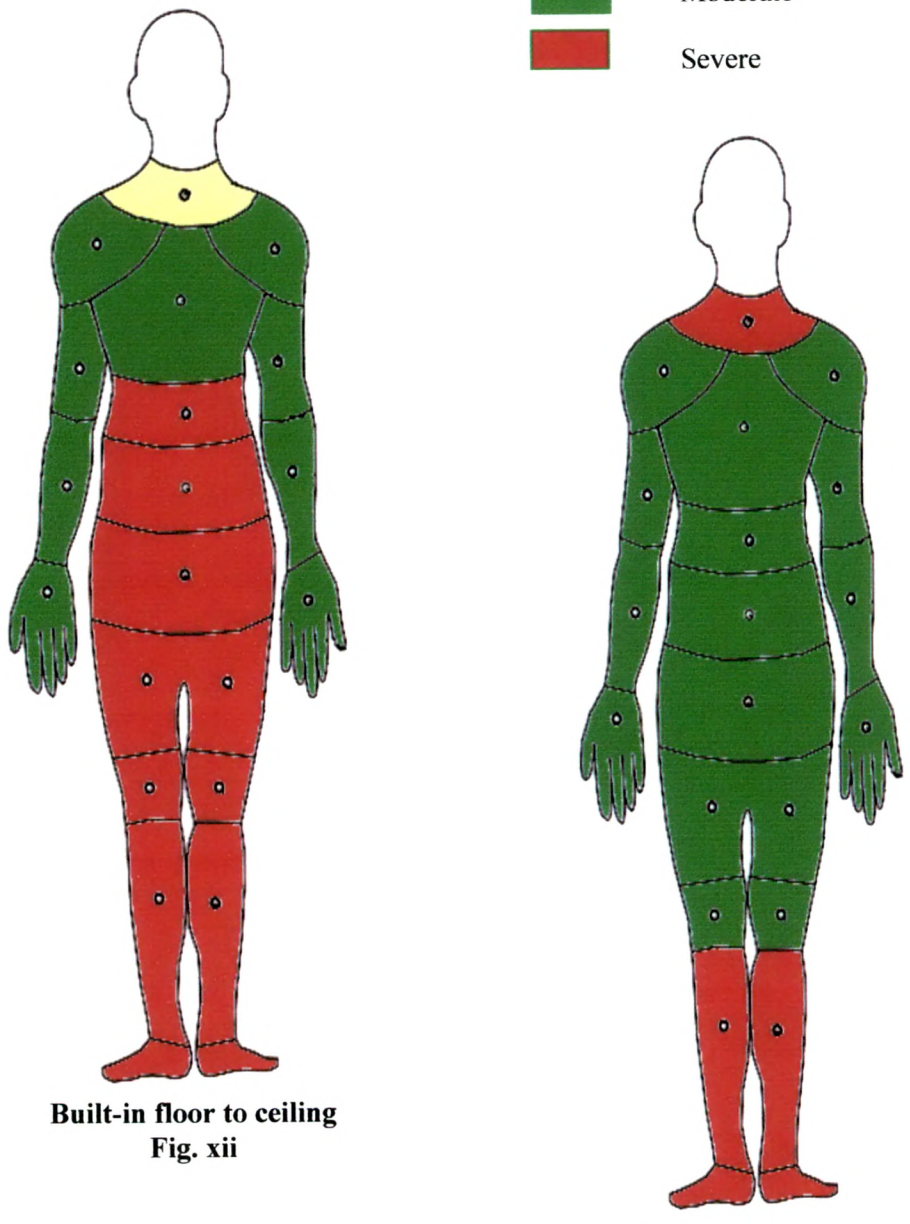
(iv). Chest of drawers in bedroom: Pain felt

It was found that the respondents reported severe pain in neck and ankle/feet, whereas moderate pain was found in rest of the body parts while using chest of drawers. It was revealed that due to adoption of awkward postures, use of wrong muscles and frequent movements of neck and legs/ankle/feet while using chest of drawers leads to pain respective body parts (Table 64). The body map shows the extent of pain felt by the respondents while using chest of drawers (Fig xiii).

Table 64: Extent of pain felt by elder women while using existing chest of drawers in bedroom

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	-	3.8
2	Shoulder	-	2.8	-
3	Arms/Elbow	-	2.63	-
4	Wrist/hand	-	2.67	-
5	Upper back	-	2.46	-
6	Lower back	-	2.62	-
7	One or both hips/thighs/buttock	-	2.8	-
8	One or both knees	-	3.00	-
9	One or both legs/ankle/feet	-	-	4.00

Fig 49: Extent of pain felt by elder women while using existing storage units in bedroom: Built-in floor to ceiling and Chest of drawers



Built-in floor to ceiling
Fig. xii

Chest of drawers
Fig. xiii

(v) Wall Storage Unit in bedroom: Pain felt

The respondents felt severe pain in neck, moderate pain was felt by the respondents in other body parts while using wall storage unit. The unusual and frequent movements of neck led to pain in neck while using the wall storage unit (Table 65). The body map shows the extent of pain felt by the respondents while using existing wall storage unit (fig xiv).

Table 65: Extent of pain felt by elder women while using existing wall storage unit in bedroom:

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	-	3.85
2	Shoulder	-	2.8	-
3	Arms/Elbow	-	2.5	-
4	Wrist/hand	-	2.67	-
5	Upper back	-	2.6	-
6	Lower back	-	2.4	-
7	One or both hips/thighs/buttock	-	2.89	-
8	One or both knees	-	3.00	-
9	One or both legs/ankle/feet	2.00		-

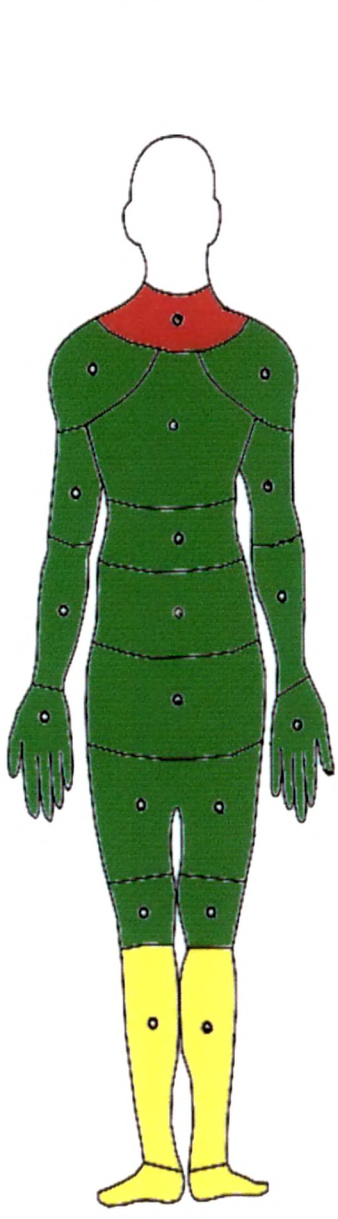
(vi). Base storage unit in bedroom: Pain felt

The respondents experienced severe pain in one or both hips/thighs/buttock, however moderate pain was felt by the elder women while using base storage unit (Table 66). This might have been because these units were quite low, mean height of top shelf was 53 cms and that of lower shelf was about 13 cms from floor. The body map (fig xv) shows the extent of pain felt by the respondents while using base storage unit.

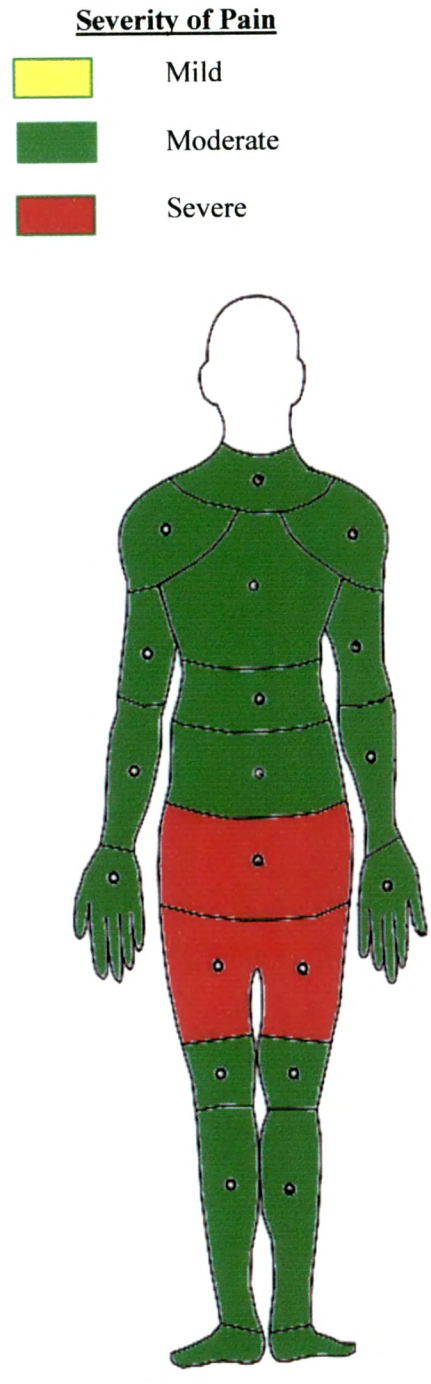
Table 66: Extent of pain felt by elder women while using existing base storage unit in bedroom:

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	2.67	-
2	Shoulder	-	2.9	-
3	Arms/Elbow	-	2.4	-

Fig 50: Extent of pain felt by elder women while using existing storage units in bedroom: Wall storage unit and Base storage unit



Wall storage unit
Fig. xiv



Base storage unit
Fig. xv

4	Wrist/hand	-	2.5	-
5	Upper back	-	2.6	-
6	Lower back	-	2.6	-
7	One or both hips/thighs/buttock	-	-	3.82
8	One or both knees	-	2.75	-
9	One or both legs/ankle/feet	-	3.13	-

(vii) Box bed in bedroom: Pain felt

It was found that the respondents felt severe pain in one or both hips/thighs/buttocks, one or both knees and one or both legs/ankle/feet, whereas moderate pain was reported by them in rest of the body parts while using box bed. It was revealed that more use of lower body parts in strenuous positions such as squatting or kneeling while using box bed leads to pain in lower body parts (Table 67). The body map shows the extent of pain felt by the respondents in various parts of body while using box bed (Fig xvi).

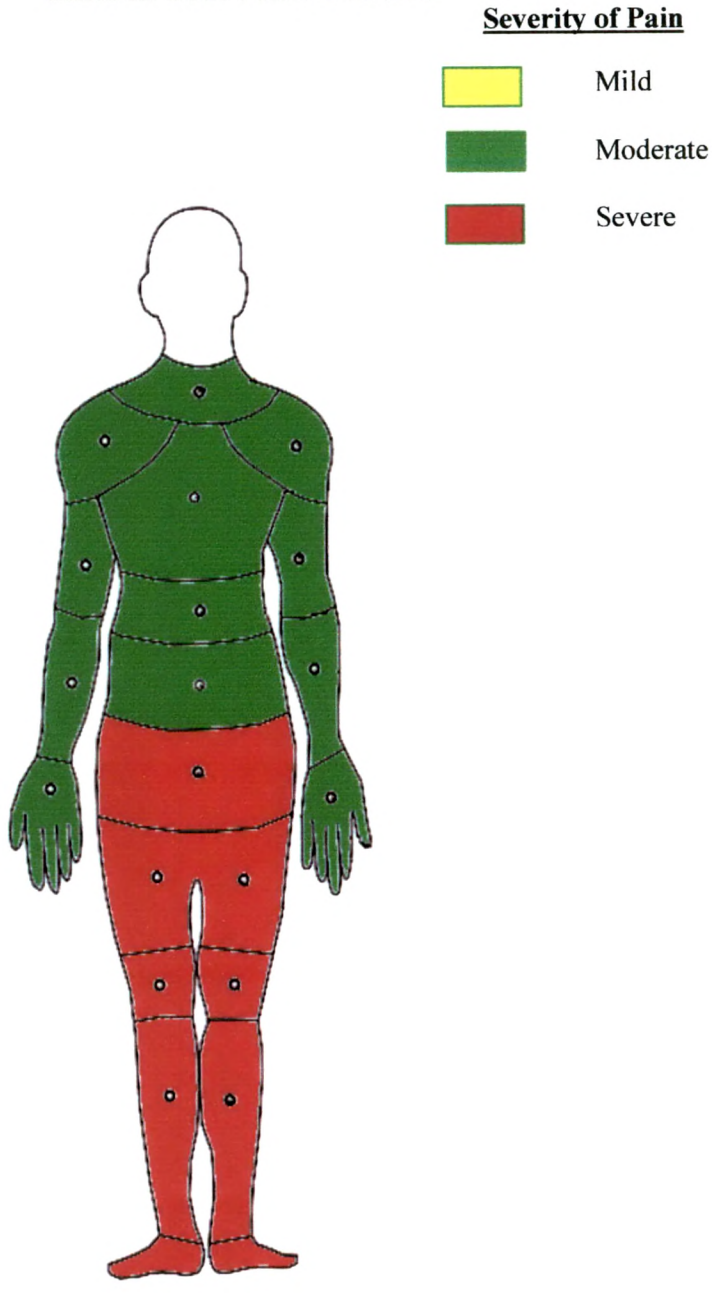
Table 67: Extent of pain felt by elder women while using existing box bed

Sr. No.	Body regions/parts	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Neck	-	3.13	-
2	Shoulder	-	2.82	-
3	Elbow	-	2.6	-
4	Wrist/hand	-	2.5	-
5	Upper back	-	2.7	-
6	Lower back	-	2.4	-
7	One or both hips/thighs/buttock	-	-	3.8
8	One or both knees	-	-	3.8
9	One or both legs/ankle/feet	-	-	3.82

Conclusion

The total weighted mean score for individual storage unit in kitchen was calculated by adding up the weighted mean scores of extent of pain in the body parts of each storage unit and dividing the total score by number of body parts i.e. 9.

Fig 51: Extent of pain felt by elder women while using existing storage units in bedroom: Box bed



Box bed
Fig. xvi

Table 68: Extent of pain felt by elder women while using existing storage units in bedroom

S.no.	Storage unit	Extent of Pain		
		Mild (1-2.3)	Moderate (2.4-3.7)	Severe (3.8-5.0)
1	Free-standing	-	2.75	-
2	Built-in (upto 6/7 feet)	-	2.91	-
3	Built-in floor to ceiling	-	3.11	-
4	Chest of drawers	-	2.97	-
5	Wall storage unit	-	2.74	-
6	Base storage unit	-	2.81	-
7	Box bed	-	3.06	

After analyzing the data of all storage units it was found that the elder women felt moderate pain while using all the storage units in bedroom but on comparing the figures it was found that more pain/discomfort was felt by the respondents while using built-in floor to ceiling and box bed. The worst affected body parts were neck, one or both hips/thighs/buttocks, one or both knees and one or both legs/ankle/feet. Therefore, it may be concluded that wrong placement/poor design/unsuitable dimensions of storage units give rise to the stress given to the body while using the storage unit, which is not with in easy and normal reach, which makes hard for the respondents to keep their body in comfortable posture and the wrong use of muscles causes the muscles of the body to stretch and led to static fatigue as well as all these factors led to pain in body.

Kashyap (2007) conducted a study on old age home. The findings revealed that high pain was perceived by the respondents while using lower shelves as compare to upper shelves. Lower shelves were found most discomfort-able and elevate the perceived pain intensity to maximum in their different body parts. The most affected body parts were neck, shoulder, arms and legs.

Section: 5.2

4.5.2. Problems Regarding Physical Characteristics of the Storage Units:

This section consists of various problems faced by elderly respondents regarding physical characteristics of the storage unit., which were included under various sub-heads like space availability, inner features and outer features of the storage unit. The results are presented with weighted mean sores. The response of "face problem" was given score of '2' and "do not face the problem" was ascribed a score of '1'. The range of possible scores was categorized into three categories having equal interval, so as to find out the extent of problem experienced. Its range is as follows:

Extent of Problems experienced	Score
Low	1.00 - 1.3
Moderate	1.4 -1.6
High	1.7 – 2.00

4.5.2.1. Problem regarding physical characteristics of storage units in kitchen:

The problems related to physical characteristics were sub-categorized into (i) space availability, (ii) inner features and (iii) outer features of the storage units in kitchen. The findings are as follows:

A. Problems Related to Space Availability for storage unit in Kitchen:

This section consists of various problems arising in storage units in kitchen due to various causes.

Table 69: Problems related to space availability for storage unit in Kitchen

Sr. No.	Problem related to Space Availability	Weighted Mean Score (Out of 2.00)
1.	Due to small size of the room, less space is available to have the storage unit	1.26
2.	Due to furniture arrangement in the room, less clearance space is available around storage	1.07
3.	Placement of storage unit was not suitable	1.20
	Total	**1.18**

Regarding the problem of "space availability" with the storage units in kitchen, the weight mean score was comparatively high (1.26/2.00) for the problem of "less space available for storage unit due to small size of the kitchen" than that for other problems (Table 69). However all the problems with space availability in kitchen were experienced to low extent as revealed through weighted mean scores (1.18/2.0). Those who had built-in open shelves faced this problem more as compared with other storage units. The next were those who had other racks and free standing units 1.38 and 1.33 out of 2.00 respectively (Appendix Table 1.).

Extent of problems faced by respondent regarding space availability

The possible score of 1 to 2 was divided into 3 categories having equal interval so as to show the extent of problems faced. Higher scores reflected higher extent of problems.

Table 70: Extent of problems related to space availability for storage unit in kitchen:

Range of scores	Extent of problems	Respondents n=85	
		f	%
-1.3	Low	74	87.06
1.4-1.6	Moderate	2	2.35
1.7– 2.0	High	9	10.59

Majority of the respondents faced the space related problems to a low extent (Table 70). However there were about one tenth of respondents who faced it to a high extent.

B. Problems Related to Inner Features of the Storage Units:

The various problems under inner features were further grouped into four parts viz. (1) length of storage shelves and drawers (2) height, depth and distance between shelves/drawers (3) Miscellaneous problem (4) Other problems related to drawers.

Table 71: Problems related to Inner features of storage unit in Kitchen: length of storage shelves and drawers

Sr. No.	Problems about Length of storage shelves and drawers	Weighted Mean Score out of 2.00
1.	Length of the storage shelves were small and no sufficient space to keep the necessary things	1.34
2.	Length of the storage drawers were small and no sufficient space to keep the necessary things	1.15
	Total	**1.25**

Regarding the problems related to length of the shelves and drawers of the storage units under Inner features of storage units, it was found that the problem of "small length of storage shelves" (1.34/2.00) was felt higher than the other problem (Table 71). The respondents possessing open shelves were more confronted by this problem (1.54/2.00), followed by the respondents having loft and other racks, 1.46 and 1.38 respectively. (Appendix, Table 1). On the basis of weighted mean scores, it was concluded that the length related problems under inner features of the storage unit were experienced to low a extent.

Table 72: Problems related to Inner features of storage unit in Kitchen: Height, depth and distance between shelves/drawers

Sr. No.	Problems about Height, depth and distance between shelves/drawers	Weighted Mean Score out of 2.00
1.	The storage shelves/drawers were not at suitable height	1.39
2.	Depth of shelves/drawers were not adequate	1.33
3.	Distance between the shelves/drawers with-in the storage unit were not sufficient to store articles in them.	1.19
	Total	**1.30**

Under the second sub-section of problems related to Inner features of the storage units, the respondents complained more (1.39/2.00) about the "problem

of not having storage shelves/drawers at suitable height" (Table 72). On the basis of weighted mean scores it was found that respondents having loft (1.93/2.00) in their kitchen more felt this problem, followed by the respondents having built-in open shelves and built-in (upto 6/7 feet) storage units, 1.65 and 1.48 respectively (Appendix, Table 1). Further on the basis of total weighted mean score it was concluded that all the problems under this section were experienced to low extent.

Table 73: Miscellaneous problems about Inner features of storage unit in Kitchen

Sr. No.	Miscellaneous problems	Weighted Mean Score out of 2.00
1.	Illumination in the storage unit was very low which hinders the visibility	1.46
2.	Storage unit was affected by moisture, making it bad smelling	1.09
3.	Moisture in storage unit results in flaking off paint and creating problem in storing articles in them.	1.09
	Total	**1.21**

As regard to the miscellaneous problems under inner features of the storage units, the problem of "Low illumination level in storage units" was found to be complained to moderate extent by respondents, 1.46/2.00 (Table 73). On the basis of weighted mean scores, it was found that the respondents possessing wall mounted cabinets, (1.72/2.00) more encounter with this problem. The next were those who had base cabinet and other racks, 1.63 and 1.52 respectively (Appendix, Table 1). The total weighted means score (1.21/2.00) revealed that the problems under this section were experienced to low extent.

Table 74: Other problems related to drawers under Inner features of storage unit in Kitchen

Sr. No.	Other problems related to drawers	Weighted Mean Score out of 2.00
1.	The drawers of the storage unit does not slide easily while using	1.15

2.	Sections with in the drawers were not enough and wide	1.16
	Total	**1.15**

Regarding the other problems related to drawers under inner features of the storage unit, it was found that although the respondents complained more (1.16/2.00) about the problem of "Not having enough and wide sections with in the drawers" (Table 74) as compared to other problems but it was felt to a low extent.

Extent of Problem regarding Inner features of storage unit in Kitchen

Majority of the respondents (70.59 per cent) faced problems related to inner features of the storage units to low extent, whereas, around one third respondents experienced these problems to a moderate extent (Table 75).

Table 75: Extent of Problem regarding Inner features of storage unit in Kitchen

Extent of Problem experienced	Range of scores	Respondents (n=85)	
		f	%
Low	1.0 -1.3	60	70.59
Moderate	1.4-1.6	25	29.41
High	1.7-2.0	-	-

Conclusion

The total weighted mean for the entire four categories was found to be 1.23. After comparing the weighted mean scores of all the sub section it was found that the problems related height, depth and distance between shelves and drawers (1.30/2.00) were faced by the respondents more than other problems under problems related to inner features of the storage unit however that was to a low extent.

C. Outer features of the storage unit:

The various problems under outer features of the storage units were further categorized into four parts viz. (1) problems related to use of outer features (2)

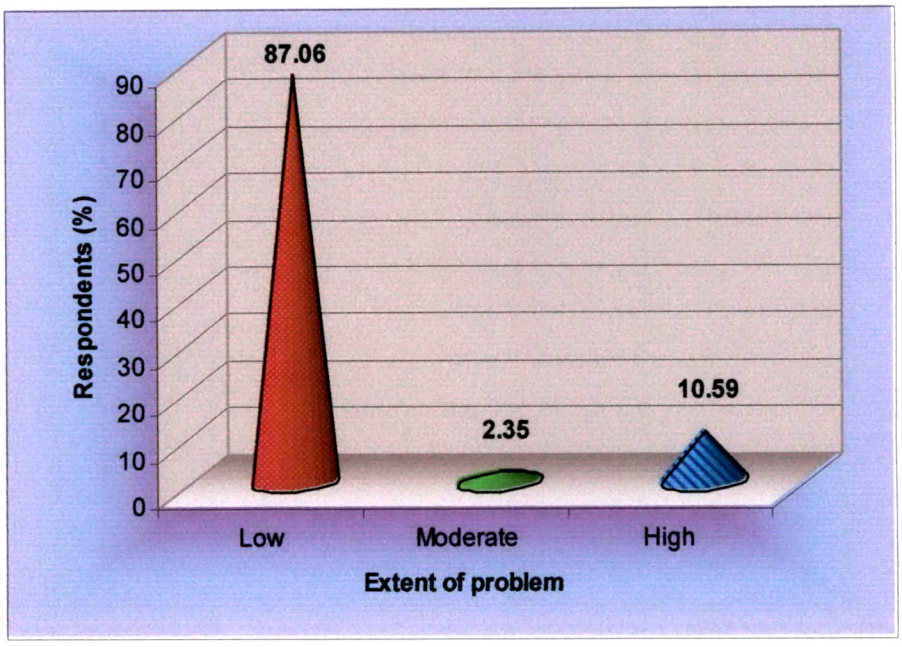


Fig 52: Extent of problems related to space availability for storage unit in kitchen

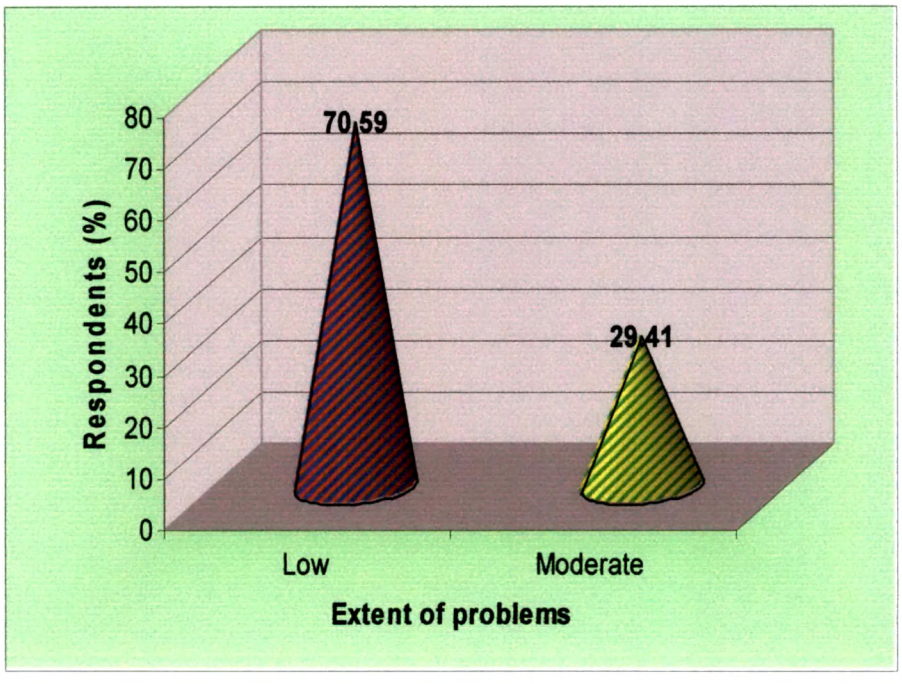


Fig 53: Extent of Problem regarding Inner features of storage unit in Kitchen

Problems related to knobs and handles (3) problems related to opening/closing system, (4) Miscellaneous problems

Table 76: Problems related to use of outer features of storage unit in Kitchen: Use of unit

Sr. No.	Problems related to use of outer features	Weighted Mean Score out of 2.00
1.	Panels/doors had poor holds or required excessive force to operate/use	1.21
2.	Drawers had poor holds or required excessive force to operate	1.09
3.	Key operation mode in storage unit required effort while using it.	1.01
	Total	**1.10**

Regarding outer features of the storage units, the problem of "poor holds of panel/door or requirement of excessive force to use the panel/door" was more (1.21/2.00) experienced by the respondents than other problems in this category (Table 76). The respondents possessing wall mounted cabinet encountered more of this problem (1.35/2.00), followed by those having built in wall cabinet and base cabinet, 1.29 and 1.27 out of 2.00 respectively (Appendix, Table 1). The total weighted mean scores shows that the problems under this section were experienced to a low extent i.e. 1.10/2.00 (Table 76).

Table 77: Problems related to outer features of storage unit in Kitchen: knobs and handles

Sr. No.	Problems related to knobs and handles	Weighted Mean Score out of 2.00
1.	Grip diameter of knobs was too large and difficult to operate/use.	1.04
2.	Knobs were to small and difficult to turn and slippery while using/working	1.11
3.	Dimension of handle was not up to their requirement and difficult to use.	1.15
4.	Placements of handle/knobs were not on the correct location on the doors panels of the storage unit.	1.18
	Total	**1.12**

Regarding the problems related to knobs and handles under outer features of the storage unit, it was found that the respondents were more (1.18/2.00) confronted with the problem of wrong placement of handle /knobs on panel/door (Table 77). The weighted mean scores revealed that the respondents having wall mounted cabinet (1.26/2.00) faced more of this problem (Appendix Table 1). On the basis of total weighted mean score (1.12/2.00), it was concluded that overall problems of this section were experienced to low extent (Table 77).

Table 78: Problems related to outer features of storage unit in Kitchen: Opening/closing system

Sr. No.	Problems related to opening/closing system	Weighted Mean Score out of 2.00
1.	Opening/closing system of storage unit was not working properly	
I	Panel /doors opens immediately after closing	1.21
II	Requires extra efforts in opening/closing	1.21
III	Create noise while using	1.21
IV	Get jammed and require application of effort while using	1.18
	Total	**1.20**

It was found that the problems complained by the respondents about panel/doors opens immediately after closing, requires extra efforts in opening/ closing and create noise while using had similar weighted mean score. It was found that the respondents possessing built in (up to 6/7 feet) (1.30/2.00), wall mounted cabinet (1.35/2.00), and free standing (1.37/2.00) more faced the above problems respectively (Appendix table 1). The total weighted mean score revealed that the problems under this category were experienced to low extent, i.e. 1.20/2.00 (Table 78).

On the basis of weighted mean scores, it was found that respondents were facing various miscellaneous problems under problems related to outer features of storage units to a similar intensity. The problems complained by the respondents were "panel/doors of the storage unit when opened, occupy too much space" "Panel/door swings open and knock into the body" and "storage unit were having sharp edges (1.17/2.00). The problems under this section on

the whole were experienced to low extent (1.15/200) as revealed by the total weighted mean score (Table 79).

Table 79: Problems related to outer features of storage unit in Kitchen: Miscellaneous problems

Sr. No.	Miscellaneous problems	Weighted Mean Score out of 2.00
1.	Panels/doors of storage unit when opened, occupy too much space and create hindrance in work	1.17
2.	Panels/doors swing open and knock into the body causing injury to their body	1.09
3.	Placement of storage unit was not on correct place which increases unnecessary walking and not easy to approach as well as not having ease in using storage unit while working	1.17
4.	Storage unit was having sharp edges or any other dangerous components which is threat to their safety.	1.17
	Total	**1.15**

Extent of problems regarding outer features of the storage units

This part consists of range, calculated on the basis of weighted mean scores of individual respondents, to find out the extent of problem faced by the respondents regarding outer features of the storage units in kitchen as well as the frequency of respondent facing these problems.

Table 80: Extent of problems regarding outer features of the storage units in Kitchen

Extent of problems	Range of scores	Respondents n=85	
		f	%
Low	1.0-1.3	79	92.9
Moderate	1.4-1.6	6	7.1
High	1.7-2.0	-	-

On the basis of individual respondents' weighted mean scores it was found that majority of the respondents were facing problems regarding outer features of the storage unit to a low extent, while very few respondents faced the problems to moderate extent (Table 80). On comparing weighted mean

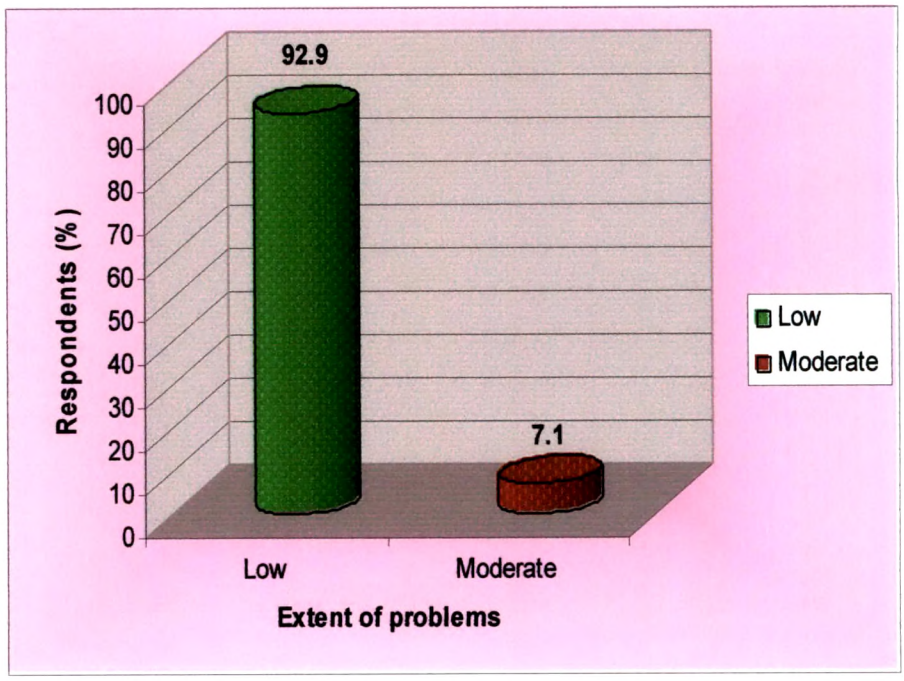


Fig 54: Extent of problems regarding outer features of the storage units in Kitchen

score of each of the sub-category of problems regarding outer features of storage units in kitchen, it was observed that for each the respondents faced the problems to a low extent. However, amongst these sub-categories, intensity of problems was felt more for opening/ closing system of storage unit.

Extent of problems faced by the respondents regarding physical characteristics of storage units in kitchen

On further analysis of the data it was concluded that the problems related to space availability was felt by respondents to a high extent (Table 70). Although, all the problems were felt to low extent but the total weighted mean score was found more (1.30/2.00) for the problems related to height, depth and distance between shelves and drawers, under inner features of the storage units (Table 72), as compared to other problems in kitchen.

4.5.2.2 Problems regarding physical characteristics of storage units in Bedroom:

The problems related to physical characteristics were sub-categorized as space availability, inner features of the storage units and outer feature of the storage units in bedroom. The findings are presented in this section.

A. Problems Related to Space Availability for storage in Bedroom:

This section consists of various problems arising in storage units due to various causes in bedroom.

Amongst various problem of "space availability" with the storage units in bedroom, the weighted mean score was more than others (1.25/2.00) for the problem of "less clearance space is available around storage, unit due to furniture arrangement" (Table 81). Those who had box bed in their bedroom confronted with this problem more (1.36/2.00) as compared to other storage units. The next were those who had chest of drawers and wall storage units (1.33 and 1.27 out of 2.00, Appendix Table 2). However, all the problems with space availability in bedroom were experienced to low extent as revealed through total weighted mean score (Table 81).

Table 81: Problems related to space availability for storage unit in Bedroom

Sr. No.	Space Availability	Weighted Mean Score out of 2.00
1.	Due to small size of the room, less space is available to have the storage unit	1.23
2.	Due to furniture arrangement in the room, less clearance space is available around storage	1.25
3.	Placement of storage unit was not suitable	1.23
	Total	**1.24**

Extent of problems related to space availability for storage unit in Bedroom

The possible score of 1 to 2 was divided into 3 categories having equal interval so as to show the extent of problems faced. Higher scores reflected higher extent of problems.

Table 82: Extent of problems related to space availability for storage unit in Bedroom

Extent of problem	Range of scores	Respondents n=85	
		f	%
Low	1.0-1.3	70	82.4
Moderate	1.4-1.6	4	4.7
High	1.7-2.0	11	12.9

Majority of the respondents faced these problems to a low extent (Table 82). However, there were about 13 per cent of respondents who faced it to a high extent.

B. Problems Related to Inner Features of the Storage Units in Bedroom:

The various problems under inner features were further grouped into four parts viz. (1) length of storage shelves and drawers (2) height, depth and distance between shelves/drawers (3) Miscellaneous problem (4) Other problems related to drawers.

Table 83: Problems related to inner features of the storage unit in Bedroom: Length of storage shelves and drawers

Sr. No.	Problems related to length of storage shelves and drawers	Weighted Mean Score out of 2.00
1.	The storage shelves/drawers were not at suitable height	1.24
2.	Depth of shelves were not adequate	1.37
3.	Distance between the shelves within the storage unit were not sufficient to store artificial in them	1.10
	Total	**1.24**

Under the second subsection of problems related to inner features of storage units, the respondents (1.37/2.00) complained more about the problem of "Inadequate depth of shelves". On the basis of weighted mean scores it was found that respondents having wall storage units (1.54/2.00) in their bedroom were facing more with this problem, followed by the respondents having built in floor to ceiling (1.40) and box bed (1.40) (Appendix Table 2). Further, on the basis of total weighted mean score it was concluded that all the problems under this section were experienced to a low extent (Table 83).

