CHAPTER 3

MATERIALS AND METHODS

The present study in focus is entitled as, "Assessment of nutritional status, fitness profile and capacity building of football players of Urban Vadodara to understand food labels and healthy processed food choices using smartphone application". This chapter deals with the framework of experimental design and elaborates on materials and methods used for fulfilling the objectives under the study in the succeeding three phases.

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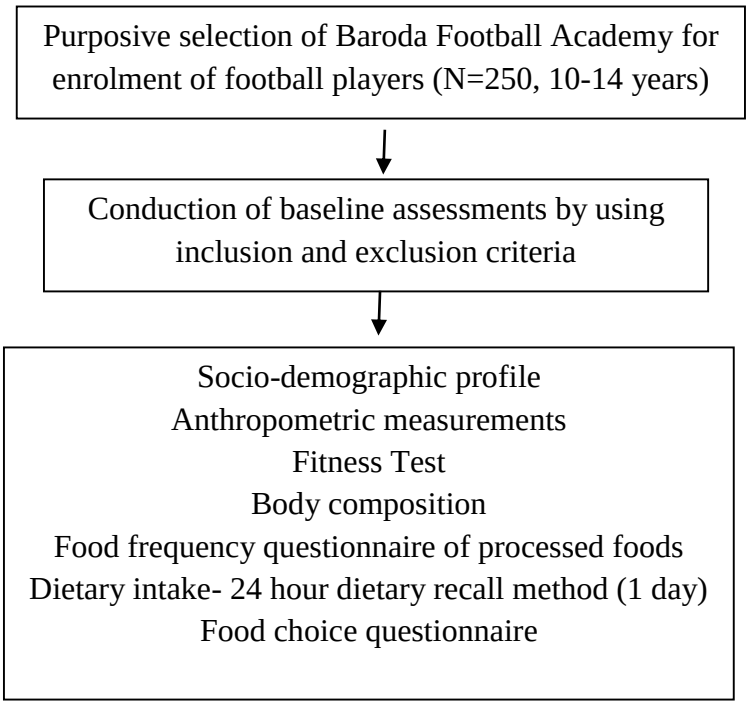
PHASE I: SITUATIONAL ANALYSIS OF FOOTBALL PLAYERS OF URBAN VADODARA

The formative phase of the study included preliminary screening for the identification of Football players of Urban Vadodara. A number of 250 subjects (boys) aged 10-14 years were selected from Baroda Football Academy in Gujarat, accredited by All India Football Federation (AIFF) by purposive sampling. The targeted subjects fulfilling the inclusion criteria were chosen after taking their ascent from parents.

Semi-structured questionnaire was used to assess the socio-demographic profile and consumption pattern of processed packaged foods among the subjects (N=250, ≥ 10 years). Kuppu Swami scale was used to assess the socio-economic status of individual. Dietary assessment was assessed by using 24- hr dietary recall method. Information on dietary intake was collected on three consecutive days. Thereafter, the entire information was elicited through anthropometric measurements, body composition and fitness status of the subjects. Schematic design of this phase is shown in the Figure 3.1.1.

Figure 3.1.1 Schematic diagram representing design of Phase I



3.1.1: Ethical clearances

The study has been approved by the Institutional Medical Ethics Committee of the Department of Foods and Nutrition, The Maharaja Sayajirao University of Baroda and granted with the Institutional Medical Ethics Committee No. IEHCR/2018/21. Informed written ascent was taken from all the willing respondents. The informed written consent form was as per WHO informed consent guidelines prior to enrolment in the trial. The football players and their family members were informed about the study.

3.1.2: Estimation of the sample size for the study

The primary objective of this phase was to generate database on nutritional status of football players by dietary intake, anthropometry, body composition and fitness status. According to Baroda Football Academy, based on inclusion criteria, total population was 500. So the sample size was estimated by the formula (Taro Yamane, 1970):

$$n = \frac{N}{1 + N (e)^2}$$

Where, n= Required Sample size

N= Total Population

e = 95% CI or 0.05 error

On plugging all of these above values into the equation, the sample size arrived at 222 and an extra buffer was set aside to counter balance the dropout. Thus, the final sample size came out to be 250.