Table 84: Problems related to inner features of the storage unit in Bedroom: Height, depth and distance between shelves/drawers

Sr. No.	Problems related to height, depth and distance between shelves/drawers	Weighted Mean Score out of 2.00
1.	Length of the storage shelves were small and no sufficient space to keep the necessary things	1.32
2.	Length of the storage drawers were small and no sufficient space to keep the necessary things	1.07
	Total	**1.19**

Regarding the problems related to length of the shelves and drawers of the storage units under inner features of storage units, it was found that respondents (1.32/2.00) complained more about the problems of "small length

of storage shelves" (Table 84). The respondents possessing wall storage unit were more faced this problem (1.45/2.00), followed by the respondents having built in (up to 6/7 feet) and box bed, 1.37 and 1.36 out of 2.00 respectively (Appendix Table 2) On the basis of total weighted mean score, it was concluded that length related problems under inner features of the storage unit, were experienced to a low extent.

Table 85: Miscellaneous problem about inner features of the storage unit in Bedroom

Sr. No.	Miscellaneous problem	Weighted Mean Score out of 2.00
1.	Illumination in the storage unit was very low which hinders the visibility	1.47
2.	Storage unit was affected by moisture, making it bad smelling	1.15
3.	Moisture in storage unit results in flaking off paint and creating problem in storing articles in them.	1.14
	Total	**1.25**

As regarding to the miscellaneous problems under inner features of the storage units, the problem of "Low illumination level in storage units" was found to be complained more by respondents, 1.47/2.00 which was to a moderate extent (Table 85). On the basis of weighted mean scores, it was found that the respondents possessing built in (up to 6/7 feet) storage unit (1.55/2.00) faced this problem to a moderate extent. The next were those who had free standing (1.53/2.00) and chest of drawers (1.47/2.00) (Appendix Table 2). The total weighted means score (1.25/2.00) revealed that the problems under this section were experienced to a low extent.

Table 86: Other problems related to drawers under inner features of the storage unit in Bedroom

Sr. No.	Other problems related to drawers	Weighted Mean Score out of 2.00
1.	The drawers of the storage unit does not slide easily while using	1.09

2.	Sections with in the drawers were not enough and wide	1.09
	Total	**1.09**

Regarding the other problems related to drawers under inner features of the storage unit, it was found that respondents complained the both problems i.e. "drawers do not slide easily" as well as "sections with-in drawers were not enough" to the same intensity (Table 86). The weighted mean scores of both problems were moderate (1.52 and 1.42 out of 2.00, respectively) for those respondents possessing chest of drawers (Appendix Table 2).

Extent of problems regarding inner features of the storage units in Bedroom

It was found that majority of the respondents experienced problems related to inner features of the storage unit to a low extent, whereas, a little more than one tenth of the respondents faced the problems to a moderate extent (Table 87).

Table 87: Extent of problems regarding inner features of the storage units in Bedroom

Extent of problem	**Range of scores**	**Respondents n=85**	
		f	**%**
Low	1.0-1.3	75	88.2
Moderate	1.4-1.6	10	11.8
High	1.7-2.0	-	-

Conclusion:

The total weighted mean for the entire four categories was found to be 1.19. After comparing the weighted mean scores of all the sub section it was found that the miscellaneous problems (1.25 /2.00) were faced by the respondents more than other problems under problems related to inner features of the storage unit in bedroom.

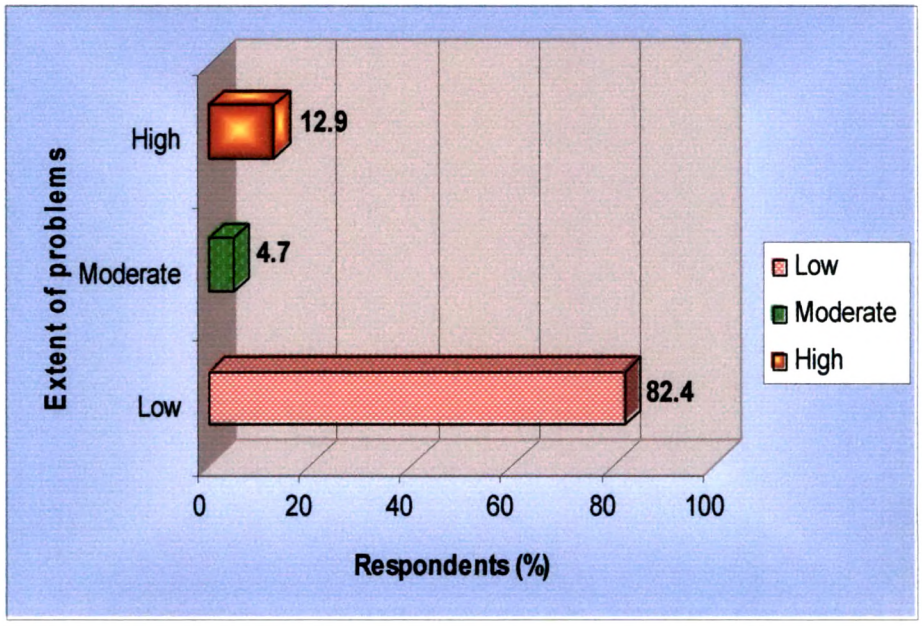


Fig 55: Extent of problems related to space availability for storage unit in Bedroom

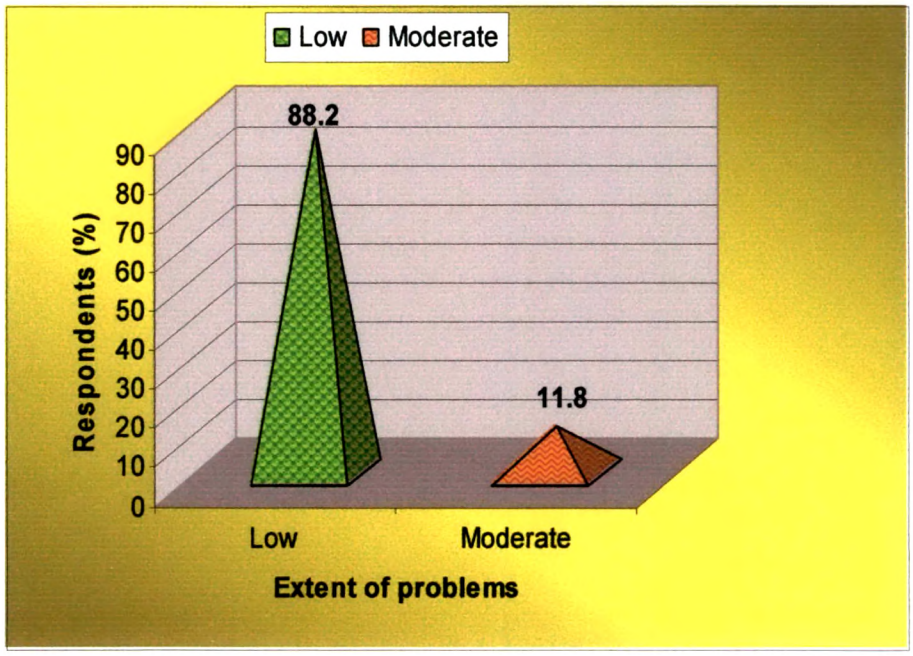


Fig 56: Extent of problems regarding inner features of the storage units in Bedroom

C. Outer features of the storage units in Bedroom:

The various problems under outer features of the storage unit were further categorized into four parts, viz. (1) problems related to use of outer features (2) Problems related to knobs and handles, (3) Problems related to opening /closing system (4) Miscellaneous problems

Table 88: Problems related to outer features of the storage unit in Bedroom: use of unit

Sr. No.	Problems related to use of outer features	Weighted Mean Score out of 2.00
1.	Panels/doors had poor holds or require excessive force to operate/use	1.14
2.	Drawers had poor holds or require force to operate	1.06
3.	Key operation mode in storage unit require effort while using it	1.16
	Total	**1.12**

Regarding the problems of second section under outer features of the storage units, the weighted mean scores was found more (1.16) for the problem "requirement of effort in key operation mode" (Table 88) as compared to other problems in this sub-category. The respondents possessing free standing storage units and built in (up to 6/7 feet) were found to be more (1.25/2.00) affected by this problem. On the basis of total weighted mean score it was concluded that the problems under this section was experienced to a low extent, 1.12/2.00 (Table 88).

Table 89: Problems related to outer features of the storage unit in Bedroom: Knobs and handles

Sr. No.	Problems related to knobs and handles	Weighted Mean Score out of 2.00
1.	Grip diameter of knobs was too large and difficult to operate/use.	1.03
2.	Knobs were to small and difficult to turn and slippery while using/working	1.03

3.	Dimension of handle was not up to their requirement and difficult to use.	1.19
4.	Placements of handle/knobs were not on the correct location on the doors panels of the storage unit.	1.16
	Total	**1.10**

Regarding the problems related to knobs and handles under outer features of the storage unit, it was found that the respondents were more (1.19/2.00) suffering from the problem of "inadequate/inappropriate dimension of handle" than other problems (Table 89). The weighted mean scores revealed that the respondents having built-in floor to ceiling storage units (1.40/2.00) faced more of this problem. On the basis of total weighted mean score (1.10/2.00), it was concluded that the problems of this section were experienced to low extent (Table 89).

Table 90: Problems related to outer features of the storage unit in Bedroom: Opening /closing system

Sr. No.	Problems related to opening /closing system	Weighted Mean Score out of 2.00
1.	Opening/closing system of storage unit was not working properly	
I	Panel /doors opens immediately after closing	1.14
II	Requires extra efforts in opening/closing	1.18
III	Create noise while using	1.22
IV	Get jammed and require application effort while using	1.19
	Total	**1.18**

Regarding the problems related to opening/closing system under outer features of storage units, the weighted mean score was found more (1.22/2.00) for the problem of "noisy storage units" amongst other problems of this category (Table 90). The problem was more (1.51/2.00) complained by the respondents having free standing storage units, followed by the respondents

having built-in floor to ceiling, 1.45/2.00 (Appendix Table 2) The total weighted mean scores revealed that the problems under this category were faced to a low extent, 1.18/2.00 (Table 90).

The weighted mean score was found more (1.31/2.00) for the problem of "Panel/door when opened, occupy too much space and create hindrance" in the section of miscellaneous problems under outer features of the storage units (Table 91). The respondents possessing built-in (up to 6/7 feet) faced this problem more (1.44/2.00) as compare to other storage units. Next to this were the respondents possessing built-in floor to ceiling and wall storage unit, 1.36 and 1.27 respectively (Appendix Table 2). The problems under this section were experienced to low extent (1.25/2.00) as revealed by the total weighted mean scores (Table 91).

Table 91: Problems under outer features of the storage unit in Bedroom: Miscellaneous problems

Sr. No.	Miscellaneous problems	Weighted Mean Score out of 2.00
1.	Panels/doors of storage unit when opened, occupy too much space and create hindrance in work	1.31
2.	Panels/doors swings open and knocks into the body causing injury to their body	1.22
3.	Placement of storage unit was not on correct place which increases unnecessary walking and not easy to approach as well as not having ease in using storage unit while working	1.24
4.	Storage unit was having sharp edges or any other dangerous components which is threat to their safety.	1.22
	Total	**1.25**

Extent of problems regarding outer features of the storage units in Bedroom

On the basis of individual respondents weighted mean scores it was found that majority of the respondents were facing problems regarding outer

features of the storage unit to low extent. While very few respondents faced the problems to moderate extent (Table 92).

Table 92: Extent of problems regarding outer features of the storage units in Bedroom:

Extent of problems experienced	Range	Respondents n=85	
		f	%
Low	1.0-1.3	79	92.9
Moderate	1.4-1.6	6	71
High	1.7-2.0	-	-

Conclusion:

A comparison of weighted mean score for each sub-category for outer features reflected that the respondents felt these problems to a low extent. Amongst these categories more intensity was felt for miscellaneous problems under outer features of the storage units in bedroom.

Extent of problems faced by the respondents regarding physical characteristics of storage units in bed room

On further analysis of the data it was concluded that the problems related to space availability was encountered by respondents to a more extent (Table 82). Although all the problems were felt to low extent but the total weighted mean scores were found more (1.25 /2.00) for the miscellaneous problems under inner features and outer features of the storage units as compared to other problems in bedroom.

Section: 5.3

4.5.3 Problems faced by the respondents while using storage units:

This section includes the problems faced by the respondents while using storage units in kitchen and bedroom. The results are presented with weighted mean scores. Further the individual respondents' weighted mean scores are categorized into three, so as to find out the extent of problem experienced. Its range is as follows:

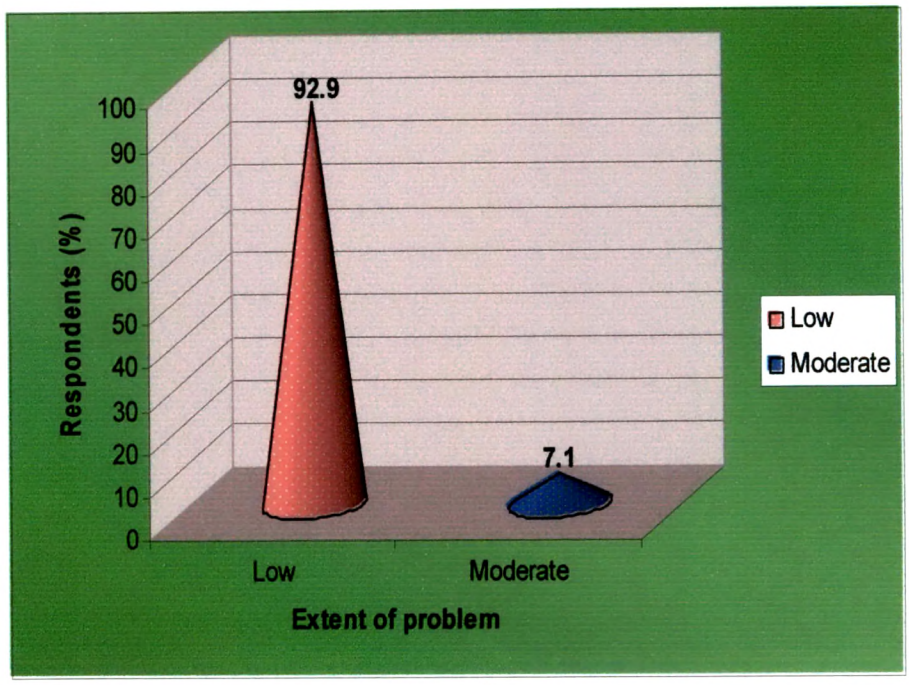


Fig 57: Extent of problems regarding Outer features of the storage units in Bedroom

Extent of problems experienced	Score
Low extent of problem	1.00-1.3
Moderate extent of problem	1.4-1.6
High extent of problem	1.7-2.00

4.5.3.1. Problems faced by the respondents while using storage units in kitchen:

This section includes various problems faced by the respondents while using storage units in kitchen. The problems were further categorized into three parts viz. (i) problems while storing articles on top shelf (2) problems while storing articles on lower shelf and (3) other problems while storing articles in storage units.

Table 93: Problems related to storing articles on top shelf of storage units in Kitchen

Sr. No.	Problems	Weighted Mean Score out of 2.00
	The top shelf was so high that	
1.	They had to support them self with one hand to lift things from upper shelf	1.27
2.	They had to grope for the things from the shelf for a moment	1.08
3.	They had to straighten their ankles to the extreme to use the upper shelf.	1.35
4.	The had to stretch on their toes to lift the things from the top shelf of the storage unit	1.19
5.	They had to use a stool to reach the things from top shelf of the storage unit.	1.14
	Total	**1.21**

Regarding the problems while storing article on the top shelf of storage unit, the weighted mean score was more (1.35/2.00) for the problems of "straightening of ankles to the extreme to use top shelf" amongst other problems (Table 93). Those who had built-in (up to 6/7 feet) storage units experienced this problem to moderate extent (1.65/2.00) as compared with

Plate 19: Raising on Heels To Reach The Articles Causes Pain in Lower Extremities

other storage units. The next were those who had built in wall cabinet (1.56/2.00) and wall mounted rack (1.55/2.00) in their kitchen (Appendix Table 3). However, all the problems under this section were experienced to a low extent (1.21/2.00) as revealed through total weighted mean score (Table 93).

Table 94: Problems related to storing articles on lower shelf of storage units in Kitchen

Sr. No.	Problems	Weighted Mean Score out of 2.00
	The height of the shelf was too low that	
1.	They had to bend on their knees notably or squat to reach the things	1.37
2.	They had to bend their upper body notably to lift the things	1.42
3.	They had to support themselves with their hands on their body or on surrounding facilities	1.28
4.	The had to force their body straight when rising	1.27
	Total	**1.34**

Regarding the problems while storing article on lower shelf, the weighted mean score was found more (1.42/2.00) for the problems of "bending of upper body notably ton lift the things" amongst other problems (Table 94). The weighted mean scores revealed that respondents possessing built in (up to 6/7 feet) storage unit complained this problem to a high extent (1.74/2.00), whereas not a single respondents having other rack complained about this problem (Appendix Table 3). On the basis of total weighted mean score it was concluded that problem under this section were experienced to a low extent 1.34/2.00 (Table 94).

Weighted mean score was found moderate (1.55/2.00) for the problem of "body joints do not remain in convenient neutral position", under the section of other problems faced by the respondents while using storage units (Table 95). It was found that the respondent possessing loft in their kitchen felt this problem to a high extent (1.93/2.00), followed by those respondents possessing

Plate 20: Wrong Body Postures- Cause of Pain in Various Body Parts

open shelves and base cabinet (1.74 and 1.64) respectively (Appendix Table 3). The total weighted mean score revealed that the problems under this section were experienced to moderate extent, 1.42/2.00 (Table 95).

Table 95: Other problems faced by respondents while using storage units in Kitchen

Sr. No.	Problems	Weighted Mean Score out of 2.00
1.	Due to frequent changes in posture and adoption of poor postures while using storage units, they suffer from body discomfort	1.41
2.	The frequently used items to be lifted were not positioned between eye level height and knuckle height	1.34
3.	Body joints do not remain in convenient neutral position while using storage unit.	1.55
4.	Storing task was more dynamic rather than a static task	1.41
5.	Storage unit was not comfortable and easy to use	1.38
	Total	**1.42**

Extent of problems faced by respondents while using storage units in kitchen

It was concluded that maximum respondents were facing problems while storing articles to a low extent while storing articles, where as around one third respondents experienced problems to moderate extent.

Table 96: Extent of problems faced by respondents while using storage units in kitchen

Extent of problem	Range	Respondents n=85	
		f	%
Low	1.0-1.3	59	69.4
Moderate	1.4-1.6	26	30.6
High	1.7-2.0	-	-

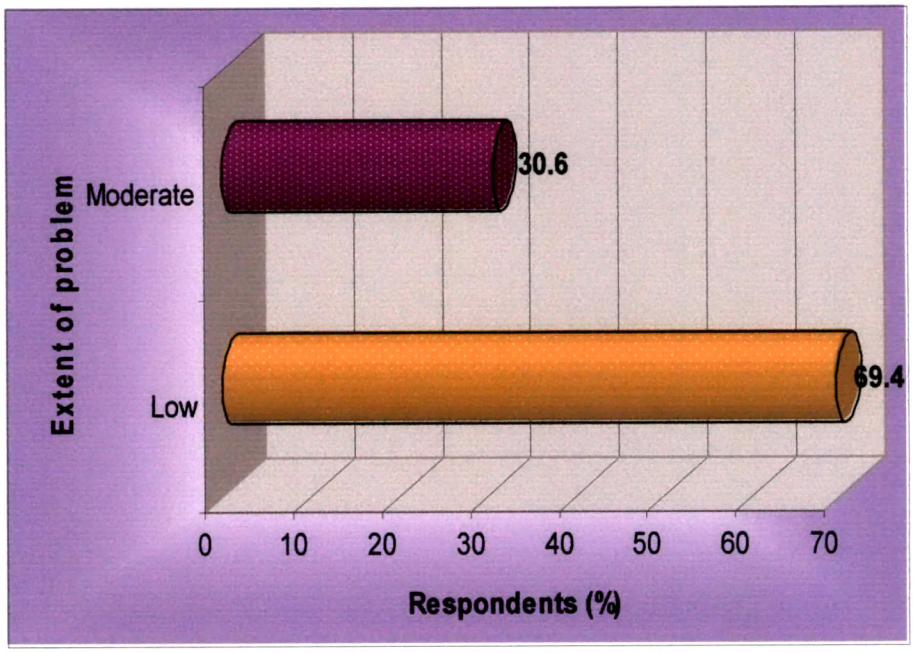


Fig 58: Extent of problems faced by respondents while using storage units in kitchen

On analyzing the data it was concluded that the problems under the section of "other problems while using storage units" was faced by respondent to moderate extent, the problems under the others two sub-sections were experienced to low extent in kitchen.

4.5.3.2 Problems faced by the respondents while using storage units in bedroom:

This section includes various problems faced by the respondents while using storage units in bedroom. The problems were further categorized into three parts viz. (i) problems while storing articles on top shelf (2) problems while storing articles on lower shelf and (3) other problems while using storage units.

Table 97: Problems related to storing articles on top shelf of storage units in Bedroom

Sr. No.	Problems	Weighted Mean Score out of 2.00
	The top shelf was so high that	
1.	They had to support them self with one hand to lift things from upper shelf	1.36
2.	They had to grope for the things from the shelf for a moment	1.25
3.	They had to straighten their ankles to the extreme to use the upper shelf.	1.21
4.	The had to stretch on their toes to lift the things from the top shelf of the storage unit	1.27
5.	They had to use a stool to reach the things from top shelf of the storage unit.	1.25
	Total	**1.27**

Regarding the problems while storing article on the top shelf of storage unit, the weighted mean score was more (1.36/2.00) for the problem of

"support them self with one hand to lift things from top shelf" than other problems in this category (Table 97). Those who had free standing storage unit faced this problem more (1.44/2.00) as compared with other storage units. However, all the problems under this section were experienced to a low extent (1.27/2.00), as revealed through total weighted mean score (Table 97).

Table 98: Problems related to storing articles on lower shelf of the storage unit in Bedroom:

Sr. No.	Problems	Weighted Mean Score out of 2.00
	The height of the shelf was too low that:	
1.	They had to bend on their knees notably or squat to reach the things	1.43
2.	They had to bend their upper body notably to lift the things	1.57
3.	They had to support them self with their hands on their body or on surrounding facilities	1.29
4.	The had to force their body straight when rising	1.49
	Total	**1.45**

Regarding the problems while storing article on lower shelf, the weighted mean score was found moderate (1.57/2.00) for the problems of "bending of upper body notably to lift the things" amongst other problem of this category (Table 98). The weighted mean scores revealed that respondents possessing built-in (up to 6/7 feet) storage unit, complained this problem high (1.78/2.00). Next were those having built-in floor to ceiling and base cabinet storage unit, 1.77 and 1.74 out of 2.00 (Appendix Table 4). On the basis of total weighted mean score it was concluded that the problems under this section were experienced to moderate extent, 1.45/2.00 (Table 98).

Table 99: Other problems faced by respondents while using storage units in Bedroom

Sr. No.	Problems	Weighted Mean Score out of 2.00
1.	Due to frequent changes in posture and adoption of poor postures while using storage units, they suffer from body discomfort	1.35
2.	The frequently used items to be lifted were not positioned between eye level height and knuckle height	1.26
3.	Body joints do not remain in convenient neutral position while using storage unit.	1.56
4.	Storing task was more dynamic rather than a static task	1.35
5.	Storage unit was not comfortable and easy to use	1.38
	Total	**1.38**

Weighted mean score was found moderate (1.56/2.00) for the problem of "body joints do not remain in convenient neutral position", as compared to other problems under the section of other problems faced by the respondents while using storage units (Table 99). It was found that the respondents possessing box bed in their bedroom, highly (1.93/2.00) faced this problem, followed by those respondents possessing chest of drawers and base storage units 1.90 and 1.68 out of 2.00 respectively (Appendix Table 4). The total weighted mean score revealed that the problems under this section were experienced to a low extent, 1.38/2.00 (Table 99).

Extent of other problems faced by respondents while using storage units in bedroom

Further, it was concluded that majority of the respondents were facing other problems while using storage units to low extent, whereas around twenty five percent respondents experienced problems to moderate extent (Table 100).

Table 100: Extent of other problems faced by respondents while using storage units in bedroom:

Extent of problems	Range	Respondents n = 85	
		f	%
Low	1.0-1.3	63	74.1
Moderate	1.4-1.6	22	25.9
High	1.7-2.0	-	-

On analyzing the over all data it was concluded that the problems under the section of "problems while storing articles on lower shelf" was faced by the respondent to a moderate extent, whereas the problems under the other two sub-section were experienced to low extent in bedroom.

Section: 5.4

4.5.4 Posture adopted by Respondents while using existing storage unit

A good working posture is as important for the performance of tasks as it is for promoting health and minimizing stress and discomfort during work. For analyzing and evaluating the working postures adopted by the elder women while using storage units in kitchen and bedroom Ovako Working Posture Analyzing System (OWAS) was used.

4.5.4.1 Posture adopted by the respondents while using existing storage units in kitchen

The working postures of the respondents while using existing storage units in kitchen were observed by the researcher and a code number was assigned to each posture by using the posture coding sheet of OWAS method (Wide Methodology). The position of back, upper limbs i.e. arms and lower limbs i.e. legs as well as load of force used in carrying out activities were considered for analysis of posture.

(i) Free standing storage unit in kitchen: Posture adopted

It was found that maximum respondents kept their back straight (58.3 percent), arms at below shoulder level (79.2 percent), and both legs straight

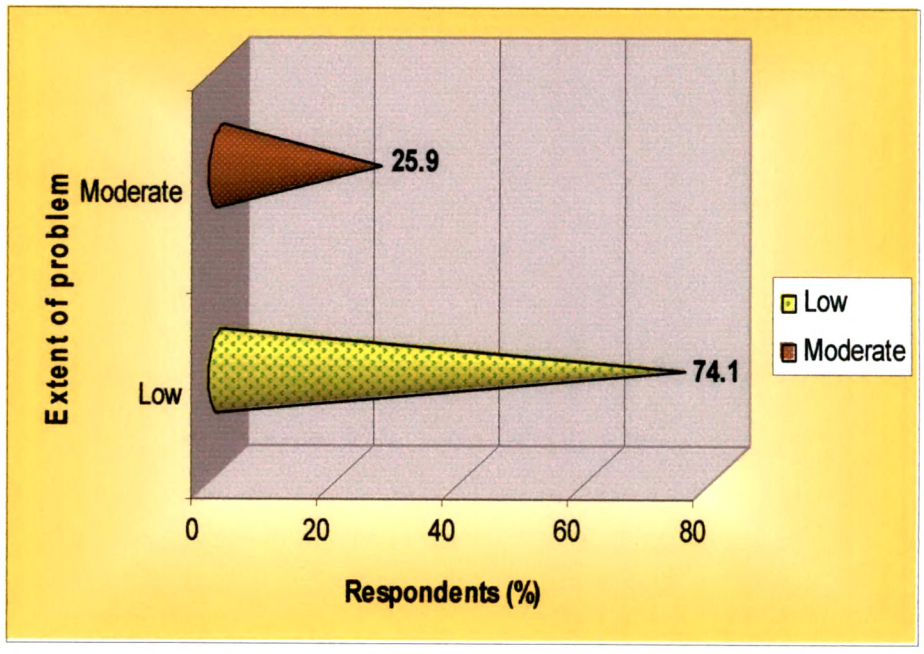


Fig 59: Extent of other problems faced by respondents while using storage units in bedroom

(95.8 percent) while using top shelf of free standing storage unit (Table 101). Out of 24 free standing storage units only 18 storage units had middle shelf and it was found that around 61 percent respondents kept their back bent, while majority of respondents (88.9 percent) kept their arms below shoulder level with both legs straight (38.9 percent) while using middle shelf of free-standing storage unit. They adopted this posture as the mean height of middle shelf was found to be 47.6 cms. They experienced pain in legs/ankle/feet (3.00/5.00) and in the back (2.85 out of 5.00, Table 51).Regarding posture adopted by the respondents while using lower shelf of free standing, hundred percent respondents kept their back bent, arms below shoulder level whereas, posture of legs of around 70 percent respondents were found to be in standing or squatting position with both knees bent (Table 101) due to very low height (13.3 cms) of lower shelf. It was found in the present study that the mean total height of free-standing unit was found to be 103 cms, due to this height the respondents had to bend themselves and hence their neck and shoulders were put to stress while searching and taking out/keeping articles/items from these storage units. Hence, corrective measures were recommended for about eighty per cent of respondents for using lower shelf of free-standing units in kitchen (Refer Table 102).In the present investigation the respondents were asked to state the problems while using the storage unit. The intensity index for the item on "they had to bend their upper body notably to lift the things from the lower shelf" was found to be 1.42 out of 2.00, which was considered as moderate. It is possible that since the respondents had got accustomed to the existing storage units and their use, they did not perceive these aspects as problems"

(ii) Built in (Up to 6/7 feet) storage unit in kitchen: Posture adopted

While using top shelf of built in storage unit (up to 6/7 feet) maximum respondents kept their back straight (95.7 percent), arms at or above shoulder level (52.2 percent) and standing with the weight on one straight leg (56.5 percent). The top shelf of built-in storage unit was found to be 111-171 cms, probably which made the respondents to stretch their legs and arms to reach for the articles stored there (Table 29). While stating the problems with top shelf,

the problem that they "had to straighten their ankles to reach for the items" got a score of 1.35/2.00 on intensity scale (Table 93). Back of all the respondents were found straight whereas, majority of respondents kept their one arm at or above shoulder level (82.6 percent) and stood with both legs straight (95.7 percent) while using middle shelf of built in storage unit (Up to 6/7 feet). Back and both arms of all the respondents were found to be bent and below shoulder level respectively whereas, majority of the respondents (86.9 percent) were found in standing or squatting position with both knees bent while using lower shelf of built-in (Up to 6/7 feet), (Table 101). The lower shelf of built-in storage units were found to be 15.26 cms which was quite low and hence might have caused pain to a severe extent in legs/ankle/feet, hips/thighs/buttocks and knees (Table 29). Hence, 91 per cent of those respondents who had this type of storage unit needed corrective measures in their posture as soon as possible (Table 102)

(iii) Built in wall cabinet in kitchen: Posture adopted

It was found that majority of the respondents keep their back straight (88.9 percent), both arms at or above shoulder level (55.6 percent) and stand with weight on one straight leg (66.7 percent) while using top most shelf of built in wall cabinet. The mean height of top shelf of built-in wall cabinet was found to be quite high as 188 cms (Table 30), this might have led the respondents to adopt such a posture. As well as more than half of the respondents (55.6 per cent) reported that "they had to straighten their ankles to extreme to use the upper shelf of the cabinet" (Intensity index 1.56/2.00, Appendix Table 3). Hence, corrective measures in posture were required in near future for about one tenth of the respondents out of those who had such a storage unit in their house. Out of 27 built in wall cabinets only eleven cabinets had middle shelf. It was revealed that around 90 percent respondents maintain their back straight, hundred percent respondents keep their one arm at or above shoulder level and almost 72 percent respondents stand with their both legs straight while using middle shelf of built in wall cabinet. Just as in top and middle shelf, back of maximum respondents (88.9 percent) was found to be

straight whereas, 100 percent respondents keep their one arm at or above shoulder level as well as majority of the respondents (88.9 percent) stand with both legs straight while using lower shelf of built in wall cabinet (Table 101).

(iv) Wall mounted Cabinet in kitchen: Posture adopted

It was found that majority of the respondents (95.7 percent) keep their back straight while using top shelf, middle shelf (100 percent) and lower shelf (100 percent) whereas, maximum number of respondents keep their both arms at or above shoulder level (56.5 percent) and stand with weight on one straight leg (69.6 percent) while using top shelf of wall mounted cabinet. All the respondents keep their one arm at or above shoulder level and stand with both legs straight while using middle self of wall mounted cabinet. Similar to middle shelf majority of the respondents keep their one arm at or above shoulder level (100 percent) and stand with both legs straight while using lower shelf of wall mounted cabinet (Table 101).

(v) Base cabinet in kitchen:

With regard to posture adopted by the respondents while using base cabinet, It was found that a little less than 60 percent respondents kept their back bent, where as, 100 percent respondents kept their both arms below shoulder level as well as majority of the respondents (93.2 percent) stood with both legs straight. Out of 44 base cabinets only 36 cabinets had middle shelf. For using middle shelf majority of the respondents kept their back bent (97.2 percent), arms below shoulder level and stood or squatted with both knees bent (63.9 percent). Alike top and middle shelf high percentage of respondents kept their back bent (95.5 percent), arms below shoulder level and stood or squatted with both knee bent (52.3 percent) while using lower shelf of base cabinet (Table 101). The mean height of base cabinet was found to be 80.5 cms (Table 32). The lower position height of the respondents was found to be 80 cms on an average (Table 19). As top shelf height of the base cabinet was 49.7 cms which was quite lower than average lower position height in standing position of the respondents. Hence they had to bend to use these shelves of base cabinet. About 52 per cent respondents faced the problem of bending their knees or

Table 101: Posture adopted by Respondents while using storage unit in kitchen

Sr. No.	Body Parts	Free standing (n=24)						Built in (upto6/7 feet) (n=25)					
		Top self		Middle shelf		Lower shelf		Top self		Middle shelf		Lower shelf	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Back			N=8									
	a) Straight	14	58.3	7	38.9	-	-	22	95.5	23	100	-	-
	b) Bent	9	36.5	11	61.1	24	100	-	-	-	-	23	100
	c) Twisted	-	-	-	-	-	-	1	4.3	-	-	-	-
	d) Bent & twisted	1	4.2	-	-	-	-	-	-	-	-	-	-
2	Arms/Upper limbs												
	a) Both arms are below shoulder level	19	79.2	16	88.9	24	100	-	-	4	17.4	23	100
	b) One arm is at or above shoulder Level	5	20.8	2	11.1	-	-	11	47.8	19	82.6	-	-
	c) Both arms at or above shoulder level	-	-	-	-	-	-	12	52.2	-	-	-	-
3	Legs/ Lower limbs												
	a) Standing with both legs straight	23	95.8	7	38.9	-	-	10	43.5	22	95.7	-	-
	b) Standing with the weight on one straight leg	1	4.2	-	-	-	-	13	56.5	1	4.3	-	-
	c) Standing or squatting with both knees bent	-	-	6	33.3	17	70.8	-	-	-	-	20	86.9
	d) Standing or squatting with one knee bent	-	-	5	27.8	1	4.2	-	-	-	-	1	4.4
	e) Kneeling on one or both knee	-	-	-	-	6	25	-	-	-	-	2	8.7
	f) Walking or moving	-	-	-	-	-	-	-	-	-	-	-	-
	g) Sitting	-	-	-	-	-	-	-	-	-	-	-	-
4	Lord of force												
	a) below 10Kg	-	-	-	-	-	-	-	-	-	-	-	-

Sr. No	Body Parts	Built in wall cabinet (n=27)						Wall mounted cabinet (n=23)					
		Top self		Middle shelf		Lower shelf		Top self		Middle shelf		Lower shelf	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Back			(n=11)							(n=3)		
	a) Straight	24	88.9	10	90.9	24	88.9	22	95.7	3	100	23	100
	b) Bent	-	-	-	-	-	-	-	-	-	-	-	-
	c) Twisted	3	11.1	1	9.1	3	11.1	1	4.3	-	-	-	-
	d) Bent & twisted	-	-	-	-	-	-	-	-	-	-	-	-
2	Arms/Upper limbs												
	a) Both arms are below shoulder level	-	-	-	-	-	-	-	-	-	-	-	-
	b) One arm is at or above shoulder Level	12	44.4	11	100	27	100	10	43.5	3	100	23	100
	c) Both arms at or above shoulder level	15	55.6	-	-	-	-	13	56.5	-	-	-	-
3	Lower limbs/legs												
	a) Standing with both legs straight	9	33.3	8	72.7	24	88.9	7	30.4	3	100	22	95.7
	b) Standing with the weight on one straight leg	18	66.7	3	27.3	2	7.4	16	69.6	-	-	1	4.3
	c) Standing or squatting with both knees bent	-	-	-	-	1	3.7	-	-	-	-	-	-
	d) Standing or squatting with one knee bent	-	-	-	-	-	-	-	-	-	-	-	-
	e) Kneeling on one or both knee	-	-	-	-	-	-	-	-	-	-	-	-
	f) Walking or moving	-	-	-	-	-	-	-	-	-	-	-	-
	g) Sitting	-	-	-	-	-	-	-	-	-	-	-	-
4	Load of force	-	-	-	-	-	-	-	-	-	-	-	-

Sr. No	Body Parts	Wall cabinet (n=44)						Wall mounted rack (n=71)					
		Top self		Middle shelf		Lower shelf		Top self		Middle shelf		Lower shelf	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Back			(n=36)									
	a) Straight	18	40.9	-	-	-	-	68	98.5	71	100	71	100
	b) Bent	26	59.1	35	97.2	42	95.5	-	-	-	-	-	-
	c) Twisted	-	-	-	-	-	-	3	4.2	-	-	-	-
	d) Bent & twisted	-	-	1	2.7	2	4.5	-	-	-	-	-	-
2	Upper arms/ limbs												
	a) Both arms are below shoulder level	44	100	36	100	44	100	-	-	-	-	48	67.6
	b) One arm is at or above shoulder Level	-	-	-	-	-	-	29	40.8	71	100	23	32.4
	c) Both arms at or above shoulder level	-	-	-	-	-	-	42	59.2	-	-	-	-
3	Lower limbs/legs												
	a) Standing with both legs straight	41	93.2	2	5.6	-	-	31	43.7	67	94.4	70	98.6
	b) Standing with the weight on one straight leg	-	-	-	-	-	-	40	56.3	4	5.6	1	1.4
	c) Standing or squatting with both knees bent	2	4.5	23	63.9	23	52.3	-	-	-	-	-	-
	d) Standing or squatting with one knee bent	1	2.3	10	27.8	5	11.4	-	-	-	-	-	-
	e) Kneeling on one or both knee	-	-	1	2.8	16	36.4	-	-	-	-	-	-
	f) Walking or moving	-	-	-	-	-	-	-	-	-	-	-	-
	g) Sitting	-	-	-	-	-	-	-	-	-	-	-	-
4	Load of force	-	-	-	-	-	-	-	-	-	-	-	-

Sr. No	Body Parts	Other rack (n=21)						Loft (n=15) shelves		Built-in open			
		Top self		Middle shelf		Lower shelf		Top shelf		Top shelf		Lower shelf	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Back				(n=11)								
	a) Straight	15	71.4	7	63.6	16	76.2	15	100	35	100	-	-
	b) Bent	6	28.6	35	36.4	5	23.8	-	-	-	-	35	100
	c) Twisted	-	-	-	-	-	-	-	-	-	-	-	-
	d) Bent & twisted	-	-	-	-	-	-	-	-	-	-	-	-
2	Arms/ Upper limbs												
	a) Both arms are below shoulder level	17	80.9	10	90.9	21	100	-	-	-	-	35	100
	b) One arm is at or above shoulder Level	4	19.1	1	9.1	-	-	4	26.7	29	82.9	-	-
	c) Both arms at or above shoulder level	-	-	-	-	-	-	11	73.3	6	17.1	-	-
3	Legs/ Lower limbs												
	a) Standing with both legs straight	20	94.5	6	54.5	16	76.2	11	73.3	22	62.9	-	-
	b) Standing with the weight on one straight leg	-	-	1	9.1	-	-	4	26.7	13	37.1	-	-
	c) Standing or squatting with both knees bent	-	-	4	36.4	1	4.8	-	-	-	-	18	51.4
	d) Standing or squatting with one knee bent	1	4.8	-	-	-	-	-	-	-	-	6	17.2
	e) Kneeling on one or both knee	-	-	-	-	4	19.0	-	-	-	-	11	31.4
	f) Walking or moving	-	-	-	-	-	-	-	-	-	-	-	-
	g) Sitting	-	-	-	-	-	-	-	-	-	-	-	-
4	Load of force	-	-	-	-	-	-	-	-	-	-	-	-

squat to reach the things (Intensity index 1.52/2.00, Appendix). Hence they reported severe pain in hips/thighs/ buttocks (3.8/5.00), knees (2.95/500) and lower back (3.08/5.00), (Table 55). This clearly revealed that 86 per cent and 63 per cent of respondents required corrective measures in posture as soon as possible while using middle and lower shelves (respectively) of the base cabinets (Table 102).

(vi) Wall mounted rack in kitchen: Posture adopted

Majority of the respondents kept their back straight while using top (95.8), middle (100%) and lower (100%) shelves of the wall mounted rack. A little less that 60 percent respondents were habitual of keeping their both arms at or above shoulder level and stand with weight on one straight leg while using top shelf. Whereas, 100 percent respondents keep their one arm at or above shoulder level and stood with both legs straight while using middle shelf of wall mounted rack. It was found that maximum respondents kept their both arms below shoulder level (67.6 percent) and stood with both legs straight (98.6 percent) while using lower shelf of wall mounted rack (Table 101). This may be due to the mean height of lower shelf i.e. 122.7 cms of wall mounted rack. More than half of the respondents faced the problem of straightening their ankles to the extreme to use the upper shelf of the wall mounted rack (Appendix Table 3).

(vii) Other rack in kitchen: Posture adopted

A high percentage of the respondents keep their back straight (71.4 percent), both arms below shoulder level (80.9 percent) and stand with both legs straight (94.5 percent) while using top shelf of other rack. Out of 21 other racks only eleven racks consists middle shelf. It was revealed that maximum respondents keep back straight (63.6 percent), both arms below shoulder level (90.9 percent) and stand with both legs straight (54.5 percent) while using middle shelf of other rack. As similar to top and middle shelf, majority of respondents keep their back straight (76.2 percent), both arms below shoulder level (100 percent) and stand with both legs straight (76.2 percent) while using lower shelf of other rack (Table 101). The mean total height of other rack was

found to be 51.4 cms (Table 34). It was observed that in most of the kitchens, other rack was placed on work counter, making it easier for the respondents to use the rack. But in few kitchens it was placed on floor and as the table 4.4.14 shows that lower shelf's height of the rack ranged from 7-112 cms. Therefore, the respondents had to bend their back or kneel down on their legs to reach the things stored on the middle and lower shelves/drawer. This leads to severe pain in neck and hips/thighs/buttocks of the respondents (Table 57). Hence, corrective measures in posture were required in near future for few of the respondents out of those who had such a storage unit in their house (Table 102).

(viii) Loft in kitchen: Posture adopted

Regarding posture adopted by the respondents while using left, it was found that, all the respondents keep their back straight, while majority keep their both arms at or above shoulder level (73.3 percent) and stand with both legs straight (73.3 percent) (Table 101). The mean total height of loft was found to be 243.07 cms (Table 36). The mean maximum vertical upward arm reach height, body raised toes of the respondents was found to be 201.5 cms (Table 19). As the height of loft was quite high then maximum vertical upward arm reach, the respondents had to use a stool to reach the things stored on the loft (Appendix Table 3). Due to this, the respondents faced problems in using loft frequently. At the same time it was unsafe for them to stand on the stool for using loft. The adoption of awkward posture and use of wrong muscles while using loft led to severe pain in arms/elbows and hips/thighs/buttocks whereas moderate pain was felt by the respondents in other body parts (Table 58).

(ix) Built-in Open Shelves in kitchen: Posture adopted

It was fond that all the respondents keep their back straight while using top shelf of built-in open shelves whereas, all the respondents were in the habit of bending their back while using lower shelf of built-in open shelves. Majority of the respondents keep their one arm at or above shoulder level (82.9 percent) and stand with both legs straight while using top shelf of built-in open shelves. In case of lower shelf, all the respondents keep their arms below shoulder level

and around half of the respondents (51.4 percent) stand or squat with both knees bent (Table 101). The height of top and lower open shelves found in respondents' kitchen ranged from 145-184 cms and 24-55 cms respectively (Table 35). The average upper position height in standing position and lower position height in leaning position of the respondents were found to be 159.5cms and 34.2 cms, respectively. The intensity index shows that due to difference in the dimensions, the respondents had to straighten their ankles/stretch on their toes to lift the things from top open shelf (1.46/2.00) as well as had to bend their knees or squat (1.51/ 2.00) to lift things from lower open shelves (Appendix). The use of static posture for prolonged time while using open shelves leads to sever pain in knees, legs/ankle/feet of the respondents (Table 59). Hence, corrective measures in postures were recommended as soon as possible for about 70 per cent respondents for using lower open shelves in kitchen (Reference Table 102).

Action level- Corrective measures needed for posture adopted in Kitchen

The codes assigned by the investigator to the postures adopted by the respondents while using existing storage units in kitchen were further analyzed to suggest action category for each adopted posture. The suggested action level categories were as follows:

Sr. No	Action Level categories	Posture
1	No corrective measures	Good posture
2	Corrective measures in the near future	Less poor posture
3	Corrective measures as soon as possible	Somewhat poor posture
4	Corrective measures immediately	Very poor posture

(i) Free standing in kitchen: Corrective measures

The Table 5.4.2 of action level for adopted posture depicts that, a little more than 40 percent respondents need corrective measures in their posture in the near future for top shelf, around 44 percent respondent's postures need corrective measures as soon as possible for middle shelf while approx. 80

percent respondents need correction in their adopted posture as soon as possible for lower shelf of free standing storage unit. This may be due to poor design of storage units that leads incorrect postures leading to severe pain in neck and moderate pain in most of the body parts as reported by the respondents while expressing physiological problems faced by them while using free standing storage units in kitchen (Wide section 5.1).

(ii) Built-in (Up to 6/7 feet) storage unit in kitchen: Corrective measures

It was found that only one respondents need corrective measures in the near future for posture adopted for using top shelf while, no corrective measures were needed in postures adopted by the respondents for using middle shelf. Whereas, around 91 percent respondents needs corrective measures as soon as possible in their postures adopted for using lower shelf of built in (up to 6/7 feet) storage unit. Poor designing, prolonged standing and wrong placement of units might leads to adoption of awkward posture which gives rise to severe pain in legs/ankle/feet and moderate pain in other body parts as reported by the respondents while expressing physiological problems faced by them while using built-in (up to 6/7 feet) storage units in kitchen (Wide section 5.1).

(iii) Built in wall cabinet in kitchen: Corrective measures

Only eleven percent respondents need corrective measures in the near future in posture, adopted for using top shelf whereas, none of the respondents need any corrective measures in their postures adopted for using middle and lower shelf of built in wall cabinet. Probably due to prolong standing posture and lifting of heels to reach the things stored on the top shelf gives rise to strenuous posture ultimately leading to severe pain in hips/thighs/buttocks as reported by the respondents while expressing physiological problems faced by them while using built-in wall cabinet kitchen (Wide section 5.1).

Table 102: Corrective measures needed for the posture adopted by the respondents in using storage units of kitchen

Sr. No.	Action category / Storage unit	No corrective measures (Good Posture)		Corrective measures in the near future (Less poor posture)		Corrective measures as soon as possible (Somewhat poor posture)		Corrective measures immediately (Very poor posture)	
		f	%	f	%	f	%	f	%
1	Free Standing								
	• Top Shelf (n=24)	14	58.3	10	41.7	-	-	-	-
	• Middle Shelf (n=18)	7	38.9	3	16.7	8	44.4	-	-
	• Lower Shelf (n=24)	-	-	5	20.8	19	79.2	-	-
2	Built - in (up to 6/7 feet)								
	• Top Shelf (n=23)	22	95.7	1	4.3	-	-	-	-
	• Middle Shelf (n=23)	23	100	-	-	-	-	-	-
	• Lower Shelf (n=23)	-	-	2	8.7	21	91.3	-	-
3	Built – in Wall Cabinet								
	• Top Shelf (n=27)	24	88.9	3	11.1	-	-	-	-
	• Middle Shelf (n=11)	11	100	-	-	-	-	-	-
	• Lower Shelf (n=27)	27	100	-	-	-	-	-	-
4	Wall Mounted Cabinet								
	• Top Shelf (n=23)	23	100	-	-	-	-	-	-
	• Middle Shelf (n=3)	3	100	-	-	-	-	-	-
	• Lower Shelf (n=23)	23	100	-	-	-	-	-	-
5	Base Cabinet								
	• Top Shelf (n=44)	17	38.6	25	56.8	2	4.5	-	-
	• Middle Shelf (n=36)	-	-	3	8.3	31	86.1	2	5.6
	• Lower Shelf (n=44)	-	-	14	31.8	28	63.6	2	4.5
6	Wall Mounted Rack								
	• Top Shelf (n=71)	69	97.2	2	2.8	-	-	-	-
	• Middle Shelf (n=71)	71	100	-	-	-	-	-	-
	• Lower Shelf (n=71)	71	100	-	-	-	-	-	-
7	Other Rack								
	• Top Shelf (n=21)	15	71.4	5	23.8	1	4.8	-	-
	• Middle Shelf (n=11)	7	63.6	-	-	4	36.4	-	-
	• Lower Shelf (n=21)	16	76.2	4	19	1	4.8	-	-
8	Loft (n=15)	15	100	-	-	-	-	-	-
9	Built-in Open Shelves								
	• Top Shelf (n=35)	35	100	-	-	-	-	-	-
	• Lower Shelf (n=35)	-	-	11	31.4	24	68.6	-	-

(iv) Wall mounted Cabinet in kitchen: Corrective measures

It was found that all the respondents require no corrective measures in their postures adopted for using top, middle and lower shelves of wall mounted cabinet. Whether no corrective measures were needed by the respondents in their posture but respondents reported severe pain in lower body parts while expressing physiological problems faced by them while using wall mounted cabinet in kitchen (Wide section 5.1). This was probably due to prolong standing posture, lifting of heels to reach the stored articles on top shelves, wrong placement of cabinets and poor design of the cabinets.

(v) Base cabinet in kitchen: Corrective measures

More than fifty percent respondents' postures adopted for using top shelf need corrective measures in the near future as well as only 4 percent respondents need corrective measures as soon as possible in their posture adopted for using top shelf of base cabinets. Majority of the respondents require corrective measures as soon as possible in their adopted postures for using middle shelf as well as less than ten per cent respondents need corrective measures in the near future, while only one respondents require corrective measures immediately in their posture adopted for using middle shelf. A Little more than 60 percent respondents need corrective measures as soon as possible in posture adopted for using lower shelf whereas around 4 percent respondents requires corrective measures immediately in posture adopted for using lower shelf of base cabinet. This was probably due to bending, kneeling or squatting posture adopted by the respondents to lift the articles from the shelves leading to severe pain in lower body pats as reported by the respondents while expressing physiological problems faced by them while using base cabinet kitchen (Wide section 5.1).

(vi) Wall mounted rack in kitchen: Corrective measures

Only two respondents require corrective measures in the near future in posture adopted for using top shelf whereas, not a single respondent need corrective measures in postures adopted for using middle and lower shelf of wall mounted rack. Whether the respondents don't need major corrective

measures in their postures while using wall mounted rack but they felt severe pain in knees and legs/ankles/ feet as reported by the respondents while expressing physiological problems faced by them while using wall mounted rack in kitchen (Wide section 5.1). This was probably due to prolonged standing posture, lifting of heels to reach the articles stored on top shelves of the rack and wrong placement of rack which might leads to awkward posture.

(vii) Other rack in kitchen: Corrective measures

It was found that around twenty three per cent respondents need corrective measures in the near future as well as only one respondent require corrective measures as soon as possible in postures adopted for using top shelf of other rack. Around thirty six per cent respondents require corrective measures as soon as possible in postures adopted for using middle shelf. Whereas, only one respondent needs corrective measures as soon as possible in posture adopted while using lower shelf of other rack. Probably due to poor design and wrong placement of the racks gives rise to awkward posture leading to severe pain in neck and lower body parts as reported by the respondents while expressing physiological problems faced by them while using other rack in kitchen (Wide section 5.1).

(viii) Loft in kitchen: Corrective measures

It was found that all the respondents needs no corrective measures in posture adopted for using loft. Whether respondents need no corrective measures in their postures while using loft but severe pain was reported by them in arms/elbows and hips/buttocks/ thighs while expressing physiological problems faced by them while using loft in kitchen (Wide section 5.1). It might be possible that unsuitable height and unreachable depth of loft leads to pain and discomfort in body.

(ix) Built-in Open Shelves in kitchen:

For using the top shelf, non of the respondent need corrective measures in their postures whereas, more than 60 percent respondents require corrective measures as soon as possible in postures adopted by the respondents for using lower shelf of built-in open shelves. The respondents need corrective measures

for the lower shelves probably due to adoption of awkward postures such as bending, kneeling and squatting positions to lift things from the shelf which might leads to pain in lower body parts as reported by the respondents while expressing physiological problems faced by them while using opens shelves in kitchen (Wide section 5.1). Corrective measures

4.5.4.2 Posture adopted by Respondents while using storage unit in Bedroom

The working postures of the respondents while using existing storage units in bedroom were observed by the researcher and a code number was assigned to each posture by using the posture coding sheet of OWAS method. The position of back, upper limbs i.e. arms and lower limbs i.e. legs as well as load of force used in carrying out activities were considered in this part.

(i) Free standing in bedroom: Posture adopted

The Table 103 depicts that maximum respondents keep their back straight (94.5 per cent), one arm at or above shoulder level (67.4 per cent) and stand with weight on one straight leg (53.5 per cent) while using top shelf. While using middle shelf, all the respondents keep their back straight, where as, majority of respondents keep their one arm at or above shoulder level (67.4 per cent) and stand with both legs straight (93.1 per cent). It was found that all the respondents keep their back bent, both arms below shoulder level and majority of respondent stand (76.8 per cent) or squat with both knees bent while using lower shelf of free standing unit (Table 103). The mean total height of free-standing storage unit in bedroom was 197.18cms. The top shelf and lower shelf height of the unit range from 141-183 cms and 9-18 cms (Table 44), respectively, which were quite varied from the normal upper position height (159.5 cms) and lower position height (34.2 cms) of the respondents (Table 19). Hence, they had to rise on their toes and had to bend to use the shelves of the storage unit. About 50 per cent respondents raise on their ankle to lift things from top shelf and little more than 60 per cent respondents bend their back to lift things from lower shelf of the storage unit (Intensity index 1.49/2.00 and 1.63/2.00 respectively, Appendix Table 4) due to this they felt moderate pain in their body parts (Table 61). This brings to light that around 80 per cent of

respondents required corrective measures in posture as soon as possible while using lower shelf of the storage unit.

(ii) Built in (up to 6/7 feet) in bedroom: Posture adopted

Back of all the respondents while using top and middle shelf was found in straight position whereas, in case of lower shelf back of all the respondents were found in bent position. Maximum respondents were in habit of keeping their both arms at or above shoulder level (62.9 per cent) and standing with weight on one straight leg (55.6 per cent) while using top shelf. It was seen that majority of respondents usually keep their one arm at or above shoulder level (81.5 per cent) and stand with both legs straight (100 per cent) while using middle shelf. All the respondents keep their arms below shoulder level as well as, a little less than 60 per cent respondents were habitual of standing or squatting with both knees bent while using lower shelf of built in (up to 6/7 feet) storage unit (Table 103).

The mean top shelf height of the storage unit was found to be 165.18 cms (Table 46). This was little more than the average upper position height (159.5 cms) of the respondents (Table 19). Whereas, the mean lower shelf height was 13.7 cms (Table 46), which was too low than the average lower position height (34.2 cms) of the respondents. In the present investigation the respondents were asked to state the problems while using the storage unit. The intensity index for the items that they "had to stretch on their toes to lift things from top shelf" and they "had to bend their upper body to lift things from lower shelves" were found to be 1.56/2.00 and 1.78/2.00, which was considered as moderate and severe, respectively (Appendix Table 4). These variations in dimensions led to severe pain in neck and moderate pain in other body parts of the respondents (Table 62). Hence, 63 per cent of respondents required corrective measure in posture as soon as possible while using the lower shelf of built-in (upto 6/7 feet) storage unit (Table 104).

(iii) Built in Floor to ceiling in bedroom: Posture adopted

It was found that hundred percent respondents keep their back straight whereas, majority keeps their both arms at or above shoulder level (90.9 percent) and

stand with both legs straight (77.3 per cent) while using top shelf of built-in floor to ceiling storage unit. For using middle shelf all the respondents keep their back straight and one arm at or above shoulder level whereas, majority of respondents stand with both legs straight (72.7 per cent). All the respondents have to bend their back and have to kept both arms below shoulder level whereas, maximum respondents stand or squat with both knees bent (59.1 per cent) while using lower shelf of the built in floor to ceiling storage unit (Table 103). The mean top shelf height of the storage unit was found to be 251.5 cms (Table 45) which was too high than average maximum vertical arm reach, body raised on toes (201.5 cms) of the respondents (Table 19). Hence, to reach the top-most shelf of the storage the respondents had to use stool for using the shelf. The study shows that all the respondents use stool for using the top most shelf (Intensity index 2.00/2.00, Appendix Table 4).The mean lower shelf height of the storage unit was found to be 14.05 cms.(Table 45) which was too low from the lower position height of the respondents in leaning position (34.2 cms). This difference in dimensions leads to adoption of bending posture by the respondents for using lower shelf. More than 75 per cent respondents bend their upper body for using the lower shelf and the intensity index was found to be 1.77 out of 2.00, which was considered as severe. Hence, the respondents reported severe pain in lower back (3.8/5.00), hips/thighs/buttocks (3.9/5.00), knees (3.8/5.00) and legs/ankle/feet (4.0/5.00) while using the storage unit. Finally it was revealed that around 68 per cent of respondents who had such storage units need corrective measures in postures as soon as possible while using lower shelf of the storage unit.

Table 103: Frequency of posture adopted by Respondents while using existing storage units in Bedroom

Sr. No	Body Parts	Free standing (n=43)						Built in (up to 6/7 feet) (n=27)					
		Top self		Middle shelf		Lower shelf		Top self		Middle shelf		Lower shelf	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Back												
	a) Straight	41	94.5	43	100	-	-	27	100	27	100	-	-
	b) Bent	-	-	-		43	100	-		-	-	27	100
	c) Twisted	2	4.7	-		-	-	-		-	-	-	-
	d) Bent & twisted	-	-	-		-	-	-		-	-	-	-
2	Arms/Upper limbs												
	a)Both arms are below shoulder level	-	-	14	32.6	43	100	-	-	5	18.5	27	100
	b)One arm is at or above shoulder Level	29	67.4	29	67.4	-	-	10	37.1	22	81.5	-	-
	c)Both arms at or above shoulder level	14	32.6	-	-	-	-	17	62.9	-	-	-	-
3	Lower limbs/legs												
	a)Standing with both legs straight	20	46.5	40	93.1	-	-	12	44.4	27	100	-	-
	b) Standing with the weight on one straight leg	23	53.5	3	6.9	-	-	15	55.6	-	-	-	-
	c) Standing or squatting with both knees bent	-	-	-	-	33	76.8	-	-	-	-	16	59.3
	d) Standing or squatting with one knee bent	-	-	-	-	3	6.9	-	-	-	-	1	3.7
	e) Kneeling on one or both knee	-	-	-	-	7	16.3	-	-	-	-	10	37.0
	f) Walking or moving	-	-	-	-	-	-	-	-	-	-	-	-
	g) Sitting	-	-	-	-	-	-	-	-	-	-	-	-
4	Load of force	-	-	-	-	-	-	-	-	-	-	-	-
	a) Below 10 kg.												

Sr. No	Body Parts	Built-in floor to ceiling (n=22)						Chest of drawers (n==21)					
		Top self		Middle shelf		Lower shelf		Top self		Middle shelf		Lower shelf	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Back									n=15			
	a) Straight	22	100	22	100	-	-	13	61.1	-	-	-	-
	b) Bent	-	-	-		22	100	8	38.1	15	100	20	94.5
	c) Twisted	-	-	-		-	-	-	-	-	-	-	-
	d) Bent & twisted	-	-	-		-	-	-	-	-	-	1	4.8
2	Arms/Upper limbs												
	a)Both arms are below shoulder level	-	-	-	-	22	100	21	100	15	100	21	100
	b)One arm is at or above shoulder Level	2	9.1	22	100	-	-	-	-	-	-	-	-
	c)Both arms at or above shoulder level	20	90.9	-	-	-	-	-	-	-	-	-	-
3	Lower limbs/legs												
	a)Standing with both legs straight	17	77.3	16	72.7	-	-	14	66.7	8	53.3	-	-
	b) Standing with the weight on one straight leg	5	22.7	6	27.3	-	-	-	-	-	-	-	-
	c) Standing or squatting with both knees bent	-	-	-	-	13	59.1	7	33.3	2	13.2	8	38.1
	d) Standing or squatting with one knee bent	-	-	-	-	2	9.1	-	-	5	33.3	1	4.8
	e) Kneeling on one or both knee	-	-	-	-	7	31.8	-	-	-	-	12	57.1
	f) Walking or moving	-	-	-	-	-	-	-	-	-	-	-	-
	g) Sitting	-	-	-	-	-	-	-	-	-	-	-	-
4	Load of force												
	a) Below 10 kg.	-	-	-	-	-	-	-	-	-	-	-	-

Sr. No	Body Parts	Wall storage unit (n=11)						Base storage unit (n=31)					
		Top self		Middle shelf		Lower shelf		Top self		Middle shelf		Lower shelf	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Back												
	a) Straight	11	100	5	100	11	100	8	25.8	1	10	-	-
	b) Bent	-	-	-		-	-	21	67.7	9	90	30	96.8
	c) Twisted	-	-	-		-	-	-	-	-	-	-	-
	d) Bent & twisted	-	-	-		-	-	2	6.5	-	-	1	3.2
2	Arms/Upper limbs												
	a)Both arms are below shoulder level	-	-	1	20	10	90.9	28	90.3	10	100	31	100
	b)One arm is at or above shoulder Level	11	100	4	80	1	9.1	3	9.7	-	-	-	-
	c)Both arms at or above shoulder level	-	-	-	-	-	-	-	-		-	-	-
3	Lower limbs/legs												
	a)Standing with both legs straight	11	100	4	80	11	100	21	67.7	2	20	-	-
	b) Standing with the weight on one straight leg	-	-	1	20	-	-	1	3.2	2	20	-	-
	c) Standing or squatting with both knees bent	-	-	-	-	-	-	8	25.8	2	20	17	54.8
	d) Standing or squatting with one knee bent	-	-	-	-	-	-	1	3.2	3	20	6	19.4
	e) Kneeling on one or both knee	-	-	-	-	-	-	-	-	1	10	8	25.8
	f) Walking or moving	-	-	-	-	-	-	-	-	-	-	-	-
	g) Sitting	-	-	-	-	-	-	-	-	-	-	-	-
4	Load of force												
	a) Below 10 kg.	-	-	-	-	-	-	-	-	-	-	-	-

Sr. No	Body Parts	Box Bed (n=30) storage space	
		f	%
1	Back		
	a) Straight	-	-
	b) Bent	30	100
	c) Twisted	-	-
	d) Bent & twisted	-	-
2	Arms/Upper limbs		
	a) Both arms are below shoulder level	-	-
	b) One arm is at or above shoulder Level	30	100
	c) Both arms at or above shoulder level	-	-
3	Lower limbs/legs		
	a) Standing with both legs straight	-	-
	b) Standing with the weight on one straight leg	-	-
	c) Standing or squatting with both knees bent	9	30
	d) Standing or squatting with one knee bent	1	3.3
	e) Kneeling on one or both knee	20	66.7
	f) Walking or moving	-	-
	g) Sitting	-	-
4	Load of force		
	a) Below 10 kg.	-	-

(iv) Chest of drawers in bedroom: Posture adopted

It was revealed that maximum respondents keep their back straight (61.9 per cent), both arms below shoulder level (100 per cent) and stand with both legs straight (66.7 per cent) while using top drawer of chest of drawers. All the respondents keep their back bent, both arms below shoulder level and around little more than 50 per cent respondents stand with both legs straight while using middle drawer. Alike middle drawer majority of respondents keep their back bent (94.5 per cent) arms below shoulder level (100 percent) and kneel on one or both knees (57.1 percent) for using lower drawer of chest of drawers (Table 103).

The mean total height of chest of drawers was found to be 85.67 cms, and the range of top drawers' height varies from 27-105 cms, as well as the range of lower drawers' height varies from 6-16 cms. The respondents reported that they "had to bend their knees or squat to reach the things stored on lower

drawer" (61.9 percent: Intensity index – 1.62/2.00); they "suffered from body discomfort due to frequent changes in posture and adoption of awkward posture" (90.5 percent, Intensity index – 1.90/2.00) as well as "body joints do not remain in convenient neutral position while using storage unit" (90.5 percent; Intensity index – 1.90/2.00) (Appendix Table 4). These problems leads to severe pain in neck, legs/ankle/feet of the respondents while using chest of drawers. This revealed that corrective measures in posture were required by the respondents as soon as possible while using top drawer (33.3 percent) middle drawer (46.7 percent) and lower drawer (42.9 percent) of chest of drawers (Table 104).

(v) Wall storage Unit in bedroom: Posture adopted

As regard to posture adopted by the respondents while using wall storage unit, it was depicted that all the respondents keep their back straight while using top, middle and lower shelf. Whereas, all the respondents were in habit of keeping one arm at or above shoulder level and stand with both legs straight while using top shelf. Alike top shelf majority of the respondents keep their one arm at or above shoulder level (80 per cent) and stand with both legs straight (80 per cent) while using middle shelf. It was found that all the respondents stand with both legs straights, and around 90 percent respondents keep their both arms below shoulder level while using lower shelf of wall storage unit (Table 103).

The range of top shelf height and lower shelf height of wall storage unit ranged from 130-177 cms and 78-133 cms respectively. More than 80 percent respondents complained that they "had to grope for the things from the top shelf of the unit for a moment", Intensity index – 1.82/2.00 which is considered as sever (Appendix Table 4). Due to this the respondents suffered from severe pain in neck (Table 65) while using the wall storage unit.

(vi) Base Storage Unit in bedroom: Posture adopted

It was found that maximum respondents usually keep their back in bent position (67.7 per cent), arm below shoulder level (90.3 per cent) and stand with both legs straight while using top shelf. While using middle shelf maximum respondents keep their back straight (90 per cent), arms below shoulder level (100 per cent) and stand or squat with one knee bent (30 percent). Majority of the respondents bend their back (96.8 percent), keep their both arms below shoulder level (100 per cent) and stand or squat with both knees bent (54.8 percent) while using lower shelf of base storage unit (Table 103).

The mean top shelf height of the base storage unit was found to be 53.24 cms.(Table 49) which was too low from the mean lower position height in standing position (80.2 cms.) of the respondents. As well as the mean lower shelf height of the unit was found as 12.84 cms., whereas the mean lower position height (34.2 cms.) of the respondents in leaning position (Table 19) was quite high from the lower shelf's height. The variation in the dimension makes the respondents (74.2 per cent) to bend their upper body to lift things from the shelf of the storage unit, intensity index 1.74/2.00 which was considered as severe (Appendix Table 4). Due to frequent adoption of bending posture and use of wrong muscles leads to severe pain in hips/thighs/buttock (3.82/5.00) of the respondents (Table 66). Hence corrective measures were required by the respondents as soon as possible while using top (22.6 per cent), middle (50 per cent) and lower shelves (74.2 per cent) of base storage unit and as well as few respondents required immediate corrective measures in their posture while using top shelf (6.5 per cent) and lower shelf (3.2 per cent) of the storage unit (Table 104)

(vii) Box bed in bedroom: Posture adopted

It was found that all the respondents bend their back, keep their both arms below shoulder level whereas, majority kneel on one or both knee (66.7 percent) while using box bed (Table 103).

The mean total length, width and depth of box bed were found to be 200.93 cms, 186.97 cms. and 43.13 cms., respectively (Table 50). It was observed that respondents (86.7 per cent) had to squat or bend notably to use the storage space of box bed, intensity index 1.87/2.00, which was considered as severe (appendix Table 4). The respondents also reported that the "body joints do not remain in convenient neutral position while using box bed (93.3per cent) and as well as bed box was not comfortable and easy to use (90 per cent) [Appendix Table 4]. These problems lead to severe pain in hips/thigh/buttock, knees and legs/ankles/feet of the respondents (Table 67). This revealed that more than 30 per cent respondents required corrective measures in posture as soon as possible while using box bed.

Action level- Corrective measures needed for posture adopted in Bedroom

The codes assigned by the investigator to the postures adopted by the respondents while using existing storage units in bedroom were further analyzed to suggest action category for each adopted posture. The suggested action level categories were as follows:

S.no	Action Level categories	Posture
1	No corrective measures	Good posture
2	Corrective measures in the near future	Less poor posture
3	Corrective measures as soon as possible	Somewhat poor posture
4	Corrective measures immediately	Very poor posture

(i) Free standing storage unit in bedroom: Corrective measures

Action level for posture adopted for using free standing unit depicts that for the lower shelf majority of the respondents (83.7 per cent) need corrective measures as soon as possible in their postures (Table 104) whereas, none of the respondent need any corrective measures in their postures for using top and middle shelf. The respondents' needs corrective measures in their postures for lower shelf probably due to adoption of awkward postures such as bending, kneeling and squatting to reach the articles stored on the lower shelf. This might leads to moderate pain in body parts as reported by the respondents

while expressing physiological problems faced by them while using free-standing storage unit in bedroom (Wide section 5.1).

(ii) Built-in (up to 6/7 feet) in bedroom: Corrective measures

A little more than 60 per cent respondents need corrective measures as soon as possible in their postures adopted for using lower shelf of built-in (up to 6/7 feet) however neither of the respondent needs corrective measures in their postures for using top shelf, nor for using middle shelf. As similar to free-standing storage unit respondents need corrective measures in postures for lower shelf probably due to frequent adoption of bending, squatting and kneeling posture leads to pain in body as reported by the respondents while expressing physiological problems faced by them while using built-in storage unit in bedroom (Wide section 5.1).

(iii) Built-in Floor to ceiling in bedroom: Corrective measures

Majority of the respondents (68.2 per cent) need corrective measures as soon as possible in their postures adopted for using lower shelf of built-in floor to ceiling. While it was found that not a single respondent needs corrective measures in their postures for using top and middle shelf. Probably due to repetitive adoption of poor postures respondents felt severe pain in lower body parts as reported by them while expressing physiological problems faced by the respondents while using built-in floor to ceiling storage unit in bedroom (Wide section 5.1).

(iv) Chest of drawers in bedroom: Corrective measures

It was found that around 33 per cent, 46 per cent, and 42 per cent respondents need corrective measures as soon as possible in their postures adopted for using top middle and lower drawers, respectively. Whereas, only one respondents need application of corrective measures immediately in their posture for using lower drawer of chest of drawers. Probably due to poor design of chest of drawers, wrong placement and adoption of awkward posture to lift the things stored in them leads to severe pain in neck and legs/ankle/feet as reported by the respondents while expressing physiological problems faced by them while using chest of drawers in bedroom (Wide section 5.1).

Sr. No.	Action category / Storage unit	No corrective measures (Good posture)		Corrective measures in the near future (Less poor posture)		Corrective measures as soon as possible (Somewhat poor posture)		Corrective measures immediately (Very poor posture)	
		f	%	f	%	f	%	f	%
1	Free Standing								
	• Top Shelf (n=43)	43	100	-	-	-	-	-	-
	• Middle Shelf (n=43)	43	100	-	-	-	-	-	-
	• Lower Shelf (n=43)	-	-	7	16.3	36	83.7	-	-
2	Built - in (up to 6/7 feet)								
	• Top Shelf (n=27)	27	100	-	-	-	-	-	-
	• Middle Shelf (n=27)	27	100	-	-	-	-	-	-
	• Lower Shelf (n=27)	-	-	10	37.0	17	63.0	-	-
3	Floor to ceiling								
	• Top Shelf (n=22)	22	100	-	-	-	-	-	-
	• Middle Shelf (n=22)	22	100	-	-	-	-	-	-
	• Lower Shelf (n=22)	-	-	7	31.8	15	68.2	-	-
4	Chest of drawers								
	• Top Shelf (n=21)	13	61.9	1	4.8	7	33.3	-	-
	• Middle Shelf (n=15)	-	-	8	53.3	7	46.7	-	-
	• Lower Shelf (n=21)	-	-	11	52.4	9	42.9	1	4.8
5	Wall storage unit								
	• Top Shelf (n=11)	11	100	-	-	-	-	-	-
	• Middle Shelf (n=5)	5	100	-	-	-	-	-	-
	• Lower Shelf (n=11)	11	100	-	-	-	-	-	-
6	Base storage unit								
	• Top Shelf (n=31)	8	25.8	14	44.5	7	22.6	2	6.5
	• Middle Shelf (n=10)	1	10	4	40	5	50	-	-
	• Lower Shelf (n=31)	-	-	7	22.6	23	74.2	1	3.2
7	Box bed (n=30)	-	-	20	66.7	10	33.3	-	-

(v) Wall storage unit in bedroom: Corrective measures

It was depicted that none of the respondent need corrective measures in their postures for using top, middle and lower shelves of wall storage unit. Whether respondents need no corrective measures in their postures for using wall storage units but moderate to severe pain was reported by them in their body parts while expressing physiological problems faced by them while using wall storage unit in bedroom (Wide section 5.1). This might be due to poor design of the unit, wrong placement and adoption of awkward posture to lift the things stored in them.

(vi) Base storage unit in bedroom: Corrective measures

Around 22 per cent, 50 percent and 74 per cent respondents need corrective measures as soon as possible in their postures adopted for using top, middle and lower shelves respectively. Whereas, only 6.5 percent and 3.2 per cent respondents need corrective measures immediately in their postures adopted for using top and lower shelves respectively. The respondents need corrective measures in their postures probably due to poor design of the units and frequent squatting, bending and kneeling posture which might leads to severe pain in lower body parts as reported by the respondents while expressing physiological problems faced by them while using base storage unit in bedroom (Wide section 5.1).

(vii) Box bed in bedroom: Corrective measures

A little more than 30 percent respondents need corrective measures as soon as possible in their posture adopted for using box bed, whereas, around 66 percent respondents need corrective measures in the near future in their posture adopted for using box bed. Box bed was not frequently used by the respondents but they felt difficulty in using them probably due to poor design and awkward postures adopted by them while using box bed. This might leads to severe pain in lower body parts of the respondents as reported by them while expressing physiological problems faced by them while using box bed in bedroom (Wide section 5.1).

Section: 6

4.6 Level of Satisfaction with existing storage units

This section comprises of findings related to satisfaction for storage units in kitchen and bedroom. The data revealed the level to which the respondents were satisfied or dissatisfied with their existing storage units present in selected areas of the house. The information would be helpful in knowing needs and preferences of the respondents required by them in their storage units.

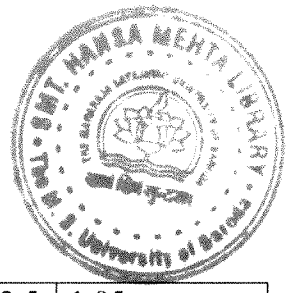
4. 6.1 Satisfaction of the respondents with their existing storage units in Kitchen

Respondents were asked to specify their level of satisfaction related to various aspects of physical features of the existing storage units in kitchen. The score of 3 was given to response of highly satisfied and 1 was assigned to response of not satisfied. Further weighted mean score of each statement was calculated to find out the most satisfied aspects of the storage unit.

The Table 105 shows the level of satisfaction of the respondents regarding existing storage units in kitchen. It was found that around 38 per cent respondents were highly satisfied with the size of the storage units available in kitchen. More than 50 per cent respondents reported that they were some-what satisfied with the height of the storage units available in their kitchen. A little less than 50 per cent respondents were some-what satisfied with the depth of the storage units. As well as around 54 per cent respondents were somewhat satisfied with the width of the storage units.

Table 105: Frequency distribution of respondents on the basis of satisfaction with existing storage units in kitchen

Sr. No.	Satisfaction regarding various aspects of storage unit in kitchen	Respondents n=85						Weighted mean score (1.0 to 3.0)
		Highly satisfied		Some what satisfied		Not satisfied		
		f	%	f	%	f	%	
1	Size of the storage units available in kitchen	33	38.8	32	37.6	20	23.5	2.15



2	Height of the storage units	16	18.8	49	57.6	20	23.5	1.95
3	Depth of the storage units	26	30.6	42	49.4	17	20	2.10
4	Length of the storage units	18	21.2	46	54.1	21	24.7	1.96
5	Allocation of the storage units	26	30.6	54	63.5	5	5.9	2.25
6	Material of the storage units	27	31.8	57	67.1	1	1.2	2.30
7	Finishing of the storage units	29	34.1	55	64.7	1	1.2	2.31
8	Opening/closing system of the storage units	17	20.0	46	54.1	22	25.9	1.94
9	Key operation mode of storage units	21	24.7	62	72.9	2	2.4	2.22
10	Appearance of storage units	27	31.8	56	65.9	2	2.4	2.29
11	Size of the door/panels of the storage units	16	18.8	54	63.5	15	17.6	2.01
12	Shape of handles/knobs	12	14.1	53	62.4	20	23.5	1.9
13	Dimensions/grip diameter of handle/knob	11	12.9	50	58.8	24	28.2	1.85
14	Material of handles/knobs	14	16.5	55	64.7	16	18.8	1.98

About two third of respondents were found to be some-what satisfied with the material of the storage units (67.1 per cent) and finishing of the storage units (64.7 per cent). About one-third were highly satisfied with these aspects. The

weighted mean supported these findings. The intensity index was found to be the highest for these aspects.

Around one-fourth respondents were not satisfied with the opening/closing system of storage units whereas, a little less than one-fourth respondents were found to be highly satisfied with the key operation mode of storage units.

Maximum respondents found appearance of storage units and size of the door/panels of the storage units some-what satisfactory. While around two per cent and 17 per cent respondents were not satisfied with the appearance and size of the doors/panels of the storage units, respectively.

It was found that only 14 per cent respondents were highly satisfied with the shape of handle/knobs whereas, around 23 per cent were found to be not satisfied with the shape of handle/knobs.

More than one-fourth of respondents were not satisfied with the dimension/grip diameter of handles/knobs. The intensity index was found to be the least for these. Equal number of respondents i.e. 21 per cent was not satisfied with the appearance and finish of handle/knobs. It was found that majority of the respondents were some-what satisfied with the hooks and hanging rods available in storage units (Table 105).

Further, on the basis of weighted mean scores it was concluded that the respondents were satisfied more with the finishing of the storage units in kitchen however, they were least satisfied with the dimensions/grip diameter of handle/knobs (Table 105).

4.6.1.1 Level of satisfaction with existing storage units in kitchen

The possible score of 1 to 3 was divided into 3 categories having equal interval so as to show extent of level of satisfaction. Higher scores reflected higher extent of level of satisfaction.

Table 106: Level of satisfaction with existing storage units in kitchen

Sr. No.	Level of satisfaction	Range	Respondents n=85	
			f	%
1	Least satisfied	18-30	8	9.4
2	Moderately satisfied	31-42	61	71.8
3	Highly satisfied	43-54	16	18.8
		Total	**85**	**100**

The table 106 depicts that majority of the respondents (71.8 per cent) were somewhat satisfied with their existing storage units in kitchen. Only 18 per cent respondents were highly satisfied with their existing storage units and 9 per cent respondents were least satisfied with their storage units.

4.6.2. Satisfaction of the respondents with their existing storage units in Bedroom

In this sub-section, respondents stated their level of satisfaction regarding various aspects of physical features of the existing storage units in bedroom.

It was depicted from table 107 that around 38 per cent respondents were highly satisfied with the size of the storage units whereas, only 18 per cent respondents were not satisfied with the same.

Height/length of the storage units available in bedroom was found highly satisfactory by around 23 per cent respondents while only 12 per cent respondents were not satisfied with the height of the storage units. Little less than one-fourth of respondents were highly satisfied with the depth of the storage units available in bedroom whereas around 28 per cent respondents were unsatisfied with the same. According to 22 per cent respondents', width of the storage units in bedroom was highly satisfactory while only 15 per cent were unsatisfied with the width of the storage units.

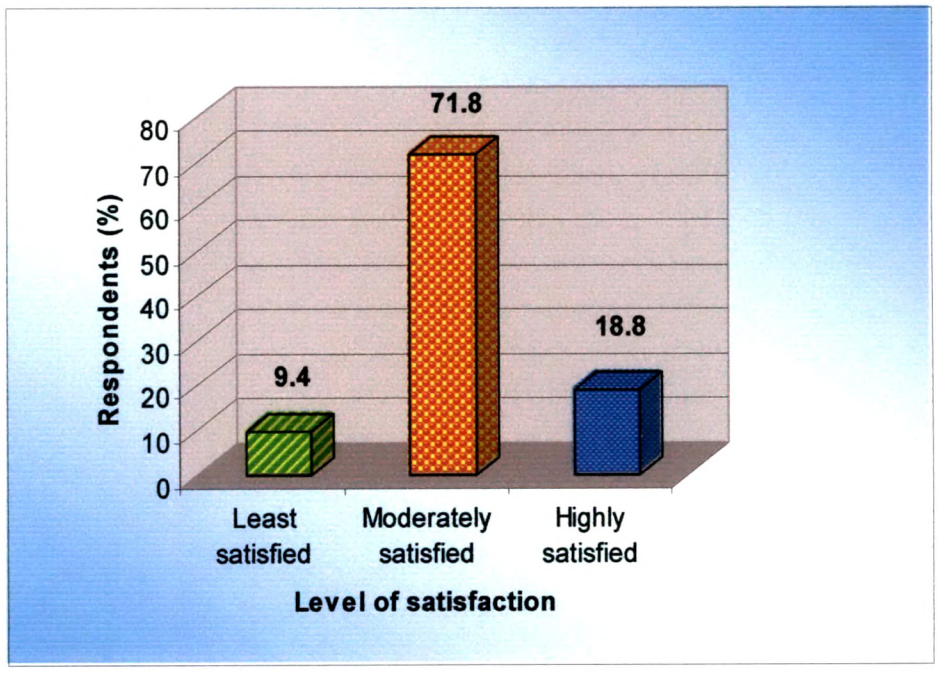


Fig 60: Level of satisfaction felt by the respondents while using storage units in Kitchen

Table 107: Frequency distribution of respondents on the basis of satisfaction with existing storage units in bedroom

S.no.	Various aspects with storage unit in bedroom	Respondents n=85						Weighted mean score 1.0-3.0
		Highly satisfied		Some what satisfied		Not satisfied		
		f	%	f	%	f	%	
1	Size of the storage units available in bedroom	33	38.8	36	42.4	16	18.8	2.2
2	Height of the storage units	20	23.5	54	63.5	11	12.9	2.11
3	Depth of the storage units	21	24.7	40	47.1	24	28.2	1.96
4	Length of the storage units	19	22.4	53	62.4	13	15.3	2.07
5	Allocation of the storage units	21	24.7	52	61.2	12	14.1	2.11
6	Material of the storage units	26	30.6	59	69.4	-	-	2.31
7	Finishing of the storage units	30	35.3	55	64.7	-	-	2.35
8	Opening/closing system of the storage units	16	18.8	58	68.2	11	12.9	2.05
9	Key operation mode of storage units	20	23.5	54	63.5	11	12.9	2.11
10	Appearance of storage units	28	32.9	57	67.1	-	-	2.33
11	Size of the door/panels of the storage units	17	20.0	53	62.4	15	17.6	2.02
12	Shape of handles/knobs	10	11.8	58	68.2	17	20.0	1.92
13	Dimensions/grip diameter of handle/knob	10	11.8	55	64.7	20	23.5	1.88
14	Material of handles/knobs	11	12.9	58	68.2	16	18.8	1.94
15	Appearance of handles/knobs	10	11.8	57	67.1	18	21.2	1.91
16	Finish of handle/knobs	10	11.8	57	67.1	18	21.2	1.90

17	Hooks in storage units	16	18.8	66	77.6	3	3.5	2.15
18	Hanging rods in storage units	15	17.6	65	76.5	5	5.9	2.12

It was found that a little less than 25 per cent respondents were highly satisfied with the allocation of storage units in bedroom. Around 30 per cent and 35 per cent respondents were reported to be highly satisfied with the material and finishing of the storage units, respectively.

Only 18 per cent respondents were highly satisfied with the opening/closing system of the existing storage units and around 13 per cent respondents were found to be not satisfied with the same.

Key operation mode of the existing storage units were reported to be highly satisfying by 23 per cent respondents. Almost 33 per cent respondents were highly satisfied with the appearance of the storage units whereas, not a single respondent found to be unsatisfied with the same.

It was found that 20 per cent respondents were highly satisfied with the size of the door/panel of the storage units whereas, similar number of respondents i.e. 20 per cent was found to be not satisfied with the shape of handles/knobs.

Little less than 12 per cent respondents were highly satisfied with the dimension/grip diameter of handles/knobs. Almost 13 per cent respondents were reported to be highly satisfied with the material of handles and knobs. Similar number of respondents (11.8 per cent) were reportedly found highly satisfied with the appearance and finish of handles/knobs, respectively as well as equal number of respondents (21 per cent) found dissatisfied with the appearance and finish of handles/knobs of existing storage units in bedroom.

Majority of the respondents (77.6 per cent) were some-what satisfied with the hooks available in storage units while hanging rods available in storage units were reportedly found highly satisfactory by 17 per cent respondents (Table 107).

On the whole it was concluded that about three fourth of respondents were 'some-what' satisfied with hooks and hanging rods in storage units. More than two third were some-what and one-third of respondents were highly satisfied with the material and finish of the storage unit. The intensity index was found to be highest for these. The least intensity index was found to be for dimension and shape for handles/ knobs (Table 107).

4.6.2.1 Level of satisfaction with existing storage units in Bedroom

The possible score of 1 to 3 was divided into 3 categories having equal interval so as to show extent of level of satisfaction. Higher scores reflected higher extent of level of satisfaction.

Table 108: Level of satisfaction with existing storage units in bedroom

Sr. No.	Level of satisfaction	Range	Respondents n=85	
			f	%
1	Least satisfied	18-30	10	11.8
2	Moderately satisfied	31-42	58	68.2
3	Highly satisfied	43-54	17	20.0
		Total	**85**	**100**

The table 108 revealed that majority of the respondents (68.2 per cent) was some-what satisfied with the available storage units in bedroom. Twenty per cent respondents were highly satisfied with the storage units whereas, only eleven per cent respondents were found to be least satisfied with the available storage units in bedroom.

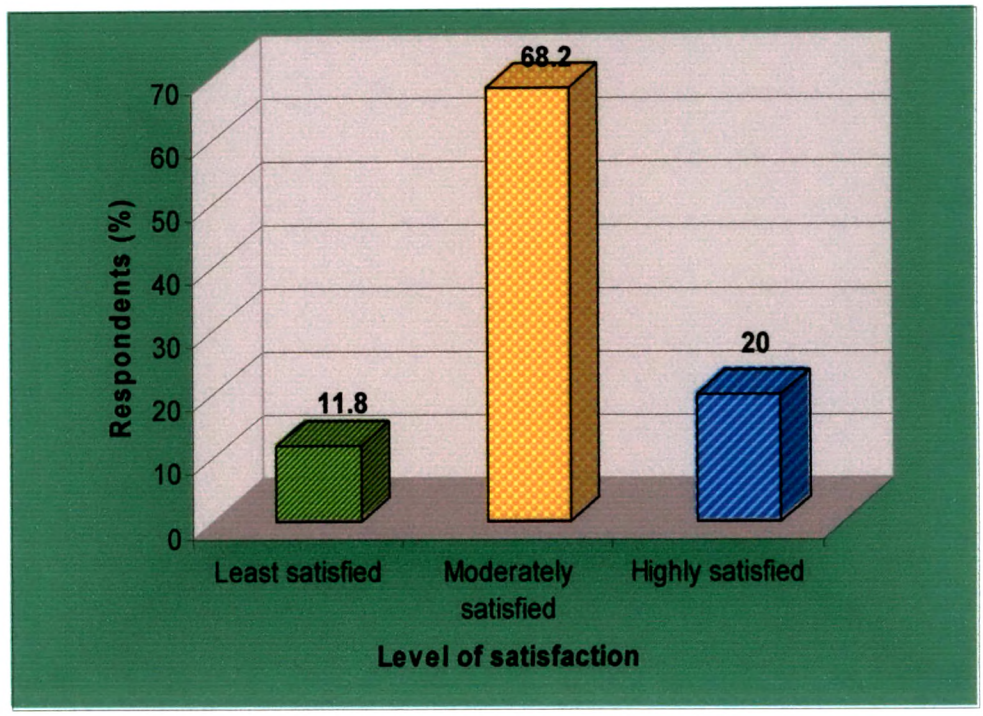


Fig 61: Level of satisfaction felt by the respondents while using storage units in bedroom

Section: 7

Testing of Hypothesis

Certain hypotheses were formulated to find out the relationship between the variables of the present study. For the purpose of statistical analysis they were stated in null form.

Ho1: There exists no relationship between extent of problems faced by the respondents with existing storage units and their personal, family and situational variables.

This broad hypothesis was made in to several specific hypotheses.

Ho1.1 (a): There exists no relationship between the extent of problems faced by the respondents with existing storage units in kitchen and their selected personal variables viz. age, health status and anthropometric measurements.

The results are presented separately for each of sub aspects of problems viz. (i) physiological problems (physiological problems was considered as severity of pain and discomfort felt while using storage unit), (ii) problems with physical characteristics of the storage units {The problems with physical characteristics of storage units included aspects like space availability, inner feature (length, height, depth and distance between shelves/ drawers) and outer features (knobs, handles, opening/closing system etc.)} and (iii) problems while using storage units (Problems while storing articles on top and lower shelves etc). The two aspects of health status viz. (i) Functional capacity (Functional capacity was extent of various activities performed by respondents independently), (ii) Problems in movement of various body parts were considered for statistical analysis. Anthropometric measurements considered for statistical analysis were as follows: (a) Normal standing height, (b) Vertical upward arm reach, (c) Total arm length.

Pearson's Product Moment of correlation coefficient was used to test the hypothesis.

Table 109: Coefficient of Correlation showing relationship between extent of problems faced by the respondents with their

existing storage units in kitchen and their selected personal variables

Variables	Problems				
	Physiological problems (r-value)	Problems regarding physical characteristics			Problems while using storage units (r-value)
		Space related problem (r-value)	Problem related to inner features (r-value)	Problem related outer features (r-value)	
Personal variables					
1. Age	0.068	0.065	0.179	0.097	0.179
2.Health status					
a. Functional capacity	-0.003	0.113	-0.065	-0.014	0.035
b. Problems in movement of body parts	0.134	0.188	0.121	0.014	0.057
3.Anthropometric measurements					
a. Normal standing height	0.07	-0.031	-0.142	-0.047	-0.192
b. Vertical upward arm reach	0.153	0.029	-0.174	-0.232*	-0.06
c. Total arm length	0.151	0.045	-0.05	-0.115	-0.107

*0.05 level of significance
**0.01 level of significance

A significant negative relationship was found between problems related to outer features of the storage units and vertical upward arm reach. This unveils that problems related to outer feature (knobs/handle/opening system) of the storage units increase with decrease in vertical upward arm reach of the respondents.

Hence, the hypothesis was partially rejected for vertical upward arm reach. Whereas, the null hypothesis was partially accepted for other personal variables.

Ho1.1 (b): There exists no relationship between the extent of problems faced by the respondents with existing storage units in bedroom and their selected personal variables.

The personal variables considered for statistical analysis were age, health status and anthropometric measurements

Table 110: Coefficient of Correlation showing relationship between extent of problems faced by the respondents with their existing storage units in bedroom and their selected personal variables

Variables	Problems				
	Physiological problems (r-value)	Problems regarding physical characteristics			Problems while using storage units (r-value)
		Space related problem (r-value)	Problem related to inner features (r-value)	Problem related outer features (r-value)	
Personal variables					
1. Age	0.051	-0.085	-0.166	-0.1	-0.103
2.Health status					
a. Functional capacity	-0.013	-0.035	-0.005	0.069	-0.046
b. Problems in movement of body parts	0.125	0.008	-0.02	-0.021	-0.016
3.Anthropometric measurements					
a. Normal standing height	0.158	-0.038	-0.05	0.005	-0.027
b. Vertical upward arm reach	-0.262*	-0.055	0.03	-0.049	-0..038
c. Total arm length	0.137	-0.029	-0.02	-0.094	-0.09

*0.05 level of significance
**0.01 level of significance

Pearson's Product Moment of correlation coefficient was used to test the hypothesis.

The result of the study showed that there was a significant relationship between physiological problems faced by the respondents while using storage units and vertical upward arm reach. The negative correlation shows that as the vertical upward arm reach increases the physiological problems while using storage units' decreases.

Hence, the hypothesis was partially rejected for vertical upward arm reach and accepted for remaining personal variables.

Ho1.2 (a): There exists no relationship between the extent of problems faced by the respondents with existing storage units in kitchen and their selected situational variables viz. attributes of storage units and extent of using storage units.

The results are presented separately for each of sub aspects of problems viz. (i) physiological problems, (ii) problems with physical characteristics of the storage units and (iii) problems while using storage units. Two situational variables considered were Attributes of storage unit and extent of using storage unit. The two aspects of attributes of storage units viz. (i) Natural and artificial light inside storage units, (ii) Total dimensions of storage units were considered for statistical analysis. A detailed analysis for each type of storage unit is presented.

Table 111: Coefficient of correlation showing relationship between extent of problems faced by the respondents with their existing storage units in kitchen and their selected situational variables: Attribute of storage unit (i) Light inside storage unit.

Variables	Problems				
	Physiological problems	Problems regarding physical characteristics			Problems while using storage units
		Space related problem	Problem related to inner features	Problem related outer features	
	(r-value)	(r-value)	(r-value)	(r-value)	(r-value)
Situational variables					
1. Attributes of storage units					

I. Light inside storage unit (Overall Storage unit)					
(i) Natural light	0.033	0.130	-0.231*	-0.331**	0.014
(i) Artificial light	0.096	0.106	0.161	-0.268*	-0.002
(a) Natural light for specific storage unit					
(1) Free-standing storage unit	0.027	0.121	0.113	0.126	-0.490**
(2) Built-in (upto 6/7 feet) storage unit	-0.092	0.046	0.101	-0.069	-0.441**
(3) Built-in wall cabinet	0.137	-0.004	-0.012	-0.279**	-0.255*
(4) Wall mounted cabinet	-0.107	-0.073	0.166	-0.293**	-0.119
(5) Base cabinet	-0.022	-0.055	0.082	-0.489**	-0.488**
(6) Wall mounted rack	0.018	0.008	-0.221*	-0.19	-0.022
(7) Other rack	-0.258*	0.14	0.414**	-0.429**	0.122
(8) Loft	-0.165	-0.399**	-0.328**	0.007	-0.274*
(9) Open shelves	-0.009	0.072	-0.093	-0.467**	-0.495**
I (b) Artificial light for specific storage unit					
(1) Free-standing storage unit	0.042	0.163	0.125	0.117	-0.505**
(2) Built-in (upto 6/7 feet) storage unit	-0.093	0.031	0.129	-0.079	-0.444**
(3) Built-in wall cabinet	0.13	0.039	-0.011	-0.271*	-0.253*
(4) Wall mounted cabinet	-0.081	-0.083	0.142	-0.268*	-0.106
(5) Base cabinet	-0.025	-0.037	0.097	-0.498**	-0.511**
(6) Wall mounted rack	0.011	0.026	-0.368**	-0.309**	-0.105
(7) Other rack	-0.306**	0.2	-0.442**	-0.415**	0.199
(8) Loft	-0.137	-0.405**	-0.336**	0.016	-0.294**
(9) Open shelves	0.008	0.059	-0.113	-0.518**	-0.496**

*0.05 level of significance
**0.01 level of significance

To test the hypothesis Person's Product Moment of correlation coefficient was computed.

Natural and Artificial light inside storage units

- A negative relationship was found to be significant between problems related to inner features of the storage units and natural light found inside overall storage units. Whereas, negative significant relationship was found between problems related to outer features of the storage units and level of natural as well as artificial light inside overall storage units. (Table 111).
- On further analysis of data, the presence of level of natural and artificial light inside each storage units disclosed negative significant relationship between physiological problems and level of natural and artificial light inside other rack.
- Relationship was found negatively significant between space related problems of storage units and level of natural and artificial light inside loft.
- The relationship was found significant (negative) between problems related to outer features of the storage units and level of natural and artificial light inside built-in wall cabinet, wall mounted cabinet, base cabinet, other rack and built-in open shelves. As well as with the level of artificial light inside wall mounted rack.
- The results shows negative significant relationship between problems while using storage units and level of natural and artificial light inside free standing storage unit, built-in (up-to 6/7 feet storage unit, built-in wall cabinet, base cabinet, loft and built-in open shelves.

The negative correlation between variables discloses that problems increase as the level of light decreases.

Table 112: Coefficient of correlation showing relationship between extent of problems faced by the respondents with their existing storage units in kitchen and their selected situational variables: Attribute of storage unit (ii) Total dimensions

Variables	Problems				
	Physiological problems (r-value)	Problems regarding physical characteristics			Problems while using storage units (r-value)
		Space related problem (r-value)	Problem related to inner features (r-value)	Problem related outer features (r-value)	
Situational variables					
II. Total dimensions of the storage units					
(1) Free-standing storage unit					
a) Total height	0.055	0.183	0.095	0.064	0.504**
b) Total width	0.021	0.148	0.117	0.093	0.461**
c) Total depth	0.039	0.145	0.155	0.134	0.518**
(2) Built-in (upto 6/7 feet) storage unit					
a) Total height	-0.081	0.05	0.162	-0.093	0.466**
b) Total width	-0.076	0.063	0.174	-0.093	0.480**
c) Total depth	-0.067	0.061	0.194	-0.094	0.477**
(3) Built-in wall cabinet					
a) Total height	0.159	0.05	0.005	0.273*	0.260*
b) Total width	0.162	0.038	0.009	0.270*	0.291**
c) Total depth	0.177	0.024	0.001	0.285**	0.290**
(4) Wall mounted cabinet					
a) Total height	-0.072	-0.045	0.12	0.289**	-0.176
b) Total width	-0.02	0.014	0.146	0.292**	-0.123
c) Total depth	-0.073	-0.065	0.143	0.278*	-0.169
(5) Base cabinet					
a) Total height	0.039	-0.018	0.14	0.538**	-0.520**
b) Total width	0.046	-0.009	0.141	0.517**	-0.521**
c) Total depth	0.068	-0.033	0.138	0.552**	0.514**
(6) Wall mounted rack					
a) Total height	0.035	0.052	0.357**	0.293**	0.227*
b) Total width	-0.087	-0.059	0.366**	0.367**	0.229*
c) Total depth	-0.04	0.022	0.332**	0.336**	0.212*
(7) Other rack					
a) Total height	0.358**	0.232*	0.412**	0.396**	0.169*

b) Total width	0.306**	0.307**	0.483**	0.466**	0.234*
c) Total depth	0.281**	0.255*	0.466**	0.457**	0.220*
(8) Loft					
a) Total height	-0.123	0.398**	0.341**	0.006	0.293**
b) Total width	-0.101	0.374**	0.348**	0.012	0.280**
c) Total depth	-0.12	0.407**	0.338**	0.017	0.279**
(9) Built-in top open shelves	-0.03	0.069	0.564**	-0.099	0.488**
a) Total height	-0.037	0.08	0.526**	-0.076	0.504**
b) Total width	-0.053	0.044	0.575**	-0.096	0.477**
c) Total depth					
10) Built-in lower open shelves	0.084	0.073	0.511**	-0.08	-0.482**
a) Total height	-0.036	0.073	0.551**	-0.095	-0.492**
b) Total width	-0.062	0.048	0.570**	-0.088	0.471**
c) Total depth					

*0.05 level of significance
**0.01 level of significance

Total dimensions of storage units in kitchen

- The result shows significant relationship between physiological problems and total dimensions of other rack.
- The relationship was found to be significant between space related problems of storage units and total dimensions of other rack and loft. This reveals that space related problems increases with increase in total dimensions of these storage units.
- Further, the result reveals significant relationship between problems related to inner features of the storage units and total dimensions of wall mounted rack, other rack, loft and Built-in open shelves.
- Correlation was found significant between problems related to outer features of the storage units and total dimensions of built-in wall cabinet, wall mounted cabinet, base cabinet, wall mounted rack and other rack.
- The relationship was found significant between problems while using storage units and total dimensions of free standing, built-in (upto 6/7 feet)

storage unit, built-in wall cabinet, base cabinet, wall mounted rack, other rack, loft, built-in top and lower shelves.

The positive relationship between variables shows that problems increase with increase in total dimensions i.e height, width and depth of the storage units but negative relationship between problems while using storage unit and total dimensions of base cabinet and built-in lower open shelf shows that as the height and width of lower shelf of the unit increases the problem while using these storage units decreases.

Table 113: Coefficient of correlation showing relationship between extent of problems faced by the respondents with their existing storage units in kitchen and their selected situational variables: Extent of Using storage unit

Variables	Problems				
	Physiological problems	Problems regarding physical characteristics			Problems while using storage units
		Space related problem	Problem related to inner features	Problem related outer features	
	(r-value)	(r-value)	(r-value)	(r-value)	(r-value)
Situational variables					
2. Extent of Using storage units (Total)	0.094	-0.047	-0.055	-0.032	-0.064
2 (a) Extent of Using specific storage unit					
(1) Free-standing storage unit	0.084	0.119	0.129	0.126	0.476**
(2) Built-in (upto 6/7 feet) storage unit	-0.092	0.045	0.195	-0.095	0.466**
(3) Built-in wall cabinet	0.094	0.03	-0.023	0.252*	0.282**
(4) Wall mounted cabinet	-0.065	-0.074	0.088	0.232*	-0.192
(5) Base cabinet	-0.019	-0.064	0.067	0.463**	0.561**
(6) Wall mounted rack	-0.082	-0.027	0.410**	0.382**	0.300**
(7) Other rack	0.276*	0.239*	0.496**	0.404**	0.267*

(8) Loft	-0.045	0.378**	0.338**	-0.023	0.282*
(9) Open shelves	-0.042	0.051	-0.081	0.543**	0.454**

*0.05 level of significance
**0.01 level of significance

Extent of using storage units

- Significant relationship was found between physiological problems faced by the respondents and extent of using other rack.
- The result shows significant relationship between space related problems of storage units and extent of using other rack and loft.
- Relationship was found significant between problems related to inner features of the storage units and extent of using wall mounted rack, other rack and loft.
- Significant relationship was found between problems related to outer features of the storage units and extent of using built-in wall cabinet, other rack and built-in open shelves.
- Result shows significant relationship between problems while using storage units and extent of using free standing, built-in (upto 6/7 feet) storage unit, built-in wall cabinet, base cabinet, wall mounted rack, other rack, loft and open shelves.

A positive relationship between variables shows that problems increase with increase in use of specific storage units. This may be due to faulty design and wrong placement of storage units.

Hence, the hypothesis was partially rejected. It means that there was partial relationship between extent of problems faced by the respondents with existing storage units and selected situational variables.

Ho1.2 (b): There exists no relationship between the extent of problems faced by the respondents with existing storage units in bedroom and their selected situational variables.

The situational variables selected for the statistical analysis were (i) attributes of storage units (Natural and Artificial light inside storage unit and total dimensions of existing storage unit) and (ii) extent of using storage units.

Table 114: Coefficient of correlation showing relationship between extent of problems faced by the respondents with their existing storage units in bedroom and their selected situational variables: Attribute of storage units (i) Lighting inside storage unit

Variables	Problems				
	Physiological problems	Problems regarding physical characteristics			Problems while using storage units
		Space related problem	Problem related to inner features	Problem related outer features	
	(r-value)	(r-value)	(r-value)	(r-value)	(r-value)
Situational variables					
1. Attributes of storage units					
I. Light inside storage unit (Overall storage unit)					
(i) Natural light	-0.043	-0.517**	-0.370**	-0.368**	0.189
(i) Artificial light	0.010	-0.548**	-0.472**	-0.458**	0.134
I (a) Natural light for specific storage unit					
(1) Free-standing storage unit	0.036	-0.223*	-0.252*	-0.281**	0.209
(2) Built-in floor to ceiling storage unit	-0.08	-0.124	-0.249*	-0.242*	-0.188
(3) Built-in (upto 6/7 feet) storage unit	-0.097	0.057	0.033	0.069	0.174
(4) Chest of drawers	0.155	0.082	0.035	-0.062	0.121
(5) Wall storage unit	-0.058	0.054	0.069	0.213	-0.044
(6) Base storage unit	0.07	-0.358**	-0.330**	-0.468**	-0.306**
(7) Box bed	-0.133	-0.379**	-0.248*	0.044	-0.334**
I (b) Artificial light for specific storage unit					

(1) Free-standing storage unit	0.074	0.151	-0.234*	-0.245*	0.189
(2) Built-in floor to ceiling storage unit	-0.07	-0.163	-0.242*	-0.248*	-0.203
(3) Built-in (upto 6/7 feet) storage unit	-0.089	0.074	0.056	0.102	0.195
(4) Chest of drawers	0.128	0.044	0.028	-0.098	0.094
(5) Wall storage unit	-0.037	0.01	0.05	0.196	-0.068
(6) Base storage unit	0.097	-0.361**	-0.326**	-0.502**	-0.312**
(7) Box bed	-0.107	-0.391**	-0.287**	0.074	-0.391**

*0.05 level of significance
**0.01 level of significance

To test the hypothesis Pearson's Product Moment of correlation coefficient was computed.

Natural and Artificial light

- A negative relationship was found to be significant between space related problems, problems related to inner features and outer features of the storage units and level of artificial and natural light inside overall storage units.
- Further analysis of data showed significant negative relationship between space related problems, problems related to inner feature, outer features and problems while using storage units and natural and artificial light inside free standing storage unit, base storage unit and box bed as well as problem related to inner features and outer feature of storage units and level of natural light and artificial light inside built-in floor to ceiling storage unit.

  Negative relationship among variables shows that the various problems increase with decrease in level of natural and artificial light inside selected storage units.

Table 115: Coefficient of correlation showing relationship between extent of problems faced by the respondents with their existing storage units in bedroom and their selected situational variables: Attribute of storage unit (ii) Total dimensions

Situational Variables	Problems				
	Physiological problems (r-value)	Problems regarding physical characteristics			Problems while using storage units (r-value)
		Space related problem (r-value)	Problem related to inner features (r-value)	Problem related outer features (r-value)	
II. Total dimensions of the storage units					
(1) Free-standing storage unit					
a) Total height	0.134	0.165	0.255*	0.267*	0.234*
b) Total width	0.135	0.166	0.251*	0.264*	0.218*
c) Total depth	0.128	0.168	0.260*	0.268*	0.230*
(2) Built-in floor to ceiling storage unit					
a) Total height	-0.056	-0.183	0.245*	0.252*	0.231*
b) Total width	-0.028	-0.18	0.252*	0.244*	0.224*
c) Total depth	-0.038	-0.178	0.238*	0.249*	0.261*
(3) Built-in (upto 6/7 feet) storage unit					
a) Total height	-0.079	0.082	0.085	0.131	0.202
b) Total width	-0.078	0.085	0.08	0.12	0.192
c) Total depth	-0.08	0.069	0.067	0.101	0.177
(4) Chest of drawers					
a) Total height	0.065	-0.001	0.013	-0.12	0.058
b) Total width	0.1	0.057	-0.001	-0.096	0.043
c) Total depth	0.111	0.055	0.005	-0.095	0.075
(5) Wall storage unit					
a) Total height	-0.029	-0.033	0.033	0.175	-0.079
b) Total width	0.068	-0.055	0.045	0.128	-0.052
c) Total depth	-0.019	-0.027	0.041	0.179	-0.065
(6) Base storage unit					
a) Total height	0.148	0.324**	0.333**	0.474**	0.289*
b) Total width	0.058	0.259*	0.224*	0.382**	0.214*
c) Total depth	0.056	0.357**	0.377**	0.498**	0.303*
(7) Box bed					
a) Total length	-0.086	0.390**	0.354**	0.09	0.427**
b) Total width	-0.089	0.385**	0.352**	0.088	0.424**
c) Total depth	-0.078	0.354**	0.331**	0.082	0.402**

*0.05 level of significance

**0.01 level of significance

Total dimensions of the storage units

- Significant relationship was found between problems related to inner features, outer features and problems while using storage units and total dimensions of free standing storage unit and built-in floor to ceiling.
- Relationship was found significant between problems related to space, inner features and outer features and problems while using storage units and total dimensions of base storage unit and box bed.

The positive correlation between variables showed that problems increased with increase in total dimensions of storage units.

Table 116: Coefficient of Correlation showing relationship between extent of problems faced by the respondents with their existing storage units in bedroom and their selected situational variables: Extent of using storage unit

Variables	Problems				
	Physiological problems	Problems regarding physical characteristics			Problems while using storage units
		Space related problem	Problem related to inner features	Problem related outer features	
	(r-value)	(r-value)	(r-value)	(r-value)	(r-value)
Situational variables					
2. Extent of Using storage units (Total)	0.286**	0.437**	0.390**	0.552**	-0.041
2 (a) Extent of Using specific storage unit					
(1) Free-standing storage unit	0.18	0.206	0.228*	0.270*	0.207
(2) Built-in floor to ceiling storage unit	-0.086	-0.193	0.227*	0.246*	0.235*
(3) Built-in (upto 6/7 feet) storage unit	-0.077	0.016	0.014	0.066	0.108
(4) Chest of drawers	0.17	0.009	-0.038	-0.112	0.009
(5) Wall storage unit	-0.04	-0.038	0.043	0.181	-0.093
(6) Base storage unit	0.187	0.342**	0.300**	0.471**	0.241*

*0.05 level of significance
**0.01 level of significance

Extent of using storage units

- Coefficient of Correlation was found positively significant between extent of using storage units and physiological problems, problems related to space, inner features and outer features of the storage units. This reflected that as extent of use increased, the problems also increased.
- Extent of using specific storage units' coefficient of correlation was found significant between problems related to space and extent of using base storage units.
- Relationship was found significant between problems related to inner feature and outer features of storage unit and extent of using free-standing, built-in floor to ceiling and base storage unit.
- Significant relationship was also found between problems while using storage units and extent of using built-in floor to ceiling and base storage unit.

Hence, the hypothesis was partially rejected for level of natural and artificial light inside free-standing storage unit, built-in floor to ceiling, base storage unit and box bed, total dimensions of free standing, built-in floor to ceiling, base storage unit and box bed, extent of using free standing, built-in floor to ceiling and base storage unit. However, the null hypothesis was partially accepted for remaining situational variables.

Ho1.3 (a): There is no variation in the extent of problems faced by the respondents with existing storage units in kitchen due to personal and family variable.

Education of respondents and family income were respectively the personal and family variables included for statistical analysis. The One way Analysis of Variance was calculated to test this hypothesis.

Table 117: One Way ANOVA test showing variation in problems with storage unit in kitchen due to personal and family variables

Variables		Sum of Squares	df	Mean Square	F	Sig.
A) Education						
Physiological Problems	**Between Groups**	1704.315	5	3408.863	1.674	.151
	Within Groups	160852.462	79	203.6.107		
	Total	177896.776	84			
Space related problem	**Between Groups**	78.976	5	15.795	1.766	0.130
	Within Groups	706.624	79	8.945		
	Total	785.600	84			
Problems related to inner features	**Between Groups**	633.915	5	126.783	2.524	0.036
	Within Groups	3968.862	79	50.239		
	Total	4602.776	84			
Problems related to outer features	**Between Groups**	1335.836	5	267.167	2.074	0.077
	Within Groups	10174.869	79	128.796		
	Total	11510.706	84			
Problems while using storage units	**Between Groups**	1119.665	5	223.933	2.008	0.086
	Within Groups	8807.935	79	111.493		
	Total	9927.600	84			
B) Family Income						
Physiological Problems	**Between Groups**	2889.027	4	722.257	0.330	0.857
	Within Groups	175007.749	80	2187.597		
	Total	177896.776	84			
Space related problem	**Between Groups**	23.791	4	5.948	0.625	0.646
	Within Groups	761.809	80	9.523		
	Total	785.600	84			

Problems related to inner features	**Between Groups**	68.422	4	17.105	0.302	0.876
	Within Groups	4534.355	80	56.679		
	Total	4602.776	84			
Problems related to outer features	**Between Groups**	146.009	4	36.502	0.257	0.905
	Within Groups	11364.697	80	142.059		
	Total	11510.706	84			
Problems while using storage units	**Between Groups**	369.797	4	92.449	0.774	0.545
	Within Groups	9557.803	80	119.473		
	Total	9927.600	84			

*0.05 level of significance
**0.01 level of significance

F-ratio was found to be smaller than the table value for each of the variables. Hence, the null hypothesis was accepted. It could be concluded that there was no significant variation in the extent of problems faced by the respondents with existing storage units in kitchen with the selected personal and family variables (Table117).

Ho1.3 (b): There is no variation in the extent of problems faced by the respondents with existing storage units in bedroom due to personal and family variable.

Education of the respondents and family income were personal and family variables respectively included for statistical analysis.

Table 118: One Way ANOVA test showing variation in problems with storage unit in bedroom due to personal and family variables

Variables		Sum of Squares	df	Mean Square	F	Sig.
A) Education						
Physiological Problems	**Between Groups**	3909.181	5	781.836	0.983	0.433
	Within Groups	62819.219	79	795.180		
	Total	66728.400	84			
Space related problem	**Between Groups**	29.291	5	5.858	0.815	0.542
	Within Groups	567.721	79	7.186		
	Total	597.012	84			
Problems related to inner features	**Between Groups**	102.869	5	20.574	0.549	0.738
	Within Groups	2959.178	79	37.458		
	Total	3062.047	84			
Problems related to outer features	**Between Groups**	214.514	5	42.903	0.857	0.514
	Within Groups	3956.733	79	50.085		
	Total	4171.247	84			
Problems while using storage units	**Between Groups**	341.718	5	68.344	1.494	0.201
	Within Groups	3613.459	79	45.740		
	Total	3955.176	84			
B) Family Income						
Physiological Problems	**Between Groups**	818.001	4	204.500	0.248	0.910
	Within Groups	65910.399	80	823.880		
	Total	66728.400	84			
Space related problem	**Between Groups**	14.514	4	3.629	0.498	0.737
	Within Groups	582.497	80	7.281		
	Total	597.012	84			

Problems related to inner features	**Between Groups**	33.611	4	8.403	0.222	0.925
	Within Groups	3028.436	80	37.855		
	Total	3062.047	84			
Problems related to outer features	**Between Groups**	174.491	4	43.623	0.873	0.484
	Within Groups	3996.756	80	49.959		
	Total	4171.247	84			
Problems while using storage units	**Between Groups**	123.452	4	30.863	0.644	0.632
	Within Groups	3831.725	80	47.897		
	Total	3955.176	84			

*0.05 level of significance
**0.01 level of significance

The one way analysis of variance was computed to test this hypothesis. F-ratio was found to be smaller than the table value. Hence, the null hypothesis was accepted for each of the variable. It could be concluded that there was no variation in the extent of problems faced by the respondents with existing storage units in bedroom with selected personal and family variables (Table 118). Therefore, the null hypothesis was accepted.

Ho2: There exists no relationship between the level of satisfaction of the respondents with their existing storage units and their personal, family and situational variables.

Number of specific hypothesis were framed for carrying out the statistical analysis for selected areas of the residents i.e. kitchen and bedroom and personal, family and situational variables.

Ho2.1(a):There exists no relationship between the level of satisfaction of the respondents with their existing storage units in kitchen and their selected personal variables.

The personal variables considered for statistical analysis were age, health status and anthropometric measurements

Table 119: Coefficient of correlation showing relationship between level of satisfaction of the respondents with existing storage units in kitchen and personal variables.

Variables	r-value	Degree of freedom	Significance level
Personal variables			
1. Age	-0.098	84	N.S
2.Health status			
a) Functional capacity	-0.088	84	N.S
b) Problems in movement of body parts	-0.201	84	N.S
3.Anthropometric measurements			
a) Normal standing height	0.068	84	N.S
b) Vertical upward arm reach	0.045	84	N.S
c) Total arm length	-0.04	84	N.S

*0.05 level of significance
**0.01 level of significance

To test the hypothesis Person's Product Moment of correlation coefficient was computed.

The result of the study showed that there was no significant relationship between the level of satisfaction of the respondents with existing storage units in kitchen and the selected personal variables.

Therefore, the null hypothesis was accepted.

Ho2.1(b): There exists no relationship between the level of satisfaction of the respondents with their existing storage units in bedroom and their selected personal variables.

The personal variables considered for statistical analysis were age, health status and anthropometric measurements.

Table 120: Coefficient of correlation showing relationship between level of satisfaction of the respondents with existing storage units in bedroom and personal variables.

Variables	r-value	Degree of freedom	Significance level
Personal variables			
1. Age	0.055	84	N.S
2.Health status			
a) Functional capacity	0.019	84	N.S
b) Problems in movement of body parts	-0.204	84	N.S
3.Anthropometric measurements			
a) Normal standing height	0.06	84	N.S
b) Vertical upward arm reach	0.061	84	N.S
c) Total arm length	-0.082	84	N.S

*0.05 level of significance
**0.01 level of significance

Pearson's Product Moment of correlation coefficient was used to test the hypothesis.

The result of the study showed that there was no significant relationship between the level of satisfaction of the respondents with existing storage units and the selected personal variables.

Therefore, the null hypothesis was accepted.

Ho2.2 (a): There exists no relationship between the level of satisfaction of the respondents with their existing storage units in kitchen and their selected situational variables viz. attributes of existing storage units and extent of using storage units.

The two aspects of attributes of storage units viz. (i) Natural and artificial light inside storage units, (ii) Total dimensions of storage units were considered for statistical analysis. The other situational variable- Extent of using storage units was also included for statistical analysis.

Table 121: Coefficient of correlation showing relationship between level of satisfaction of the respondents with their existing storage units in

kitchen and their selected situational variables: Attributes of existing storage units (i) Light inside storage unit

Variables	r-value	Degree of freedom	Level of significance
Situational variables			
1. Attributes of storage units			
I. Light inside storage unit			
(i) Natural light	0.116	84	N.S
(i) Artificial light	0.046	84	N.S
I (a) Natural light for specific storage unit			
(1) Free-standing storage unit	0.115	84	N.S
(2) Built-in (upto 6/7 feet) storage unit	-0.088	84	N.S
(3) Built-in wall cabinet	0.286*	84	0.05
(4) Wall mounted cabinet	0.011	84	N.S
(5) Base cabinet	0.111	84	N.S
(6) Wall mounted rack	-0.011	84	N.S
(7) Other rack	0.03	84	N.S
(8) Loft	0.032	84	N.S
(9) Built-in open shelves	-0.126	84	N.S
I (b) Artificial light for specific storage unit			
(1) Free-standing storage unit	0.07	84	N.S
(2) Built-in (upto 6/7 feet) storage unit	-0.108	84	N.S
(3) Built-in wall cabinet	0.269*	84	0.05
(4) Wall mounted cabinet	0.002	84	N.S
(5) Base cabinet	0.118	84	N.S
(6) Wall mounted rack	-0.007	84	N.S
(7) Other rack	0.002	84	N.S
(8) Loft	0.026	84	N.S
(9) Open shelves	-0.163	84	N.S

*0.05 level of significance
**0.01 level of significance

To test the hypothesis Pearson's Product Moment of correlation coefficient was computed.

Natural and Artificial light inside storage units

The result showed positive significant relationship between level of satisfaction and level of natural and artificial light inside built in wall cabinet. This indicated that as the level of light increased the satisfaction also increased.

Table 122: Coefficient of correlation showing relationship between level of satisfaction of the respondents with their existing storage units in kitchen and their selected situational variables: Attributes of existing storage units (ii) Total dimensions

Variables	r-value	Degree of freedom	Level of significance
Situational variables			
II. Total dimensions of the storage units			
(1) Free-standing storage unit			
a) Total height	0.044	84	N.S
b) Total width	0.018	84	N.S
c) Total depth	0.026	84	N.S
(2) Built-in (upto 6/7 feet) storage unit			
a) Total height	-0.174	84	N.S
b) Total width	-0.188	84	N.S
c) Total depth	-0.177	84	N.S
(3) Built-in wall cabinet			
a) Total height	-0.293**	84	0.01
b) Total width	0.256*	84	0.05
c) Total depth	-0.262*	84	0.05
(4) Wall mounted cabinet			
a) Total height	0.074	84	N.S
b) Total width	0.051	84	N.S
c) Total depth	0.03	84	N.S
(5) Base cabinet			
a) Total height	0.161	84	N.S
b) Total width	0.188	84	N.S
c) Total depth	0.141	84	N.S
(6) Wall mounted rack			
a) Total height	0.019	84	N.S
b) Total width	-0.175	84	N.S
c) Total depth	-0.089	84	N.S

(7) Other rack			
a) Total height	0.04	84	N.S
b) Total width	-0.041	84	N.S
c) Total depth	-0.009	84	N.S
(8) Loft			
a) Total height	0.011	84	N.S
b) Total width	0.016	84	N.S
c) Total depth	0.008	84	N.S
(9) Built-in top open shelves			
a) Total height	-0.255*	84	0.05
b) Total width	0.258*	84	0.05
c) Total depth	-0.250*	84	0.05
10) Built-in lower open shelves			
a) Total height	0.231*	84	0.05
b) Total width	0.223*	84	0.05
c) Total depth	-0.261*	84	0.05

*0.05 level of significance
**0.01 level of significance

Total dimensions of storage units

There was a significant relationship found between level of satisfaction of the respondents and total dimensions of built-in wall cabinet and built-in top and lower shelves. The positive relationship between the variables reveals that level of satisfaction raises with increase in total width of built- in wall cabinet and built-in top and lower shelf and also satisfaction increases with increase in height of built-in lower open shelf. The negative relationship was found significant for total height and depth of built-in wall cabinet and built-in top shelves and also with total depth of built-in open lower shelves. But the negative correlation defines that level of satisfaction decreases with increase in total dimensions. This may be because of odd dimensions of the shelves, due to which respondents had to raise on their toes or had to stretch their arms above shoulder level and squat/ kneel to reach the articles stored on the shelves, hence creating problem for them.

Table 123: Coefficient of correlation showing relationship between level of satisfaction of the respondents with their existing storage units in

kitchen and their selected situational variables: Extent of using storage units

Variables	r-value	Degree of freedom	Level of significance
Situational variables			
2. Extent of Using storage units	0.069	84	N.S
2 (a) Extent of Using specific storage unit			
(1) Free-standing storage unit	0.019	84	N.S
(2) Built-in (upto 6/7 feet) storage unit	-0.181	84	N.S
(3) Built-in wall cabinet	0.283**	84	0.01
(4) Wall mounted cabinet	0.067	84	N.S
(5) Base cabinet	0.19	84	N.S
(6) Wall mounted rack	-0.039	84	N.S
(7) Other rack	-0.018	84	N.S
(8) Open shelves	-0.251*	84	0.05

*0.05 level of significance
**0.01 level of significance

Extent of using storage units

There was significant relationship found between the level of satisfaction of the respondents and extent of using built-in wall cabinet and built-in open shelves. The negative correlation between the variables of reveals that level of satisfaction decrease with more use of built-in open shelves, this may be due to poor design and odd dimensions of open shelves.

Hence, the hypothesis was partially rejected for level of natural and artificial light inside built-in wall cabinet, total dimensions of built-in wall cabinet, built-in open shelves and extent of using built-in wall cabinet and built-in open shelves. However, the null hypothesis was partially accepted for remaining situational variables.

Ho2.2 (b): There exists no relationship between the level of satisfaction of the respondents with their existing storage units in bedroom and their selected situational variables.

The situational variables selected for the statistical analysis were (i) attributes of storage units (Natural and Artificial light inside storage unit and total dimensions of existing storage unit) and (ii) extent of using storage units.

Table 124: Coefficient of correlation showing relationship between level of satisfaction of the respondents with their existing storage units in bedroom and their selected situational variables: Attributes of existing storage units (i) Light inside storage units

Variables	r-value	Degree of freedom	Level of significance
Situational variables			
1. Attributes of storage units			
I. Light inside storage unit			
(i) Natural light	-0.100	84	N.S
(i) Artificial light	-0.170	84	N.S
I (a) Natural light for specific storage unit			
(1) Free-standing storage unit	-0.21	84	N.S
(2) Built-in floor to ceiling storage unit	-0.004	84	N.S
(3) Built-in (upto 6/7 feet) storage unit	-0.116	84	N.S
(4) Chest of drawers	0.143	84	N.S
(5) Wall storage unit	0.005	84	N.S
(6) Base storage unit	0.028	84	N.S
(7) Box bed	-0.208	84	N.S
I (b) Artificial light for specific storage unit			
(1) Free-standing storage unit	-0.01	84	N.S
(2) Built-in floor to ceiling storage unit	-0.029	84	N.S
(3) Built-in (upto 6/7 feet) storage unit	-0.126	84	N.S
(4) Chest of drawers	0.171	84	N.S

(5) Wall storage unit	0.002	84	N.S
(6) Base storage unit	-0.004	84	N.S
(7) Box bed	0.268*	84	0.05

*0.05 level of significance
**0.01 level of significance

To test the hypothesis Pearson's Product Moment of correlation coefficient was computed.

- The result showed significant relationship between the level of satisfaction of the respondents and level of artificial light inside bed box. The positive correlation shows that level of satisfaction increased with increase in light.

Table 125: Coefficient of correlation showing relationship between level of satisfaction of the respondents with their existing storage units in bedroom and their selected situational variables: Attributes of existing storage units (ii) Total dimensions

Variables	r-value	Degree of freedom	Level of significance
Situational variables			
II. Total dimensions of the storage units			
(1) Free-standing storage unit			
a) Total height	-0.008	84	N.S
b) Total width	0.005	84	N.S
c) Total depth	0.017	84	N.S
(2) Built-in floor to ceiling storage unit			
a) Total height	-0.024	84	N.S
b) Total width	-0.036	84	N.S
c) Total depth	-0.02	84	N.S
(3) Built-in (upto 6/7 feet) storage unit			
a) Total height	-0.118	84	N.S
b) Total width	-0.121	84	N.S
c) Total depth	-0.122	84	N.S
(4) Chest of drawers			
a) Total height	0.228*	84	0.05

b) Total width	0.287**	84	0.01
c) Total depth	0.241*	84	0.05
(5) Wall storage unit			
a) Total height	-0.046	84	N.S
b) Total width	-0.001	84	N.S
c) Total depth	-0.001	84	N.S
(6) Base storage unit			
a) Total height	0.088	84	N.S
b) Total width	0.036	84	N.S
c) Total depth	0.027	84	N.S
(7) Box bed			
a) Total length	-0.290**	84	0.01
b) Total width	-0.294**	84	0.01
c) Total depth	-0.316**	84	0.01

*0.05 level of significance
**0.01 level of significance

- There was a significant relationship between the level of satisfaction of the respondents and total dimension of chest of drawers and bed box. The positive relationship showed that level of satisfaction increased with increase in total dimension of the chest of drawers. Whereas, the negative correlation reveals that level of satisfaction decreases with increase in total dimensions of box bed.

Table 126: Coefficient of correlation showing relationship between level of satisfaction of the respondents with their existing storage units in bedroom and their selected situational variables: Extent of using storage unit

Situational Variables	r-value	Degree of freedom	Level of significance
2. Extent of Using storage units	0.103	84	N.S
2 (a) Extent of Using specific storage unit			
(1) Free-standing storage unit	0.015	84	N.S
(2) Built-in floor to ceiling storage unit	0.031	84	N.S
(3) Built-in (upto 6/7 feet) storage	-0.089	84	N.S

unit			
(4) Chest of drawers	0.231*	84	0.05
(5) Wall storage unit	-0.049	84	N.S
(6) Base storage unit	0.06	84	N.S

*0.05 level of significance
**0.01 level of significance

- The relationship was also found significant between level of satisfaction of the respondents and extent of using chest of drawers.

Hence, the hypothesis was partially rejected for level of artificial light inside bed box, total dimensions of chest of drawers and bed box and extent of using chest of drawers. However, the null hypothesis was partially accepted for remaining situational variable in bedroom.

Ho2.3 (a): There exists no variation in the level of satisfaction of the respondents with their existing storage units in kitchen due to personal and family variable.

Education of respondents and family income were personal and family variables considered for statistical analysis.

Table 127: One Way ANOVA test showing variation in satisfaction with storage unit in kitchen due to personal and family variables in kitchen

Variables		Sum of Squares	df	Mean Square	F	Sig.
Education	**Between Groups**	288.548	5	57.710	1.687	0.147
	Within Groups	2702.463	79	34.208		
	Total	2991.012	84			
Family income	**Between Groups**	167.115	4	41.779	1.184	0.324
	Within Groups	2823.897	80	35.299		
	Total	2991.012	84			

The One Way Analysis of Variance was computed to test this hypothesis. F-ratio was found to be smaller than the table value for each of the variable.

Hence, the null hypothesis was accepted. It could be concluded that there was no significant variation in the level of satisfaction of the respondents with their existing storage units in the kitchen due to their education and family income.

Ho2.3 (b): There exists no variation in the level of satisfaction of the respondents with their existing storage units in bedroom due to personal and family variable.

Education of respondents and family income were personal and family variables considered for statistical analysis.

Table 128: One Way ANOVA test showing variation in satisfaction with storage unit in kitchen due to personal and family variables in bedroom

Variables		Sum of Squares	df	Mean Square	F	Sig.
Education	**Between Groups**	155.267	5	31.053	0.907	0.481
	Within Groups	2705.745	79	34.250		
	Total	2861.012	84			
Family income	**Between Groups**	106.566	4	26.642	0.774	0.545
	Within Groups	2754.446	80	34.431		
	Total	2861.012	84			

The One Way Analysis of Variance was computed to test this hypothesis. F-ratio was found to be smaller than the tabulated value for each of the selected variable. Hence, the null hypothesis was accepted. It could be concluded that there was no significant variation in the level of satisfaction of the respondents with their existing storage units in the bedroom due to their education and family income.

Ho3: There is no relationship between the extent of problems of the respondents with existing storage units and their level of satisfaction with existing storage units

Number of specific hypothesis were framed for carrying out the statistical analysis for selected areas of the residents i.e. kitchen and bedroom

Ho3. (a): There exists no relationship between the extent of problems of the respondents with existing storage units in kitchen and their level of satisfaction with existing storage units in kitchen.

The various problems viz. physiological problems, problems with physical characteristics of the storage units and problems while using storage units were included for statistical analysis.

Table 129: Coefficient of correlation showing relationship between extent of problems and level of satisfaction in kitchen

Variables	r-value	Degree of freedom	Significance level
1. Physiological problems	-0.006	84	N.S
2. Space related problems	-0.082	84	N.S
3. Problems related to inner features	-0.123	84	N.S
4. Problems related to outer features	0.088	84	N.S
5. Problems while using storage units	-0.131	84	N.S

*0.05 level of significance
**0.01 level of significance

To test the hypothesis Pearson's Product Moment of correlation coefficient was computed. The calculated r-value was found to be smaller than the table value for each of the selected variable. Hence the null hypothesis was accepted. It could be concluded that there was no significant relationship between the level of satisfaction of the respondents with existing storage units and extent of problems faced by the respondents with existing storage units in kitchen (Table 129).

Ho3. (b): There exists no relationship between the extent of problems of the respondents with existing storage units in bedroom and their level of satisfaction with existing storage units in bedroom.

Various problems viz. physiological problems, problems with physical characteristics of the storage units and problems while using storage units were included for statistical analysis.

Table 130: Coefficient of correlation showing relationship between extent of problems and level of satisfaction with existing storage units in bedroom.

Variables	r-value	Degree of freedom	Significance level
1. Physiological problems	0.042	84	N.S
2. Space related problems	-0.230*	84	0.05
3. Problems related to inner features	-0.220*	84	0.05
4. Problems related to outer features	-0.255*	84	0.05
5. Problems while using storage units	-0.185	84	N.S

*0.05 level of significance
**0.01 level of significance

To test the hypothesis, Pearson's Product Moment of Correlation Coefficient was computed. The result of the study showed that there was a significant negative relationship between the level of satisfaction of the respondents with their existing storage units and problems regarding space available, inner features and outer features of the storage units. The negative relationship between the variables disclosed that as the problems increased the level of satisfaction with storage units decreased.

Hence, the hypothesis was partially rejected for space related problems, problems related to inner and outer features of the storage units in bedroom. However, the null hypothesis was partially accepted for other problems.

Section: 8

Suggested Ergonomically Appropriate Guidelines for Storage Design

Storage is the most important factor, in the creation of an orderly and creative home. It is also the most difficult of all house keeping problems. Even new and modern houses are not built to provide adequate storage space. "A motto for good storage has been defined by Devdas (1959) as: "A place for everything and everything in its place. Good storage is one which contributes to well order living, increases efficiency, conserves family resources and contributes to health and safety." Storage systems are great triumphs of synergetic efficiency. Storage system should be both flexible and versatile. A house must have adequate provision to store various tools, equipment, food supplies and other essential amenities to lighten homemakers' workload. Proper organization of storage units can hasten up work. Time and energy can be conserved for other fruitful activities. Good storage facilities in the kitchen add to the efficiency of work and give maximum comfort to the worker. Following are some guidelines for efficient (functional) storage facilities.

Storage arrangements

To save steps and motions following should be done:

1. All equipment and supplies should be conveniently stored at the work centers where they are first used. Store frequently used items at the place of first use.
2. The utensils and supplies used first with water be stored at the sink center.
3. Those utensils that are used first with heat be kept at the range,
4. All other utensils should be stored at the mixing center,
5. Space can be conserved and walking reduced by combining mixing center supplies and utensils with those used first at the sink and serving supplies and utensils with those used first at the range.

6. Place items so they are easy to see, reach, grasp and replace.
7. Sort items to be stored according to the function of the center.
8. Store unlike items one row deep and one layer deep.
9. Stack only those items having the same dimensions.
10. Provide sufficient clearance for grasping and replacing items.
11. Place frequently used, heavy items within normal reach.
12. Organize items within the storage space to reduce the search and facilitate the flow of motions.
13. The storage shelves near to the work are reduce unnecessary walking and stooping and may reduce unwanted fatigue during work.
14. Have multiple of one item if they are to be used are several centers (Only if it is not very costly).

Comfortable Storage Heights

1. Arranging supplies and equipment within easy reach saves needless walking, reaching and stretching.
2. The normal and easy working area of a person helps determine the maximum heights and depths of storage shelves.
3. Adequate number of shelves and storage arrangements should be provided within maximum comfortable reach of the worker.
4. Lower storage shelves should be within comfortable reach of the worker to avoid excess bending or squatting posture.
5. Depth of the upper shelves should be within eye level so that worker can see and grasp item stored in single/double row.

Storage Space

1. Determine two sets of space standard:

a) Ample in which supplies can be stored without crowding and with little stacking of unlike items; and

b) Minimum can be planned for situations where economy would be necessary and where space would be limited.

Space Allowance for Working

1. Cramped positions contribute to dissatisfaction with the working situations, dislike of the activity, and less effective performance of the task.
2. For adequate space allowance for working, must consider

a) The basic Position: The worker's basic position may be to stand, sit, walk, bend, squat or kneel. Space for the basic position can be determined from measurements of the individual. Various body measurements are essential in designing places for work and non work activities; by taking into account the space requirements for the average person, sufficient horizontal space can be provided for the legs when the individual is seated, enough distance between seat and elbow, and so on.

b) Basic movement or elementary activity: The elementary activity may be to reach, carry, and push: open doors, drawers; operate appliance; manipulate equipment, tools; arrange various items such as sheets, towels, supplies. Space allowances for basic movements are also related to personal preferences and work habits as well as to body size. In fact, body use may be more important than body size in determining space needs.

c) Additional space needed for part of an appliance or storage facility: A part of an appliance, storage facility, or furniture, such as a door or drawer, requires a certain amount of space when opened; space for this structural facility must be provided in addition to space for the person's basic position and activity. Actions within a task vary in account of space needed; the most space consuming activity is logically used to determine critical space measurements.

Proposed Design for Storage Unit

Free-Standing Storage Unit for Bedroom

The number of elderly people is markedly increasing in all the developed counties. Unfortunately, the ageing population will have to cope with the associated progressive loss of physiological capabilities which may dramatically

reduce the individual's ability to participate in everyday life. The decrease in capabilities and mobility tends to confine the elderly and most of their activities to their homes.

With the changed capacity, reduced ability and increased needs people in third age require the same accommodations and compensations in late life that they found in earlier years. The home should be fitted to the physical and psychological characteristics of the elderly people and it should be designed to promote familiarity and orientation with the environment. While performing daily living activities elderly people deal with storage units frequently in the different areas of home. Sometimes storages lack functionality as well as fabrication and are not up to the needs and requirements of the elderly due to which they face problems. The faulty designs of storage units leads to adoption of poor and awkward postures in order to perform tasks which could leads to postural stress, fatigue and pain, which may in turn force the user to stop work until the muscles recover.

The manufacturers are least interested in designing and producing commodities especially designed for elder people. This may be due to low demand of such products in Indian market and as well as not gaining profit from such products. Therefore, need was felt to design storage unit for people in third age which well help them to be a viable and productive member of the house. Thus keeping in mind the physiological problems, needs and requirements of elder people, their body dimensions and on the basis of guidelines suggested earlier some designs are proposed. However, need based modifications can be made by the users as per one's convenience. The description of the recommended storage unit is given ahead:

Fig. 62: Suggested Design of Free- standing Storage units in bedroom. Design 1 and 2: Front view

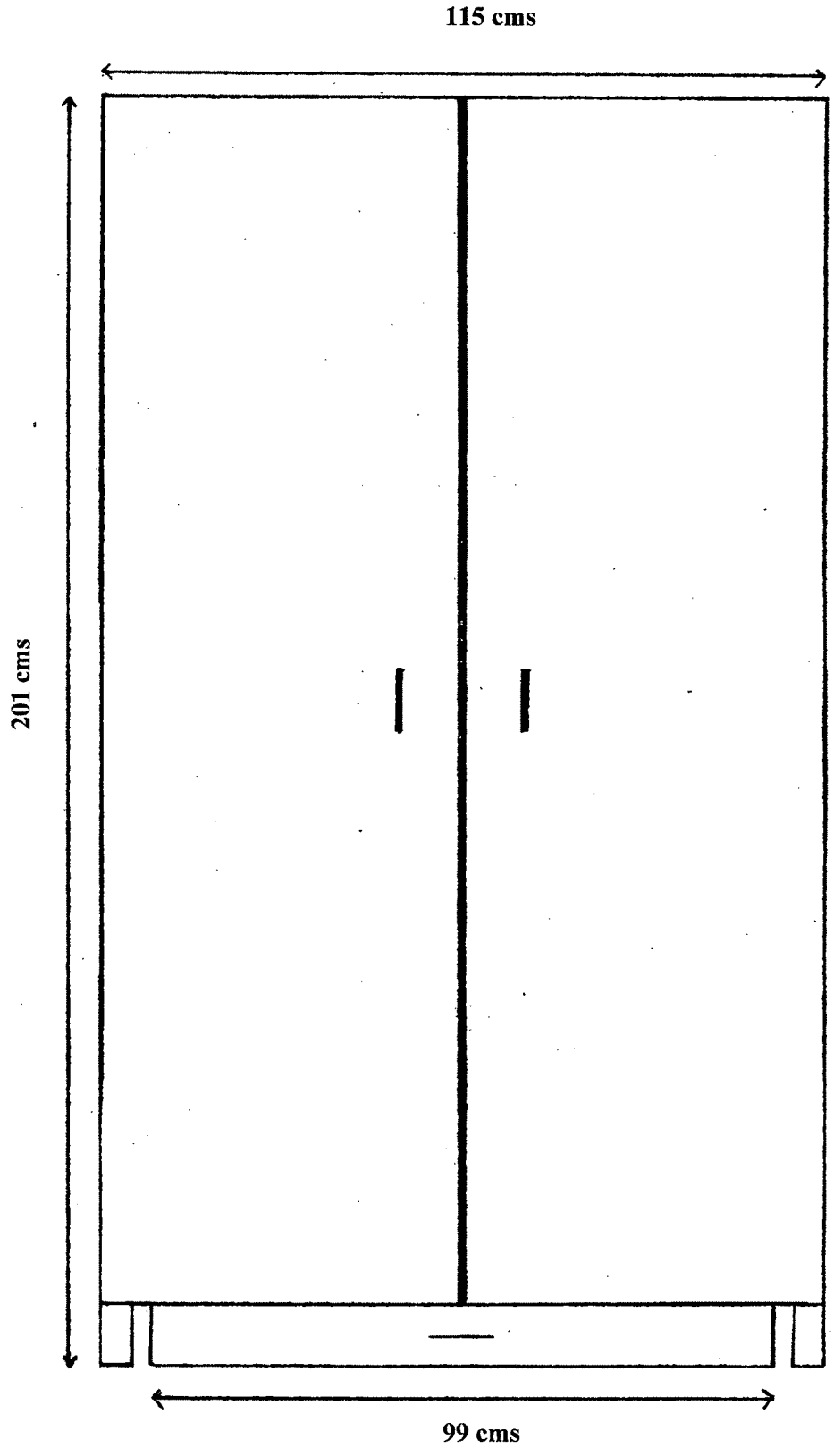


Fig 63: Design1 and 2: Total Dimensions

Free-standing storage unit in bedroom

Proposed Design 1

Material: The storage unit is made of wood. The "Saag" wood is used for framing and block board of 19 cms thickness for making shelves and partitions.

Finish: Storage unit has matted finish to avoid shine and glare so that it is easy to see because the elder people have low visibility power. Shine and glare makes them more uncomfortable.

Inside colour: The inside colour of the storage unit is white to make the things easily visible for elder people. Generally people use wood coloured paint or varnish. But by applying white or light coloured paint the visibility can be facilitated. The painted wood has matt finish to avoid glare.

Total dimension of storage unit

Height: 201 cms (from floor)

Width: 115 cms

Depth: 56 cms

The total height and total depth of the storage unit was recommended mainly on the basis of average maximum vertical arm reach, body raised on toes of the respondents and maximum horizontal reach (5^{th} percentile) of the respondents.(Fig 63)

1) Top shelf (A):

Height: 170 cms (from floor)

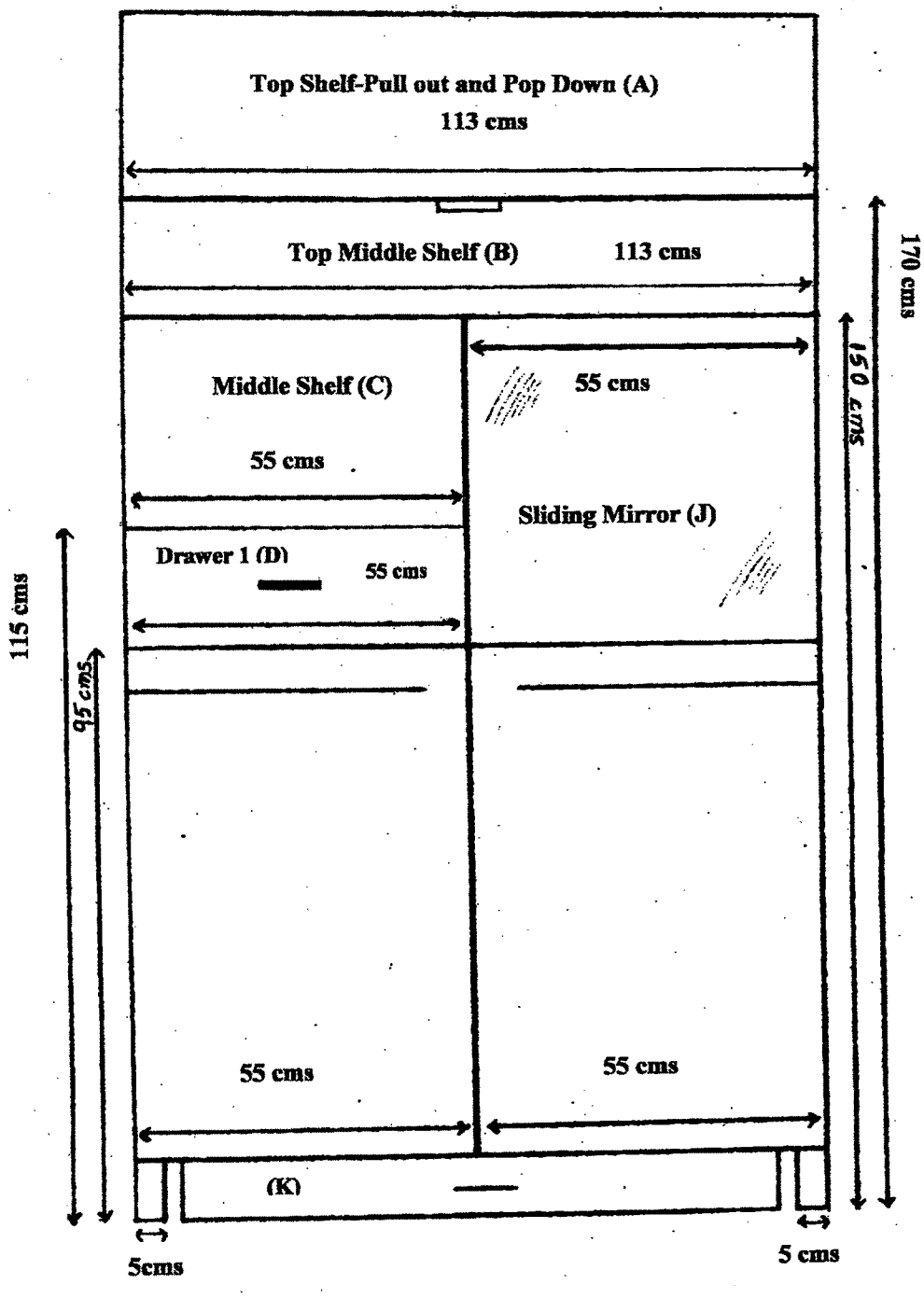
Width: 113 cms

Depth: 48 cms

Inner height of the section: 30 cms

Fig 64: Open view Mirror on Left side

Fig 65: Open view Mirror on Right side



Design 1: Open View

Fig 66: Design 1- Open View with Shelf's Dimensions (A)

The result of the present study revealed that the elder women face problem while using top most shelf of the storage unit as they have to support themselves with hand or to surroundings or have to rise on their toes to lift things from the top shelf. So keeping in mind such problems of elderly, the top shelf in the present design is made to pull out and pop down upto 5 inches so that the elderly can easily see and reach the stored things. The height of the shelf was recommended on the basis of comfortable vertical upward grasp reach (5^{th} percentile) of the respondents.

The shelf is of one inch in thickness; it can be easily pulled out and can be pop down to 5 inches. Pulleys are used for pulling out the shelf. The pulleys are similar to that used in easy pull out drawers. The pulling system is made of stainless steel. The pop-down system is attached between pulleys and the lower part of the shelf at both ends of the shelf. When the shelf is dragged out and pulled down the pop down system flexed open to give support to the shelf and give steady support to the shelf to remain in position. The system gets folded when shelf is pushed up and slided back to the position. The shelf has one handle fixed at the edge of the shelf horizontally for dragging the shelf out and pulling down the shelf. The pop down system is made of stainless steel and can bear weight up to 7 kgs (Fig 66, 67)

2)Top middle shelf (B):

Height: 150 cms (from floor)

Width: 113 cms

Depth: 48 cms

Inner height of the section: 19 cms

This shelf is simple and fixed in the storage unit. The height of the shelf is recommended on the basis of comfortable upper position height of the respondents (Fig 66, 68).

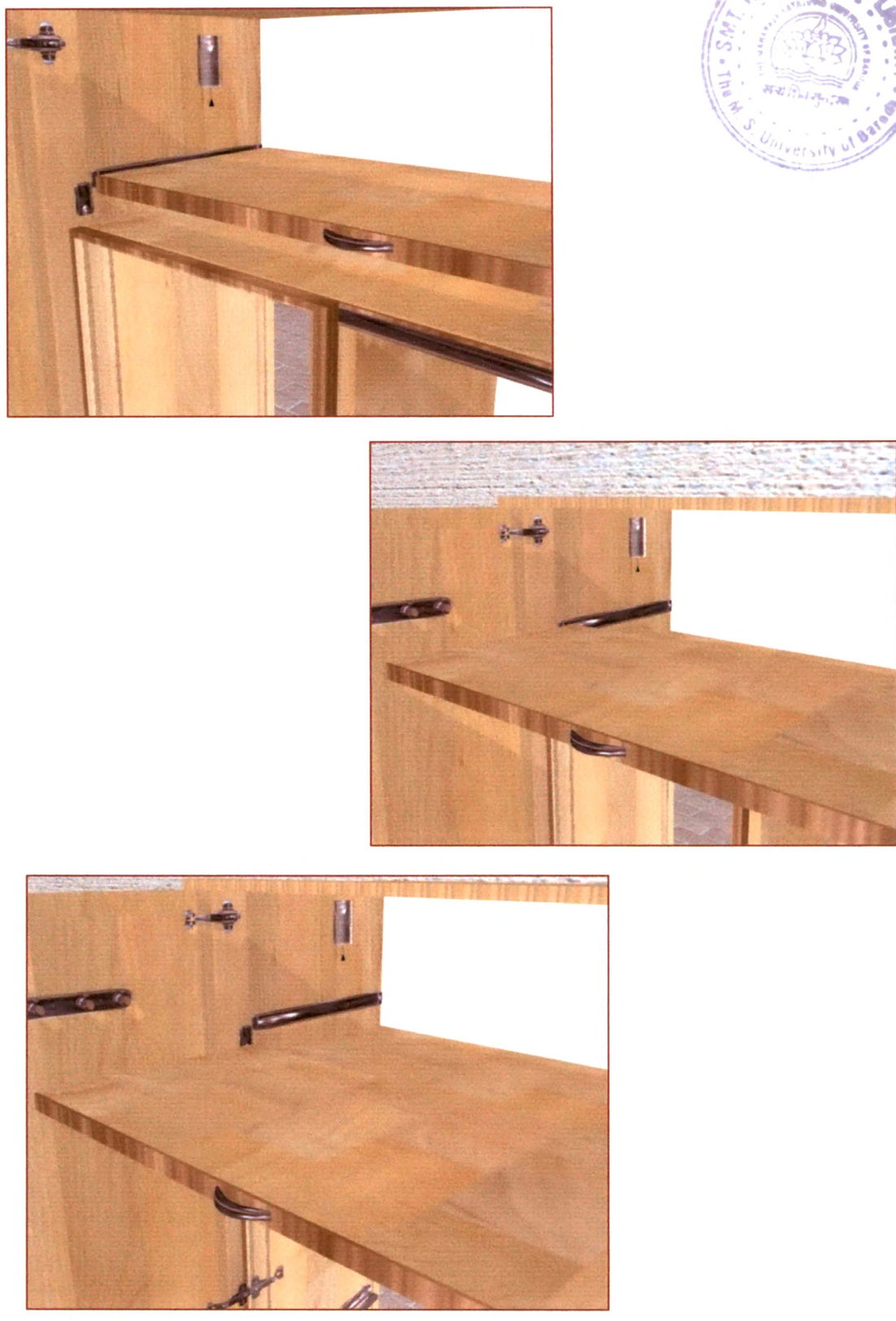


Fig. 67: Design 1- Top shelf –Pull out and pop down (A) and Light on the shelf

3) Middle Shelf (C):

Height: 115 cms (from floor)

Width: 55cms

Depth: 48 cms

Inner height of the section: 34 cms

Middle shelf (A) is simple and fixed in the storage unit. The height of the shelf lies between the comfortable upper position height and lower position height of the elderly person as found in the present study (Fig 66, 69).

4) Drawer (D):

Height: 95 cms (from floor)

Width: 55 cms

Depth: 48 cms

Inner height of the section: 19 cms

This is an easy pull out drawer, that can be easily slided on pulleys. Drawer has D-type metal handle fitted horizontally on it. The drawer has two sections one is large and the other is small. The placement of smaller section in the drawer is at front and larger is at back. A small wooden piece is used for making division in small section placed horizontally from right to left of drawer. This wooden piece can be easily removed and fitted back according to convenience and storage requirement. It can slide in to the groove provided on both the sides (right & left) of the drawer. The height of the drawer lies between the comfortable upper position height and lower position height of the user (Fig 66, 69).

5) Sliding Mirror (J):

Total Height of mirror only: 55 cms

Total Width : 55 cms

Total thickness : 1.5 cms

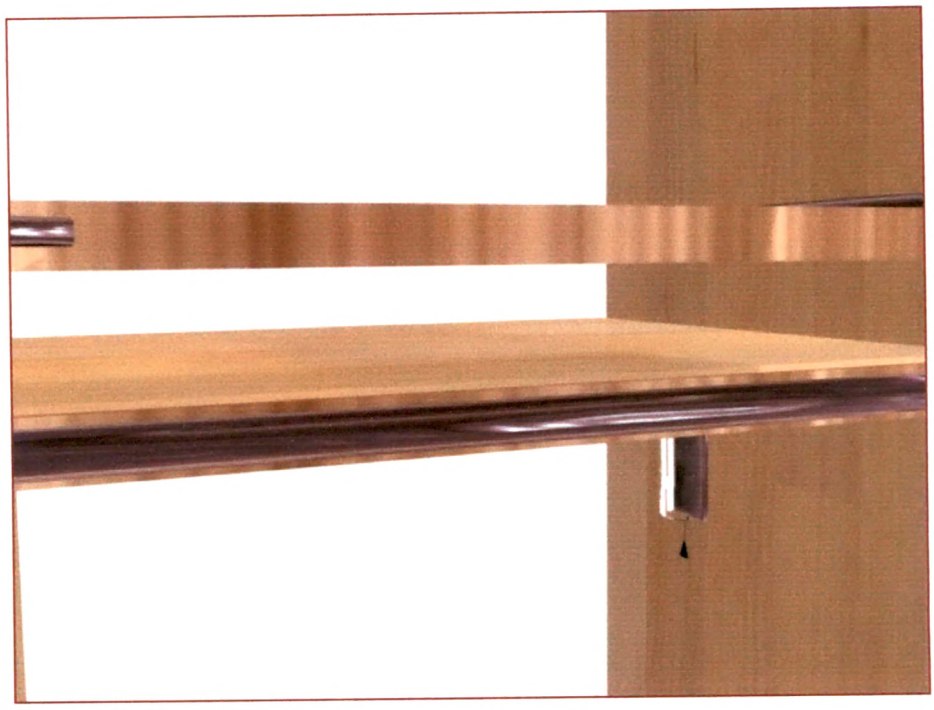


Fig 68: Design 1- Top middle shelf (B)

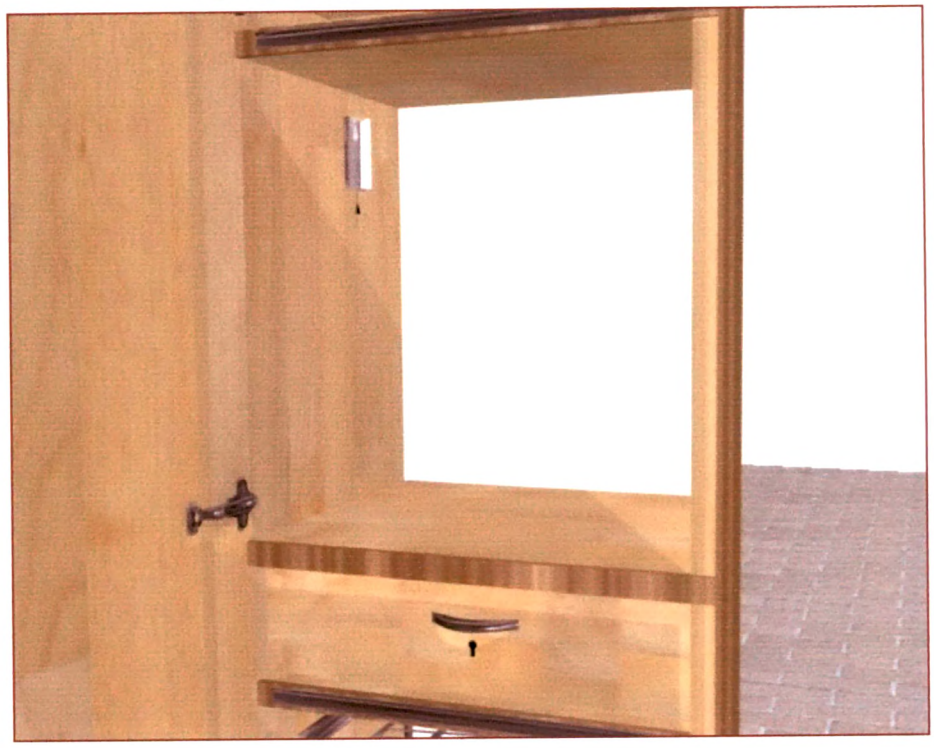


Fig 69: Design 1- Middle Shelf (C) with Light and Drawer 1 (D)

The sliding mirror is lined with a plastic frame and can be slided over to middle shelf (A) and drawer (1) and middle shelf (B), locker and drawer (2). This acts like a cover (shutter) for shelf 3 and 4 on left hand side and 6, 7 and 8 on right hand side (Fig). The mirror has utility as well as it enriches the looks of the storage unit (Fig 70, 71).

6) Middle shelf (G):

Height: 122 cms (from floor)

Width: 55 cms

Depth: 48 cms

Inner height of the section: 27 cms

This shelf is simple and fixed in the storage unit. The height of the shelf lies between the comfortable upper position height and lower position height (Fig 70 72).

7) Locker (H):

Height: 107 cms (from floor)

Width: 55 cms

Depth: 48 cms.

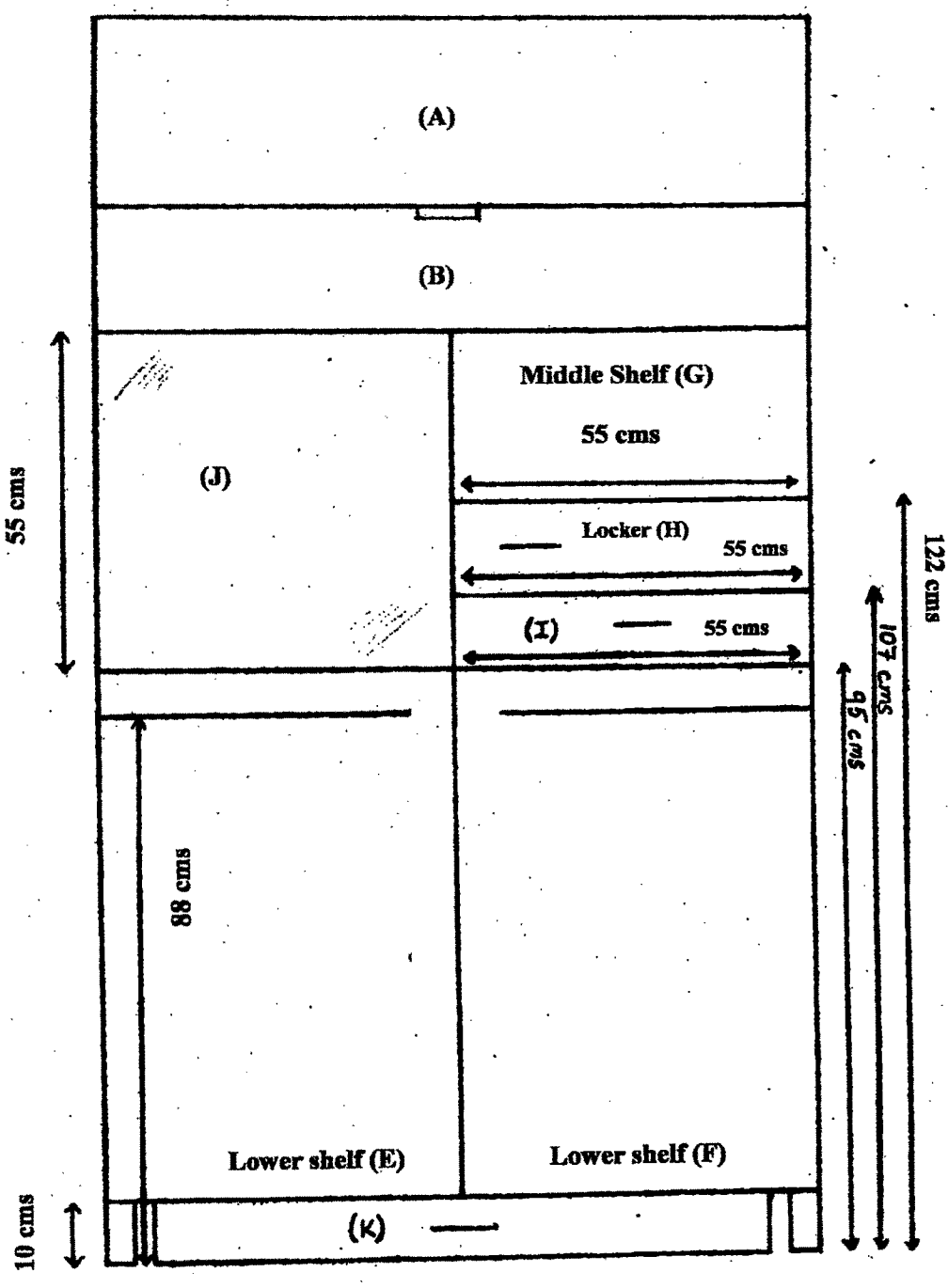
Inner height of the section: 14 cms

Locker is build at the place of middle shelf (Fig 70, 73). The panel of locker is made of wood and has easy opening hinges. Simple D-shape metal handle is fitted horizontally on the panel of the locker. Key system is used for locking. The key is broad and flat in shape for ease in operation mode. The height of the locker lies between the comfortable upper position height and lower position height

8) Drawer (I):

Height: 95 cms (from floor)

Width: 55 cms



Design 1: Open View

Fig 70: Design 1- Open View with Shelf's Dimensions (B)

Sliding Mirror (J) on Left Hand side

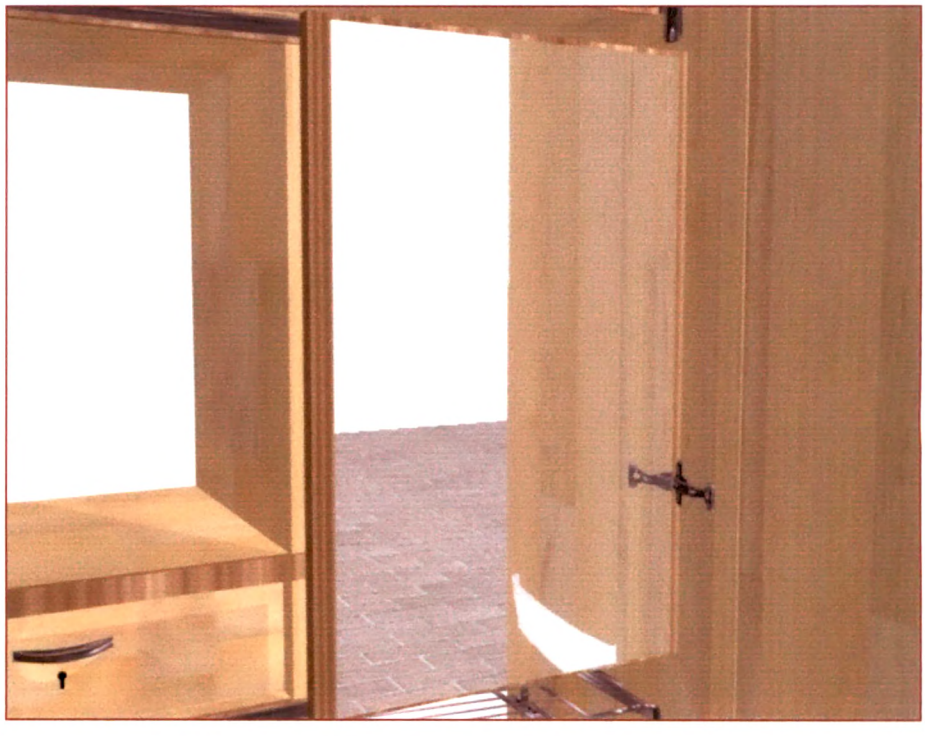


Fig 71: Design 1- Sliding Mirror (J) on Right Hand side

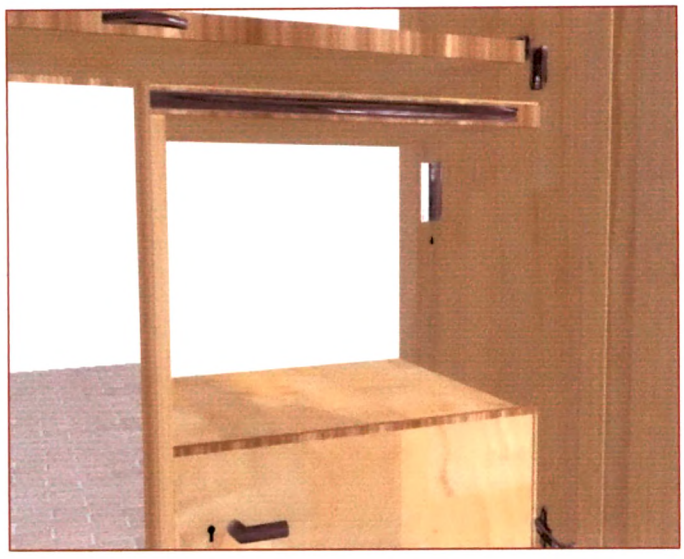


Fig 72: Design 1- Middle Shelf (G) and Light on the shelf

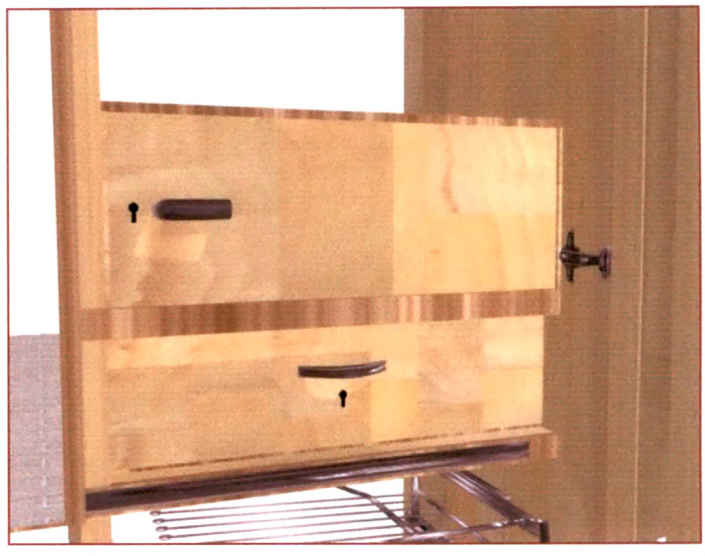


Fig 73: Design 1-Locker (H) and Drawer 2 (I)

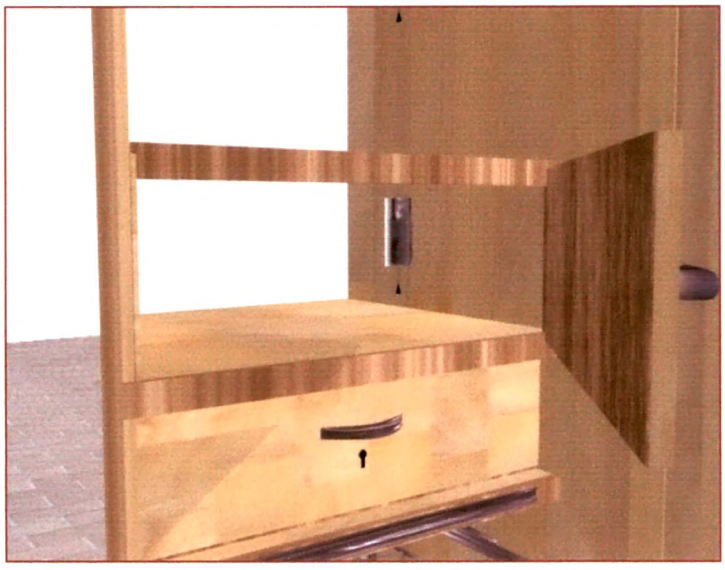


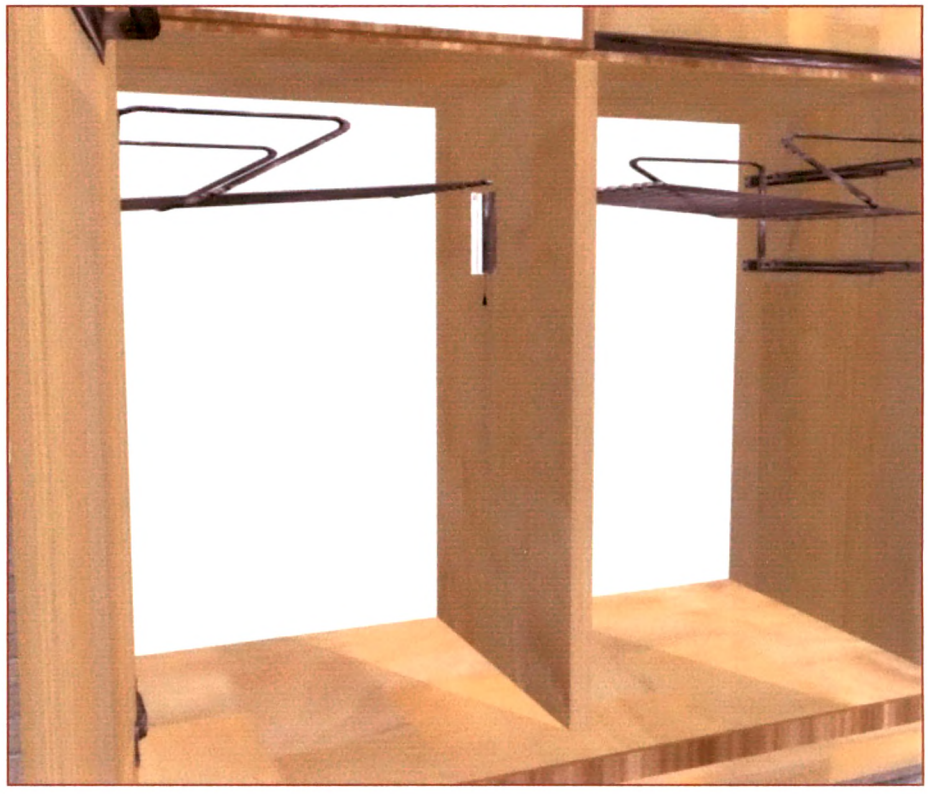
Fig 74: Design 1-Light inside Locker (H)

Depth: 48 cms
Inner height of the section: 11 cms

This is an easy pull out drawer, that can be easily slided on pulleys. Drawer has D-type metal handle fitted horizontally on it, as that shape is easy to hold. Metal is more sturdy than plastic. The drawer has two sections one is large and the other is small. The placement of smaller section in the drawer is at front and larger is at back. A small wooden piece is used for making division in small section. This wooden piece can be easily removed and fitted back according to convenience and storage requirement. It can slide in to the groove provided on both the sides (right & left) of the drawer. The height of the drawer lies between the comfortable upper position height and lower position height (Fig 70, 73).

9) Lower shelf (E and F):
Height: 10 cms (from floor)
Width: 55 cms
Depth: 48 cms
Inner height of the section: 84 cms

As the study revealed that elder women faced more pain and discomfort while storing things on lower shelf, so keeping in mind that problem, the lower portion of the storage unit is utilized for hanging rods so as to make storing easier and for maintaining a good working posture while using lower shelf. The pull out hanging rods are easy to use and help the elder people to hang clothes on them without adopting frequent bending, kneeling or squatting posture. Hence, the load on lower body parts and pain/discomfort felt by elder women while using lower shelf can be reduced. The hangers are fitted at comfortable lower position height of the respondents.



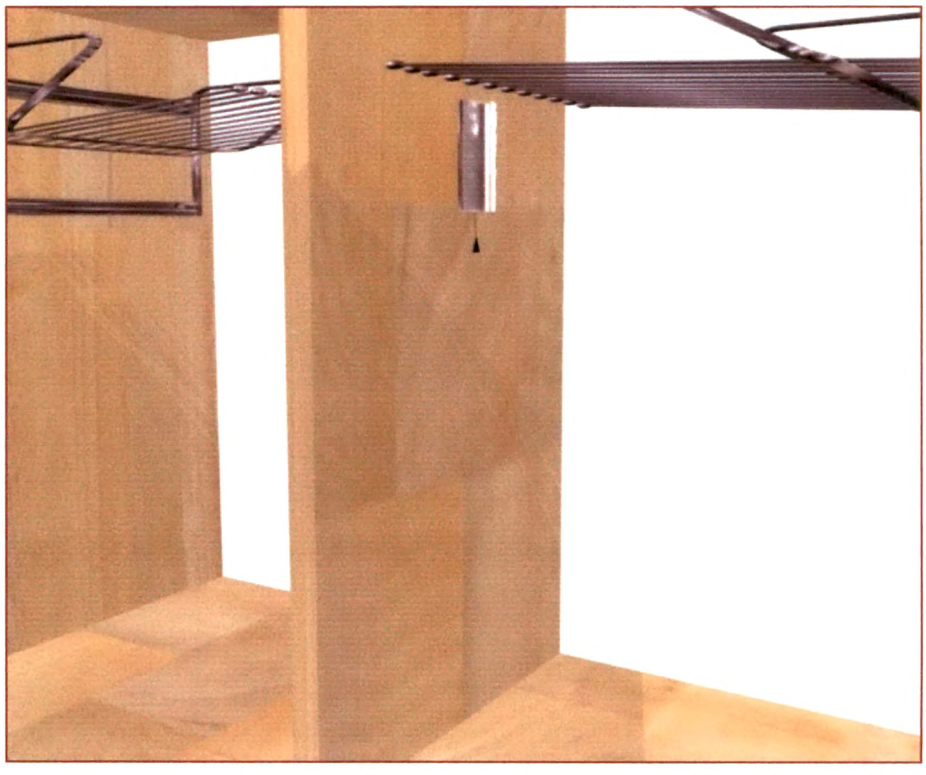


Fig 75: Design 1-Lower Shelf (E) and (F) and placement of light on the shelf

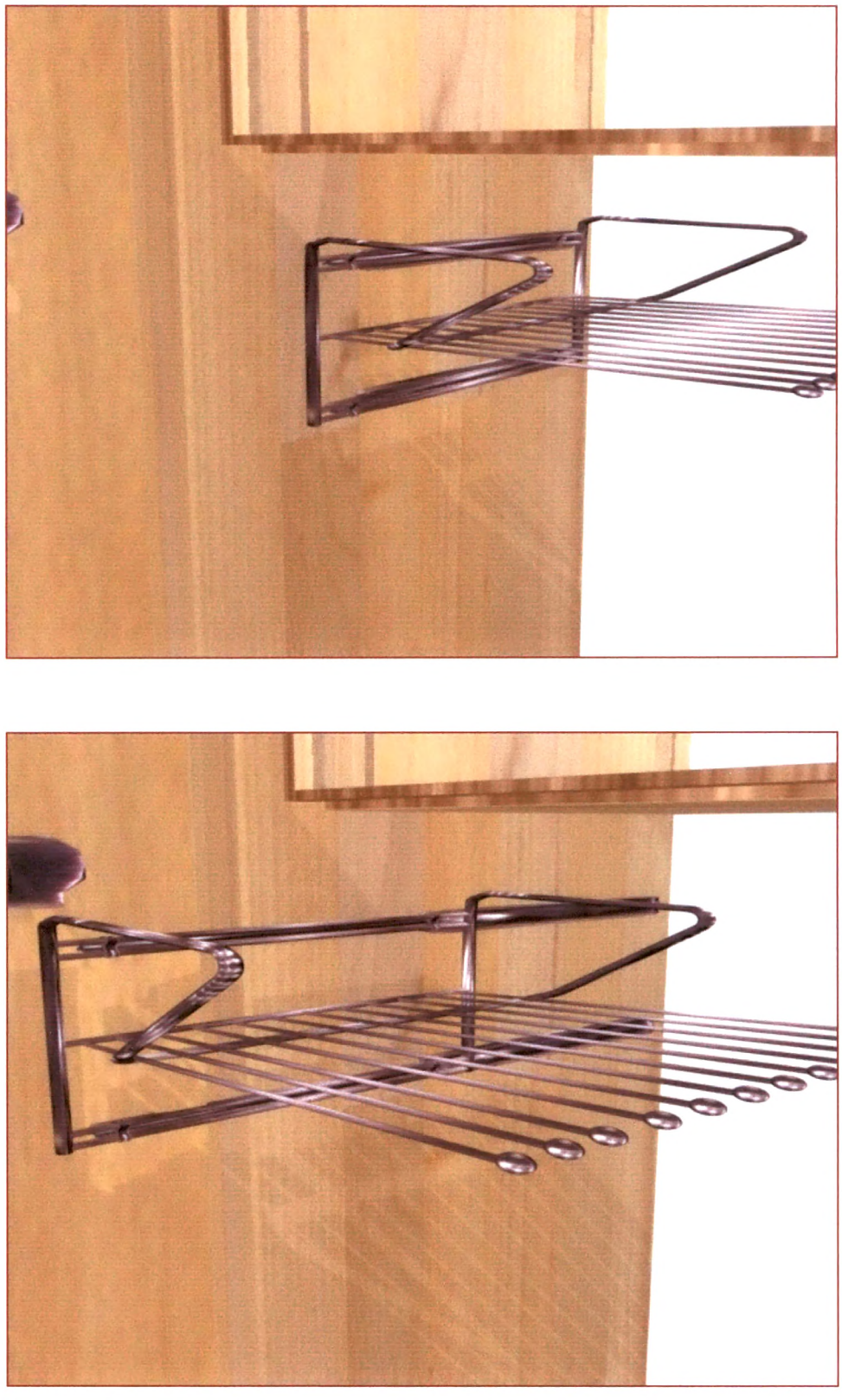


Fig 76: Design 1-Lower Shelf – Hanger rods

The lower shelf/base shelf is simple and fixed. The shelf is at 10 cms from the floor and has division, and can be used for storing rarely used items so as to avoid frequent bending to store articles. The space between lower middle and lower shelf is used for easy pull out hanging rods. The pulleys are used for dragging out the hanging rods. The pulling system and hanging rods are made of stainless steel for durability and ease in maintenance. It has several hanging rods for storing clothes and the system can be easily pulled out for hanging clothes. The dragging system makes the things easily visible for the elder people (Fig 66, 75,76).

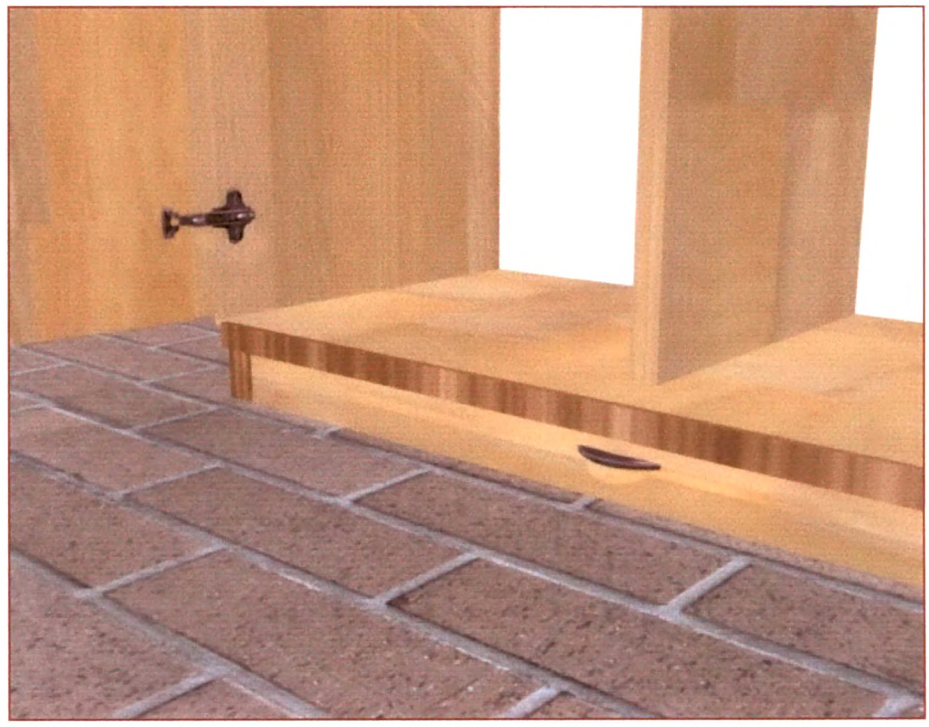
10) Sliding step (K):

Height: 9 cms

Width: 99 cmcs

Depth: 20 cms

As the study revealed that respondents faced problems while using upper shelf of the storage unit, the step is provided in storage unit to make it more comfortable for the elder people to use the upper shelf. The storage unit has a step to stand over it which helps in increasing the height of the elder people so that they can easily reach, grasp and see the things stored on the shelves. The step is fixed with easy pull out pulleys (same as used in drawers) below the lower/base shelf and has support of floor. When needed, the step can be easily pulled out and pushed back below the storage unit after use so as to avoid hindrance in work (Fig 77). The step has castor wheels below it to support. Fixed on front, and back of right and left side as well as front and back at the centre so that the span gets support. The step at the bottom and pull and pop down shelf in the storage unit makes the storing easier and comfortable for the third agers.



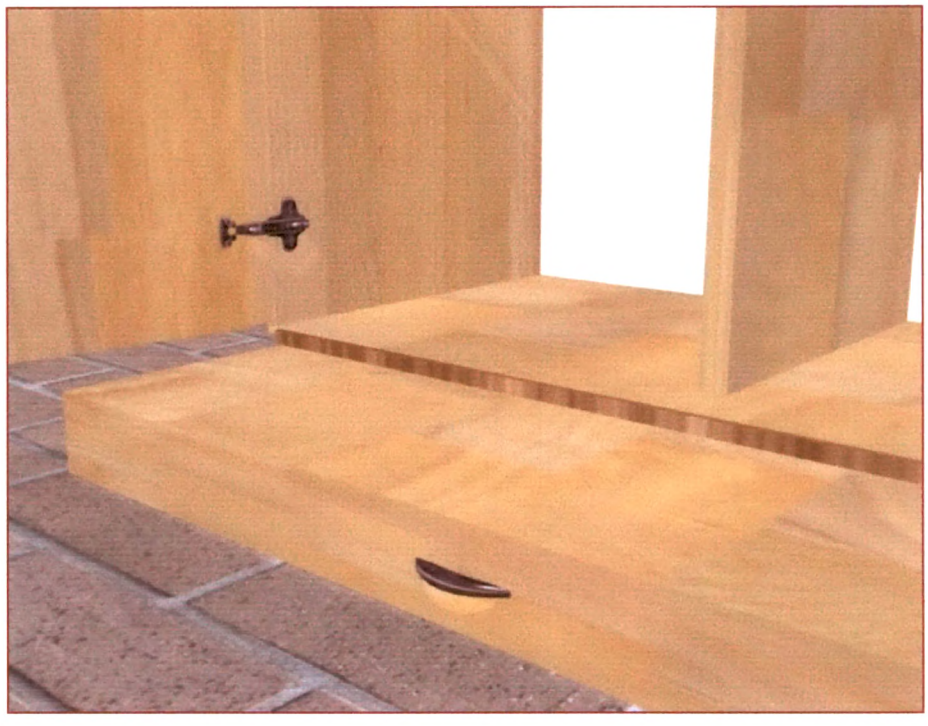


Fig 77: Design 1 and 2- Sliding step (K)

11) Transparent side pocket (on inner side of the door):

Height: 70 cms (from floor, bottom of the pocket)

Width: 15 cms

Depth: 4 cms

The storage unit has transparent pockets made of fiber plastic and fixed on inner side of the door of the storage unit for storing small items. The pocket is made transparent so that elder people can easily see the things stored inside it. It is fixed at the height of 70 cms from the floor (Fig 79). This helps to utilize the space.

12) Bangle holder (on inner side of the door): The storage unit has bangle holder fitted on the inner side of the right door. This is made of stainless steel and fitted at the height of 164 cms from the floor (Fig 78) to maximize the utilization of space.

12) Hooks: The storage unit also has hooks fixed horizontally on the door to hang things on them. The hooks are made of stainless steel for sturdiness and durability. One door has hooks, made of stainless steel, fixed at the height of 164 cms below the top of the door (Fig 80).

The horizontal rod of stainless steel is 30 cms long and fixed at 70 cms below the top of the door.(fig 81).

13) Self operated light: Older people want more light than younger, since the size of the pupil decreases with age and the eye tissues are less translucent and less light reaches the retina of the older eye. Therefore, the elder people require at-least three times light in task areas to see fine details, with minimum glare, and increased contrast. As the findings of the present study reveals that illumination level was found to be very low inside the existing storage units of the respondents.

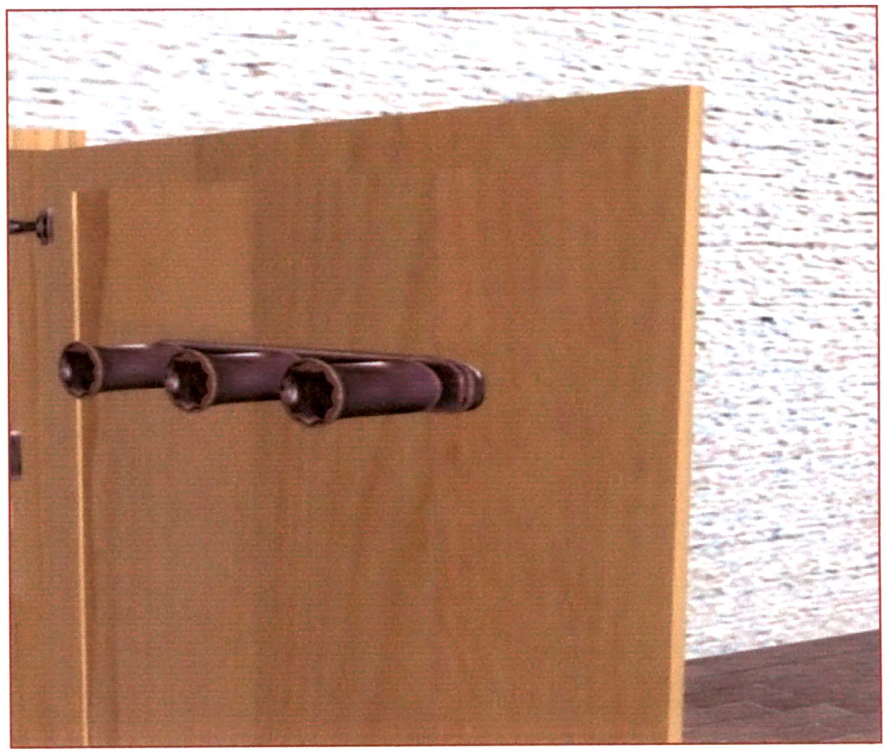


Fig 78: Design 1 and 2- Bangle Holder (L) on Right Door

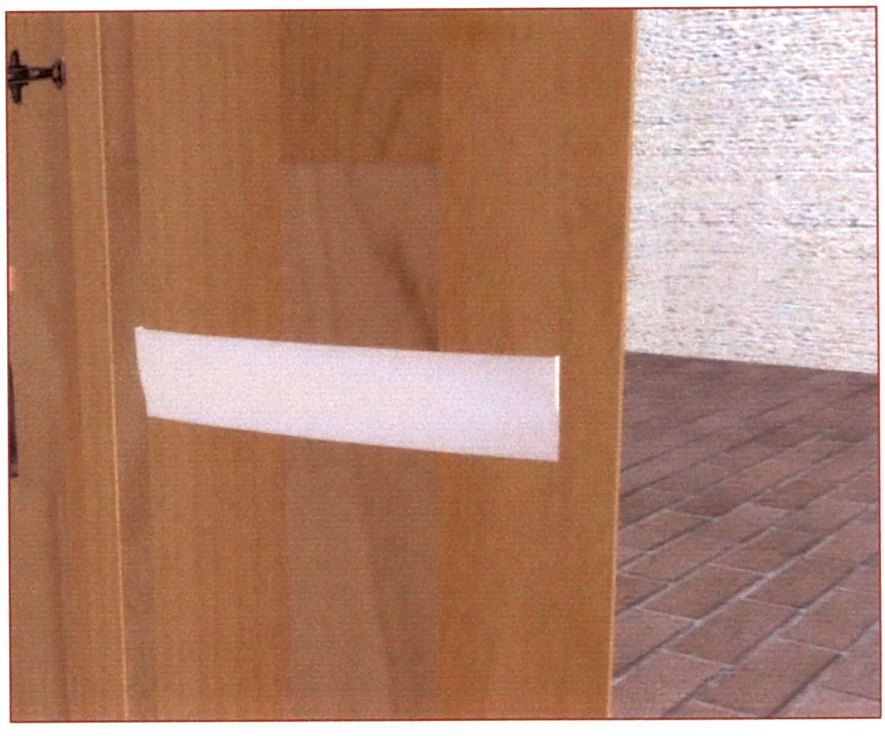


Fig 79: Design 1 and 2- Transparent Side Pocket (M) on Right Door

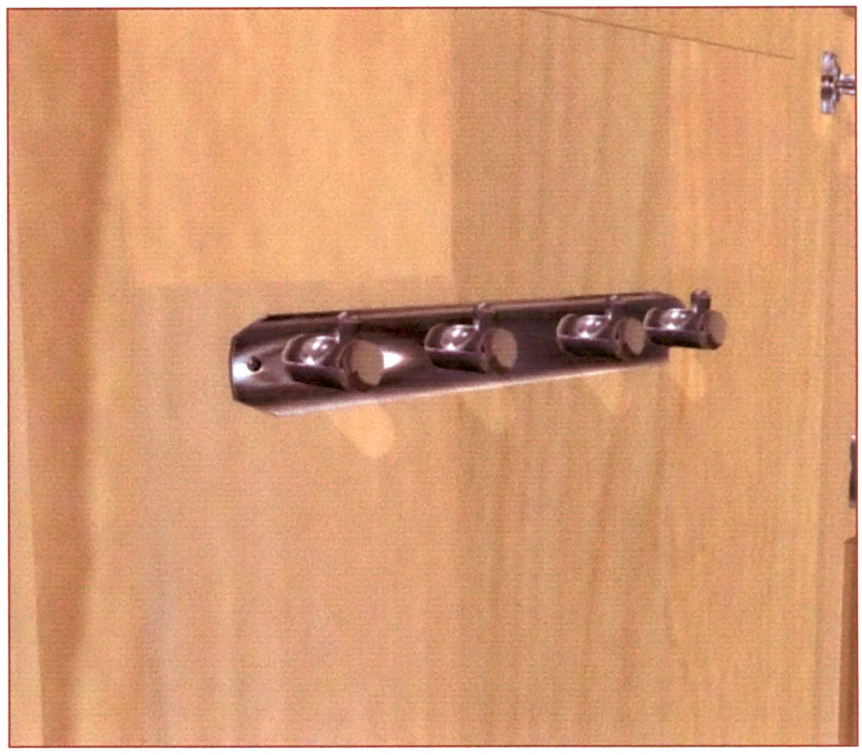


Fig 80: Design 1 and 2- Hooks (N) on Left Door

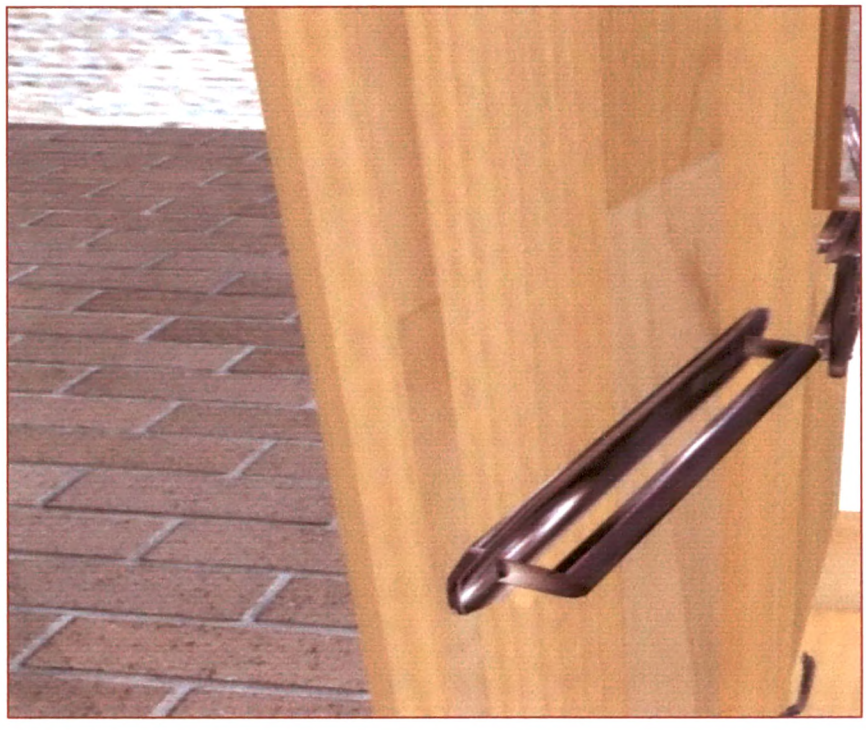


Fig 81: Design 1 and 2- Hanging rod (O) on Left Door

A need was felt to install lights inside storage unit to make things easily visible for the third agers.
Therefore, the self operated lights are fitted on each shelf as well as inside locker. The lights run on batteries and can be switched ON/OFF when needed.

17) Hinges: Good quality stainless steel door hinges which have springs are used for easy opening / closing of the doors of the storage unit. These are new in the market. Due to their working system, the doors need not have magnet for closing of the door (Fig 82). The springs are made of stainless steel which is sturdy and durable and does not rust hence, creates fewer problems in maintenance.

18) Handle: Handles are simple and straight in design, made of wood or metal and placed vertically on the door of the storage unit. The height of handle from floor lies between the average comfortable upper position height and lower position height of the respondents.

19) Legs Base (Stand):
Height: 10 cms
Width: 5 cms
Depth: 56 cms

The storage unit has two stands (legs) fixed vertically below the storage unit to give a strong steady support to the unit. The stand is made of wood as that of the entire unit and given matted finish.

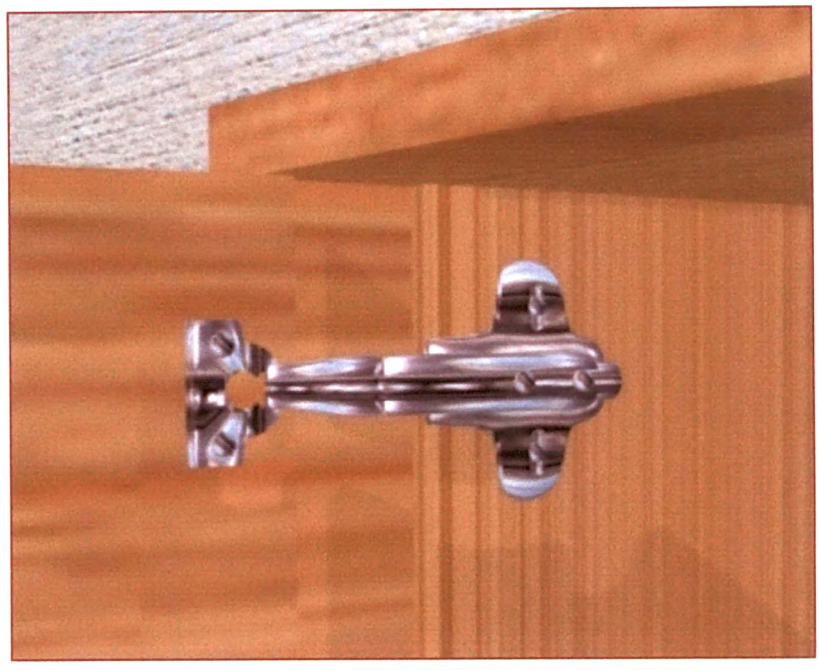


Fig 82: Design 1 and 2- Hinges used in Storage unit

Design: 2

Some variation in the arrangement of shelves is suggested as design no 2. The outer dimensions and some of the shelves remain the same as suggested in design no 1.

Material: The storage unit is made of wood. The "Saag" wood is used for framing and block board of 19 cms thickness for making shelves and partitions.

Finish: Storage unit has matted finish to avoid shine and glare so that it is easy to see because the elder people have low visibility power. Shine and glare makes them more uncomfortable.

Inside colour: The inside colour of the storage unit is white to make the things easily visible for elder people. Generally people use mahroon or wood coloured paint or varnish. But by applying white or light coloured paint the visibility can be facilitated. The paint wood has matt finish to avoid glare.

Total dimension of storage unit

Height:	201 cms
Width:	115 cms
Depth:	56 cms

The total height and total depth of the storage unit was recommended on the basis of average maximum vertical arm reach, body raised on toes of the respondents and maximum horizontal reach (5^{th} percentile) of the respondents.

1) Top shelf (A,B):

Height: 170 cms (from floor)

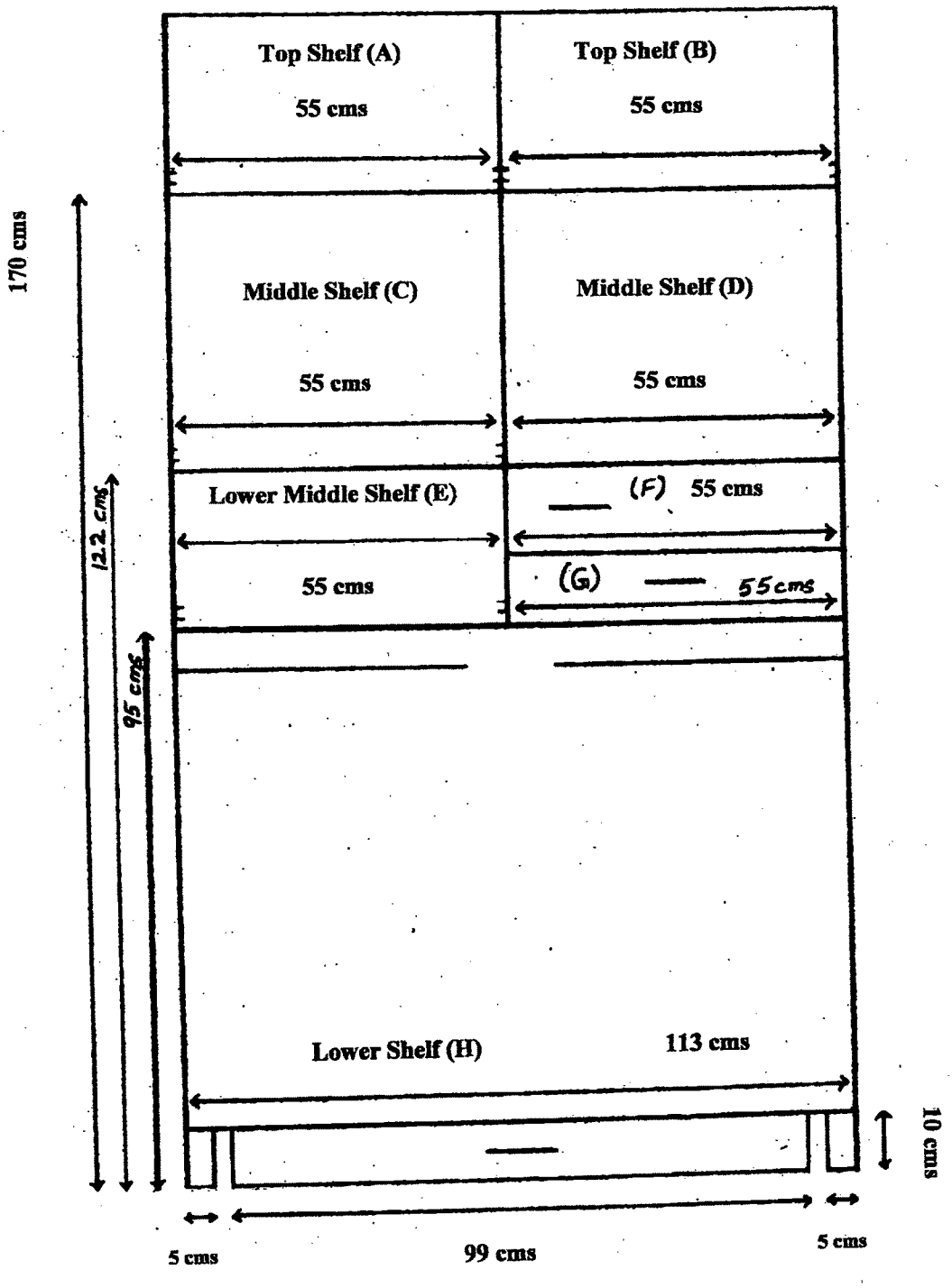
Width: 55 cms

Depth: 48 cms

Inner height of the section: 30 cms

Design 2

Fig 83: Design 2- Open View



Design 2: Open View

Fig 84: Design 2- Open View with Shelf's Dimensions (A)

The result of the present study revealed that the elder women face problem while using top most shelf of the storage unit as they have to support themselves with hand or to surroundings or have to rise on their toes to lift things from the top shelf. So keeping in mind such problems of elderly, the top shelf in the present design is made removable and adjustable so that the elderly can easily remove and adjust the shelf according to their height. The height of the shelf was recommended on the basis of comfortable vertical upward grasp reach (5^{th} percentile) of the respondents.

The top shelf is a removable and adjustable shelf. The shelf is divided in two parts so that they can be easily removed and fixed. The unit has easy shelf sliding holders fixed at the gap of 2 inches, in which shelf can be easily slided in and out and fixed to store things . The holders are made of stainless steel. (Fig 84, 85)

(2) Middle Shelf (C)

Height: 122 cms (from floor)

Width: 55 cms

Depth: 48 cms

Inner height of the section: 47 cms

Middle shelf (C) is simple and adjustable which can be adjusted by the elder people according to their height. The unit have easy shelf sliding holders fixed at the gap of 2 inches, in which shelf can be easily slided in and out and fixed to store things. The holders are made of stainless steel (Fig 84, 86). The height of the shelf lies between the comfortable upper position height and lower position height.

(3) Middle Shelf (D)

Height: 122 cms (from floor)

Width: 55 cms

Depth: 48 cms

Top Shelf (A) with Light

Fig 85: Design 2- Top Shelf (B) with Light

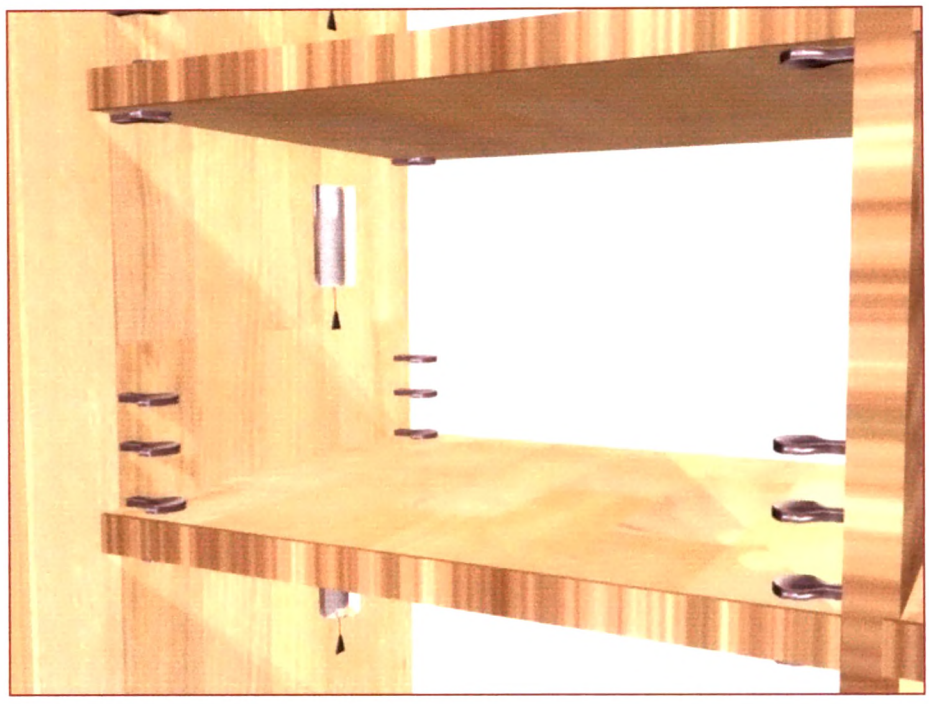


Fig 86: Design 2- Middle Shelf (C) with Light

Fig 87: Design 2- Middle Shelf (D) with Light

Inner height of the section: 47 cms

The shelf is simple and fixed in the storage unit (Fig 87, 91). The height of the shelf lies between the comfortable upper position height and lower position height.

(4) Lower Middle Shelf (E):

Height: 95 cms (from floor)
Width: 55 cms
Depth: 48 cms
Inner height of the section: 26 cms

Lower middle shelf is similar to middle shelf (C) i.e. simple and adjustable in height (Fig 84, 88). Two or three grooves at various heights are provided on which the shelf can be supported and this shelf can be totally removed also.

(5) Locker (F):

Height: 107 cms (from floor)
Width: 55 cms
Depth: 48 cms
Inner height of the section: 14 cms

Locker is placed at the bottom of middle shelf (B). The panel of locker is made of wood and has easy opening hinges. Simple D-shape metal handle is fitted horizontally on the panel of the locker for easy grip. Key system is used for locking. The key is broad and flat in shape for ease in operation mode. The height of the locker lies between the comfortable upper position height and lower position height. (Fig 89, 91).

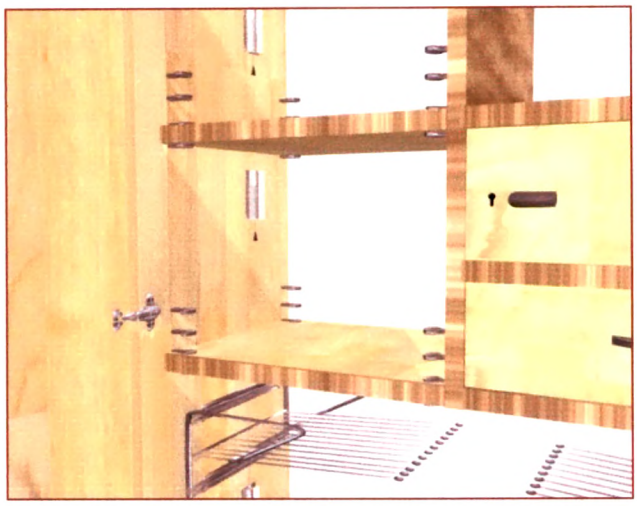
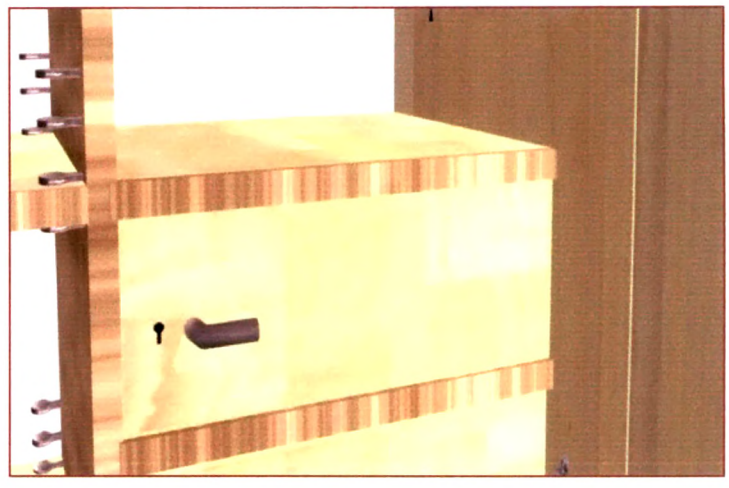


Fig 88: Design 2- Lower Middle Shelf (E) with Light

Fig 89: Design 2- Locker (F)



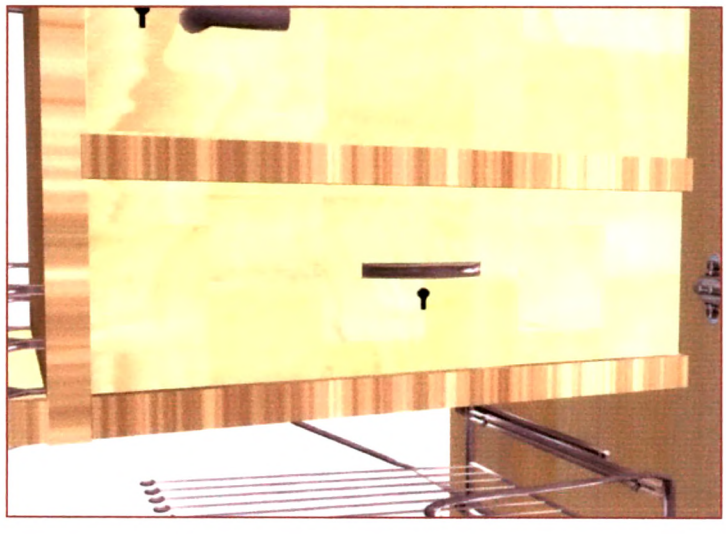


Fig 90: Design 2- Drawer (G)

(6) Drawer (G):

Height: 95 cms (from floor)

Width: 55 cms

Depth: 48 cms

Inner height of the section: 11 cms

This is an easy pull out drawer, that can be easily slided on pulleys. Drawer has D-type metal handle fitted horizontally on it as that shape is easy to hold. Metal is more sturdy than plastic. The drawer has two sections one is large and the other is small. The placement of smaller section in the drawer is at front and larger is at back. A small wooden piece is used for making division in small section. This wooden piece can be easily removed and fitted back according to convenience and storage requirement. It can slide in to the groove provided on both the sides (right & left) of the drawer. The height of the drawer lies between the comfortable upper position height and lower position height. (Fig 90, 91).

(7) Lower shelf:

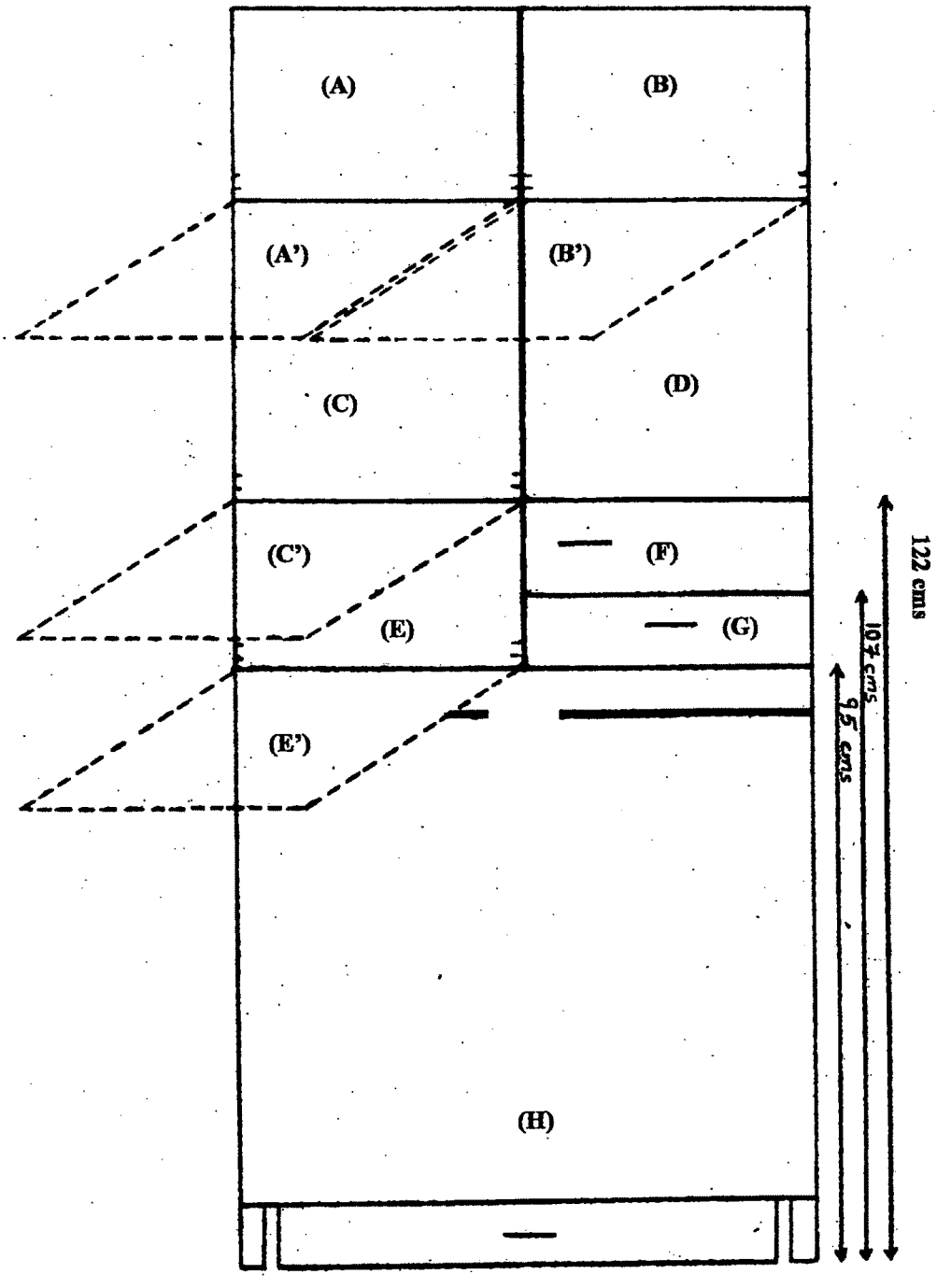
Height: 10 cms (from floor)

Width: 113 cms

Depth: 48 cms

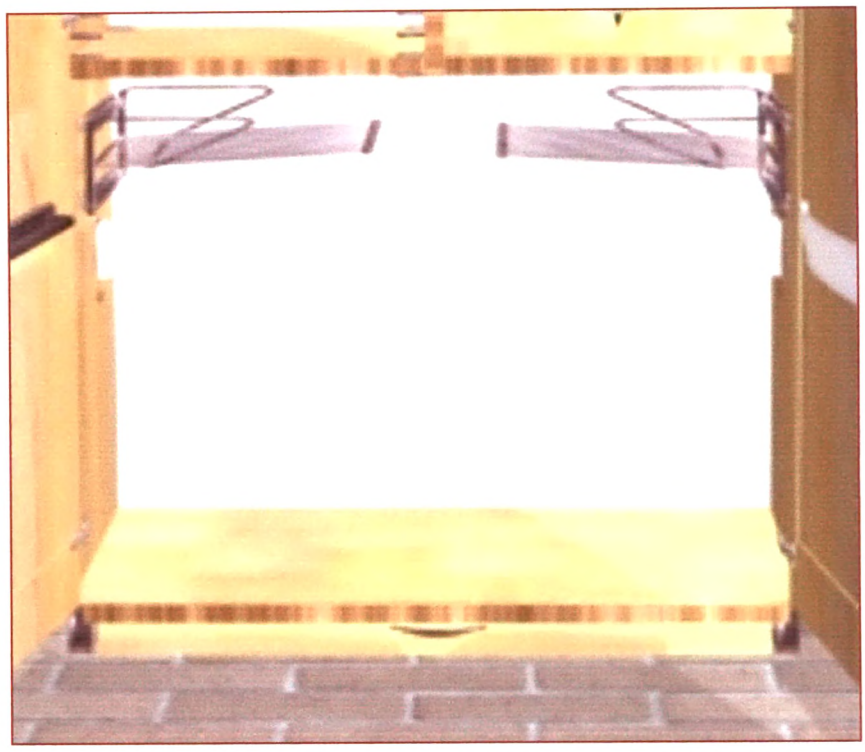
Inner height of the section: 84 cms

As the study revealed that elder women faced more pain and discomfort while storing things on lower shelf, so keeping in mind that problem the lower portion of the storage unit is utilized for hanging rods so as to make storing easier and for maintaining a good working posture while using lower shelf. The pull out hanging rods are easy to use and help the elder people to hand clothes on them without adopting frequent bending, kneeling or squatting posture. Hence, the load on lower body parts and pain/discomfort felt by elder women while using lower



Design 2: Open View

Fig 91: Design 2- Open View with Shelf's Dimensions (B)



Lower shelf (H)

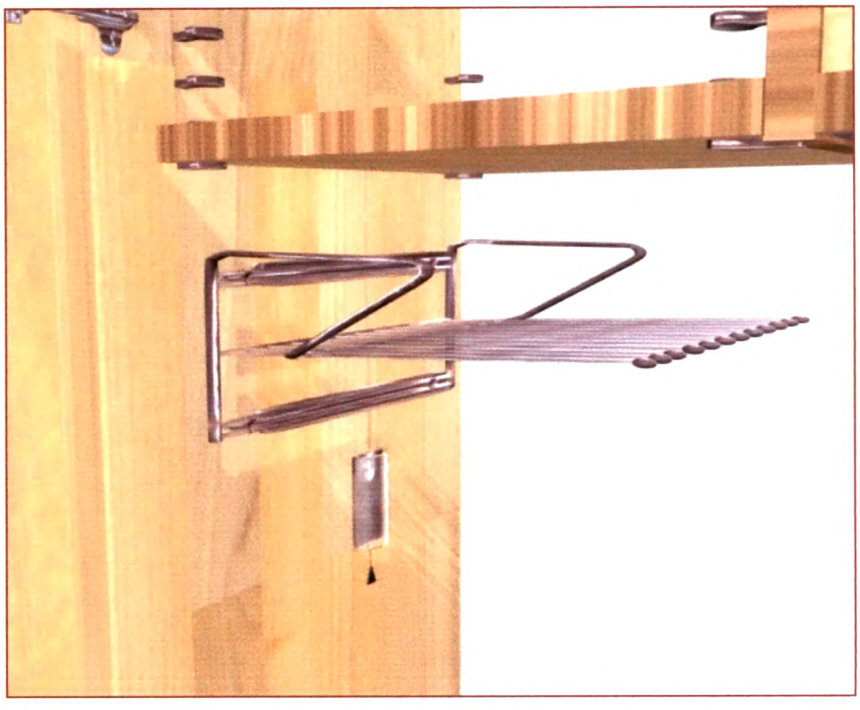


Fig 92: Design 2- Hanger rod and Light on Lower section (H)

shelf can be reduced. The hangers are fitted at comfortable lower position height of the respondents.

The lower shelf/base shelf is simple and fixed. The shelf is at 10 cms from the floor and can be used for storing rarely used items so as to avoid frequent bending to store articles. The space between lower middle and lower shelf is used for easy pull out hanging rods. The pulleys are used for dragging out the hanging rods. The pulling system and hanging rods are made of stainless steel for durability and ease in maintenance. It has several hanging rods for storing clothes and the system can be easily pulled out for hanging clothes. The dragging system makes the things easily visible for the elder people. (Fig 92).

(8) Sliding Step:

Height: 9 cms

Width: 99 cmcs

Depth: 20 cms

As the study revealed that respondents faced problems while using upper shelf of the storage unit, the step is provided in storage unit to make it more comfortable for the elder people to use the upper shelf. The storage unit has a step to stand over it which helps in increasing the height of the elder people so that they can easily reach, grasp and see the things stored on the shelves. The step is fixed with easy pull out pulleys (same as used in drawers) below the lower/base shelf and has support of floor. When needed, the step can be easily pulled out and pushed back below the storage unit after use so as to avoid hindrance in work (Fig 77). The step has castor wheels below it to support. Fixed on front, and back of right and left side as well as front and back at the centre so that the span gets support. The step at the bottom and pull and pop down shelf in the storage unit makes the storing easier and comfortable for the third agers.

(9) Transparent side pockets (on inner side of the door):

Height: 70 cms (from floor)

Width: 15 cms

Depth: 4 cms

The storage unit has transparent pockets made of fiber plastic and fixed on inner side of the door of the storage unit for storing small items (Fig 79). The pocket is made transparent so that elder people can easily see the things stored inside it. It is fixed at the height of 70 cms from the floor. This helps to utilize the space.

(10) Bangle holder (on inner side of the door): The storage unit has bangle holder fitted on the inner side of the right door. This is made of stainless steel and fitted at the height of 164 cms from the floor to maximize the utilization of space. (Fig 78).

(11) Hooks: The storage unit also has hooks fixed horizontally on the door to hang things on them. The hooks are made of stainless steel for sturdiness and durability. One door has hooks, made of stainless steel, fixed at the height of 164 cms below the top of the door. (Fig 80)

The horizontal rod of stainless steel is 30 cms long and fixed at 70 cms below the top of the door. (Fig 81).

(12) Self operated light: Older people want more light than younger, since the size of the pupil decreases with age and the eye tissues are less translucent and less light reaches the retina of the older eye. Therefore, the elder people require at-least three times lighter in task areas to see fine details, with minimum glare, and increased contrast. As the findings of the present study reveals that illumination level was found to be very low inside the existing storage units of the respondents.

Hence need was felt to install lights inside storage unit to make things easily visible for the third agers.

Therefore, the self operated lights are fitted on each shelf as well as inside locker. The lights run on batteries and can be switched ON/OFF when needed.

(13) Hinges: Good quality stainless steel door hinges which have springs are used for easy opening / closing of the doors of the storage unit. These are new in the market. Due to their working system, the doors need not have magnet for closing of the door (Fig 82). The springs are made of stainless steel which is sturdy and durable and does not rust hence, creates fewer problems in maintenance.

(14) Handle: Handles are simple and straight in design, made of wood or metal and placed vertically on the door of the storage unit. The height of handle from floor lies between the average comfortable upper position height and lower position height of the respondents.

(15) Legs Base (Stand):

Height: 10 cms

Width: 5 cms

Depth: 56 cms

The storage unit has two stands (legs) fixed vertically below the storage unit to give a strong steady support to the unit. The stand is made of wood as that of the entire unit and given matted finish.

Significant changes suggested in the proposed design for comfort of the elderly.

- Lighting in each section inside the storage unit,
- The top shelf is modified: from fixed to pull out and pop down
- Pull out hanger rods in the lower section of the wardrobe
- Sliding step in the storage unit to climb up to reach the top shelf

Suggested Dimensions for Kitchen Storage Units

Based on anthropometric measurements and reaches of the respondents of the present study various dimensions for kitchen cabinets were suggested. The table 131 gave description of various anthropometric measurements and reaches on the basis of which dimensions were suggested and comparison of suggested storage dimensions with the storage dimensions suggested by Naomi Shank (1948) for normal adults.

So it was concluded that the storage should be properly designed within the workers limits. It should fulfill the user's need. Designs without due consideration to the body dimensional requirements of intended users do not serve their purpose and have less user acceptance value. There are numerous medical problems that have resulted because of the use of articles that do not match the anthropometry of the users. Wrongly designed systems induce improper posture leading to operational uneasiness and musculo-skeletal and some physiological disorders.

Size and shape of kitchen

On the basis of finding of the present study U-shape kitchen of 12'x 10' size is suggested for the elder women. As the work triangle can be followed in an easiest way.

Various work centers in kitchen

The suggested kitchen has following work centers:

A) sink center
B) Refrigerator center
C) Storage unit
D) Range center

A) Sink center

Sink center has source of water for washing utensils, fruits, vegetables and grains. This center is placed between the refrigerator and range center for easy access of water. The sink is made of stainless steel and provided with a drain

Table 131: Comparison of Suggested dimension

S.No.	Storage Heights and Depths	Dimensions		Anthropometric and reach measurements
		Naomi Shank	Present study (cms)	
1.	Seasonal storage	84" (213.36)	210	Vertical upward arm reach from floor
2	Top shelf height a) adjustable shelf height b) Adjustable half shelf	72" (182.88) - -	177 150 140	Comfortable vertical upward arm reach (5th percentile) Upper position height (5th percentile) Upper position height
3	First shelf	52" (132.08)	131	Shoulder height
4	Light switch	48" (121.92)	122	Shoulder height (5th percentile)
5	Sink counter	38" (96.52)	90-94	Elbow height
6	Range	36" (91.44)	85-90	Waist height
7	Mixing counter, planning desk and sink floor	32" (81.28)	80-85	Lower position height (Average)
8	Lap table/ Top drawer's height	27" (68.58)	68-75	Lower position height (5th percentile)
9	Base cabinet middle shelf/drawer's height	-	48	Lower position height (95th percentile)
10	Lower shelf/drawer	4" (10.16)	8	-
11	Wall cabinet's depth	12" (30.48)	30	Minimum horizontal reach (5th percentile)
12	Counter depth	24" (60.96)	60	Average maximum horizontal reach
13	Skirting	-	8	-

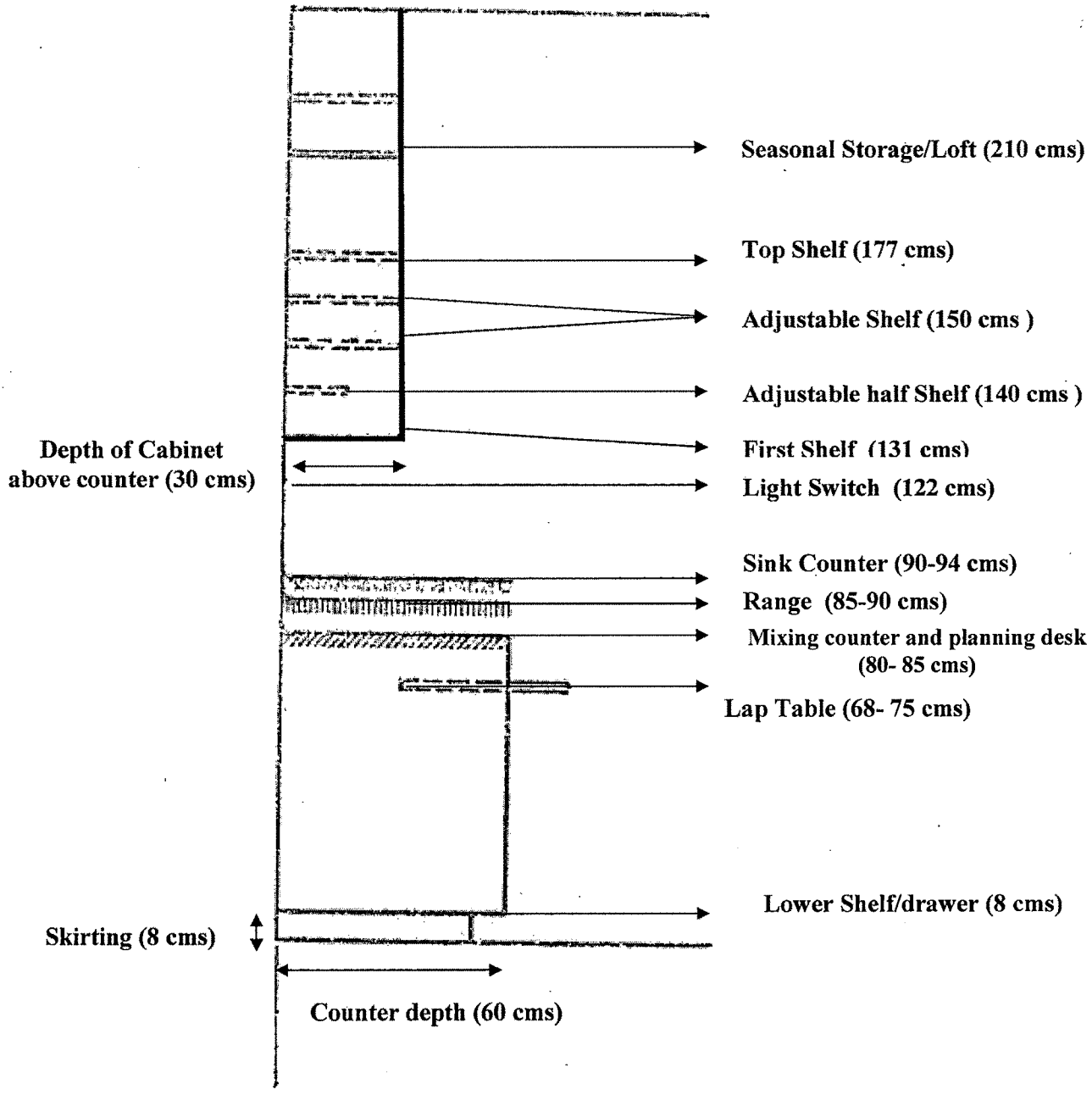
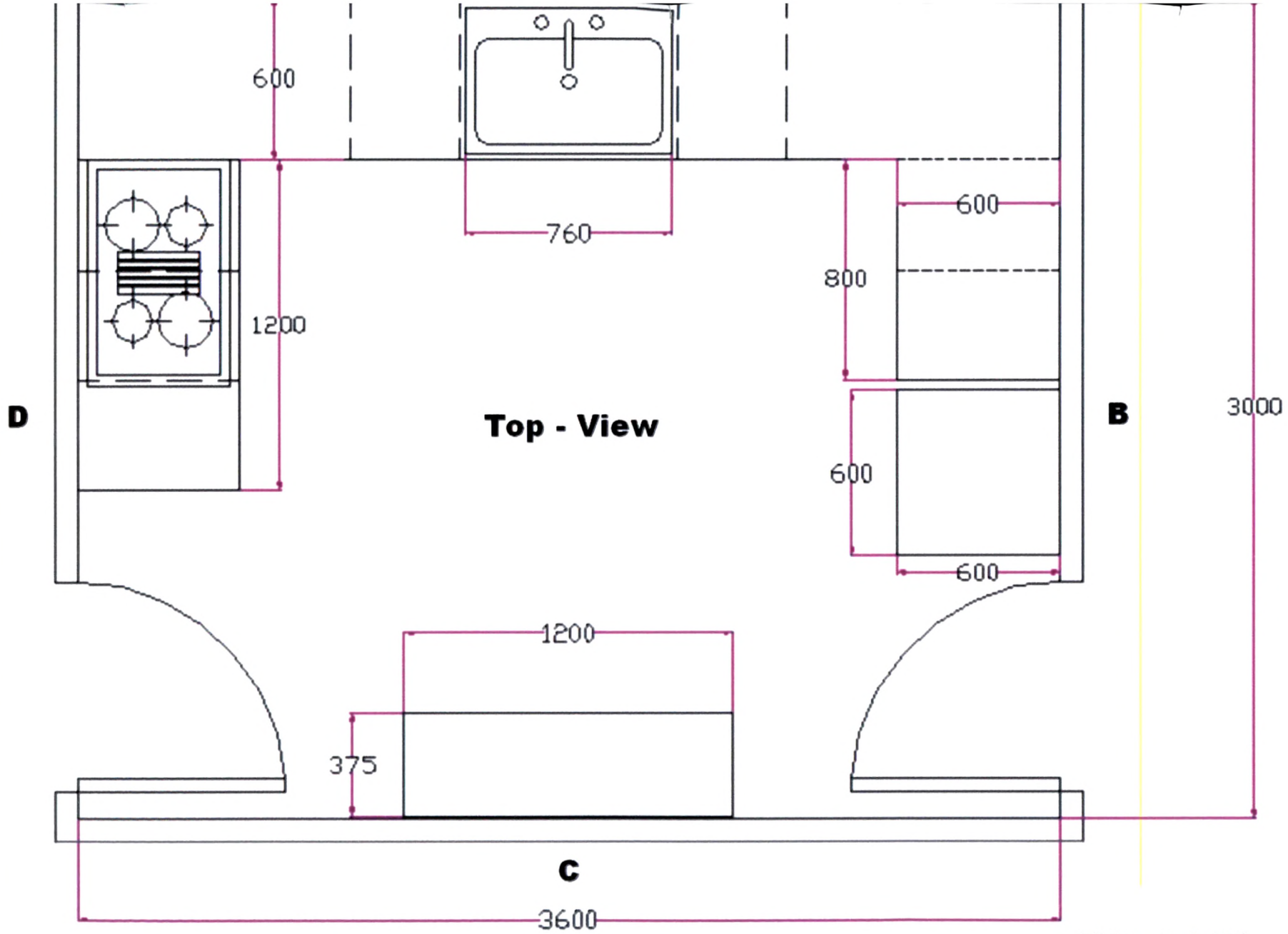


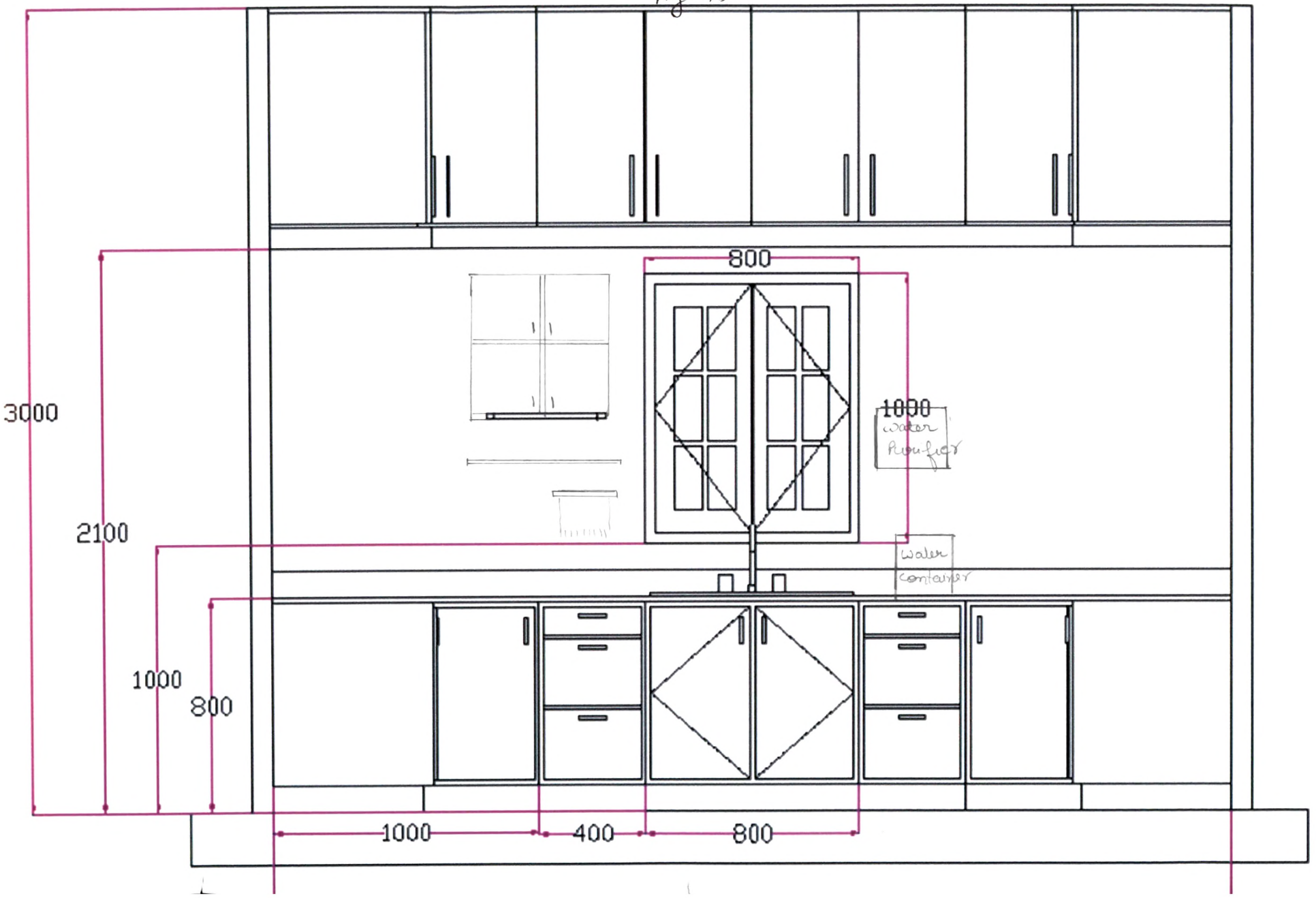
Figure 93: Suggested Dimensions for Kitchen Storage



(All Dim. Are In MM)

Fig. 94

Fig. 95


3000
2100
1000
800
800
1000
water purifier
water container
1000
400
800

board. The space below the sink is used for dust bin. The drawers on both side of the sink can be used for storing utensils used first with water such as sauce pans, strainers, sieves, peelers, knives, etc. The drawers can also be used for storing kitchen linens such as napkins, hand towels, apron etc. The side easy pull out drawers can be used for storing washing bar, scrub etc. The platform on right side of the sink can be used for placing water container. The wall on the right can be used for placement of water purifier. On the left side above drain board is a glass cabinet to store grain containers. So that it will be easy for the used to take out grains from the cabinet and wash at sink before preparing food. Below cabinet is an open shelf for strong utensils such as glasses, bowls and plates. Below the open shelf there is a hanger rod for towel. Loft is also provided at the sink center for seasonal storage.

B) Refrigerator and Mix Center

Refrigerator is seen in almost all homes. It is used for storing perishable items such as milk, fruits, vegetables, etc. Refrigerator is placed next to the door. Platform beside refrigerator is used for placing electrical equipment such as microwave, food processor and blender used in preparation of food. Cabinets above counter is used for storing glasses, tray, ice-cream cups etc. which can be used to serve the items stored in refrigerator. The cabinets can also be used for storing ready to made or ready to serve food items. The center has a lap board which can be used for carrying out mixing activity. As the board is at comfortable height, the user don't feel pain in arms, shoulder and back, while carrying out the activity. The drawer below counter is used for storing spoons, knives etc. The other cabinets below counter are used for storing rarely used heavy utensils.

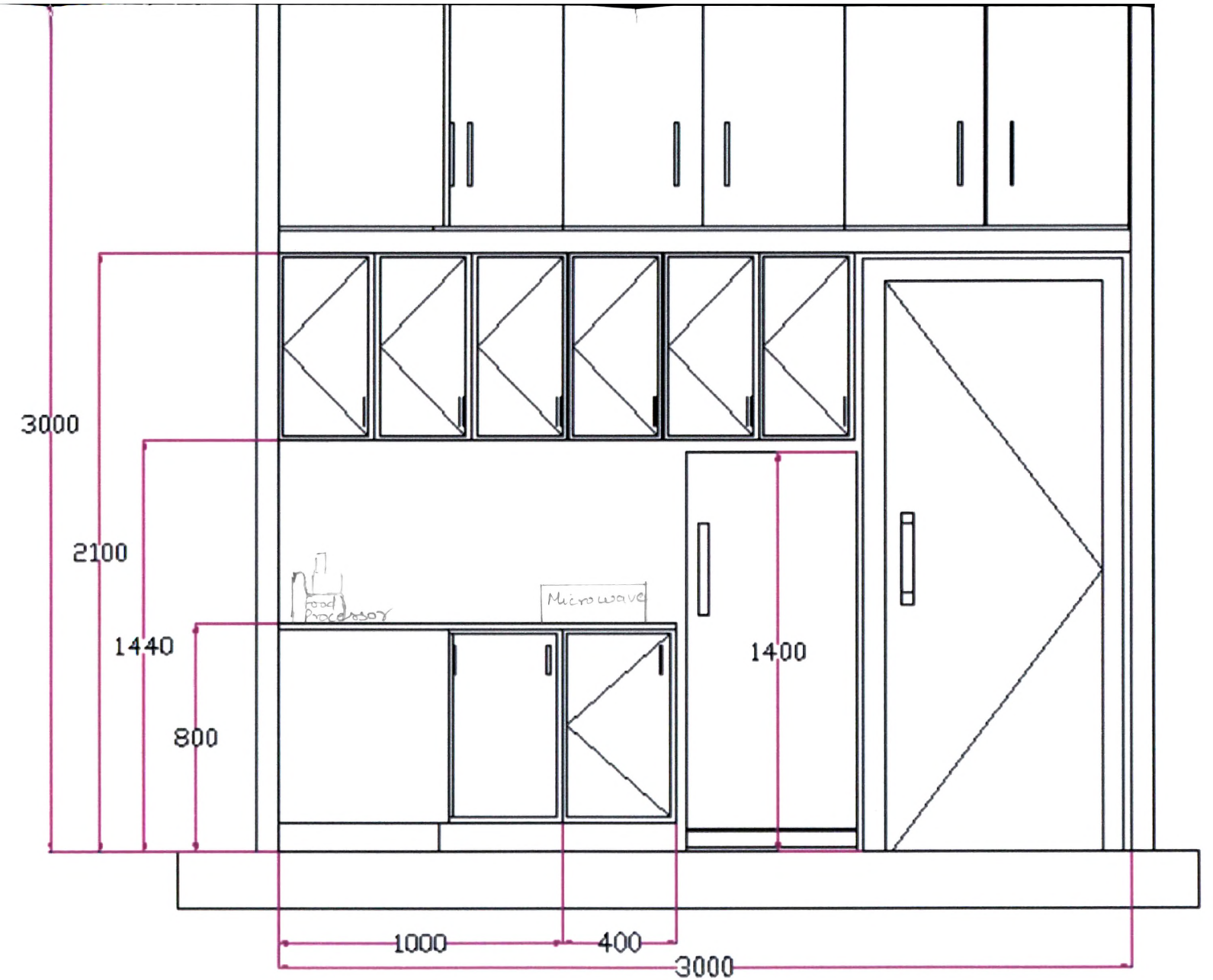


Fig 96 **B - View**

(All Dim. Are In MM)

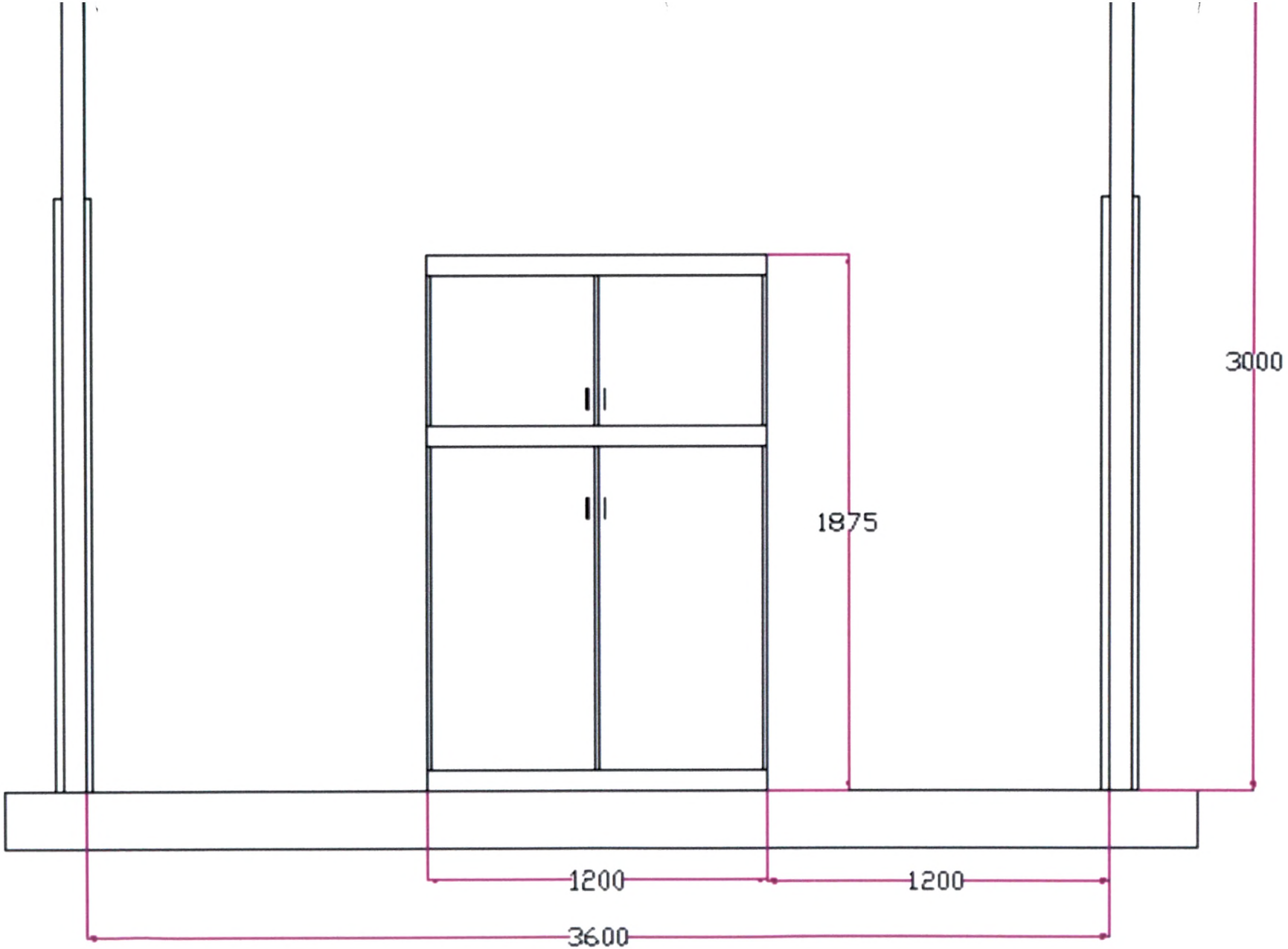
C) Storage Unit

A storage unit is built in the free space available between the two doors to utilize the space. The unit can be used for storing crockery.

D) Range Center

This center has a gas range with a chimney. The center has enough space on both side of the range to keep articles while cooking. The drawers and cabinets below the counter can be used for storing utensils used first with heat. Such as sauce pans, covers of all utensils, rolling board, rolling pin etc. and spice box used while cooking. Multipurpose hanging rods/wires is placed on the wall for storing small appliances for stirring, turning, mashing, serving etc. A multipurpose rack is also placed on the wall to store small containers of sugar, tea, coffee etc.

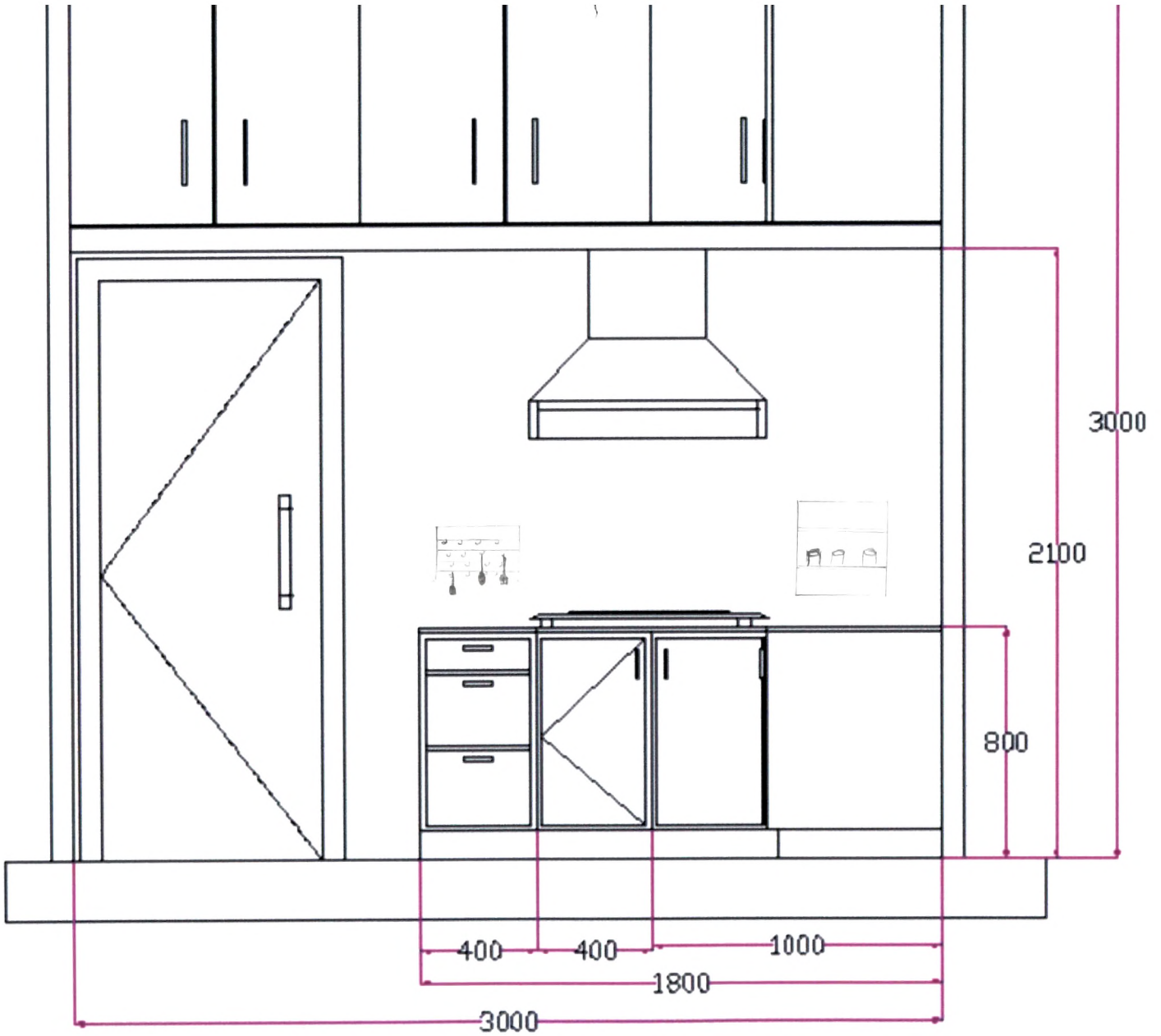
The dead space between range and sink center and sink and refrigerator center can be best used by placing multipurpose revolving racks. This can be easily used by the elder people without adopting awkward posture. The dead space below work counter can also be used in a better way by placement of revolving racks. The dead space of loft can be easily used by placing pull out and pop down shelves.



C - View

Fig 97

(All Dim. Are In MM)



D - View Fig. 98 (All Dim. Are In MM)