3.1.3: Selection of study participants

To execute the study, the sample comprised of a number of 250 players falling in the age range between 10 to 14 years. The football players attending Baroda Football Academy in Vadodara were enrolled for this phase during the time period of October 2018 to May 2019.

Prior written permissions were sought from the academy and further with coaches for visiting the academy as per scheduled timings. Subjects were first informed about the purpose of study. Football players were informed that on their inclusion in the study, their nutritional status report and Nutrition Health Education material will be provided

free as the study incentives. The clarification was made that under no circumstances the subjects be held liable for bearing any financial charge towards the nutritional status, fitness and body composition profiles or nutrition health education material on participating in the study.

The interested subjects were handed and briefed over the consent form prepared based on WHO guidelines for the consent approval. After satisfying the queries of the subjects, each of them were asked to thoroughly read and then give their written informed ascent before enrolment into the study. The subjects fulfilling the inclusion criteria were enrolled in the study.

3.1.4: Inclusion and exclusion criteria for the study subjects (N=250)

Inclusion Criteria

- Subjects playing football for 1 year and more.
- Subjects 10 years to 14 years of age.
- Willing to participate
- Academy players of Baroda football academy.

Exclusion Criteria

- Subjects less than 10 years and above 14 years of age.
- Subjects suffering from any chronic diseases condition
- Differently abled
- Those not willing to participate

3.1.5: Demographic profile of the subjects

The written ascent was taken from willing respondents and were categorized according to age groups. Demographic profile was taken by using standardized tool which included information on age, sex, educational level, occupation, religion, marital status, type of family, per capita income etc. The entire information was elicited through one-to-one interviews.

3.1.6: Anthropometric measurements

Anthropometry is the measurement of the physical dimensions characterising skeletal and tissue development and effect of relationship between the nutrient and level of well-being of the body is assessed. The anthropometric measurements were conducted by using standard methods.

1. **Weight:** Weight is the most widely used and reproducible anthropometric measurement. It indicates the body mass and a composite of all the body constituents like water, minerals, fat, protein, bone, etc. (Robinson et al 1998). A platform weighing scale to the nearest 100 g was used to measure the weight. The subject was weighed in standard indoor clothing, bare feet and without leaning against or holding anything. Scale was 'zeroed' before taking any weight, and was calibrated using standard weights at regular interval.

2. **Height:** It is a linear measurement made up of the sum of four components, i.e. Legs, Pelvis, Spine and Skull (Jellife 1966). Non-stretchable fibre glass tape was used to measure the height of the subjects. A convenient flat wall was identified at the play ground for the measurement of the height. The football players were asked to stand barefoot with the arms hanging freely by the side. Heels of the feet were placed together, the scapula and the buttock were ensured to be in contact with the measuring wall. The head was held in the Frakfort plane. Height was recorded to the nearest 0.1 cm after the subject inhaled fully and maintained the erect position. In this position, a mark was made on the wall and height was recorded with a measuring tape. Two consecutive readings were taken.

3. **Waist circumference:** The subject was made to stand erect with the abdomen relaxed and arms at the sides. The circumference was recorded using the tape at the narrowest part of the abdomen between the ribs and iliac crest.

4. **Hip circumference:** Hip circumference (HC) was measured at the point yielding the maximum circumference over the buttocks. The measuring tape was placed around the buttocks in a horizontal plane at this level without compressing the skin.

5. **Body Mass Index (BMI):** WHO Anthro plus software was used to get BMI.

3.1.7: Dietary assessment

1. Food Frequency questionnaire (FFQ):

Food frequency questionnaire was used to assess the consumption pattern of processed packaged foods. The comprehensive listing of foods were enlisted. The frequency of their consumption was acquired as per daily, two/three times a week, four/five times a week, once a week, occasionally and never basis (Appendix).

2. 24 hr Dietary Recall:

The 24 hr dietary recall obtained from the individuals can be used to describe the foods that respondents consume on a typical day basis. A consecutive three day 24-hr dietary recall was taken (Appendix V). The questionnaire was administered by the interviewer to minimise the error. The 24 hr dietary recall is used to estimate an individual's food intake over a 24 hour period, referring to the previous day/night. All the subjects were asked for their 24 hour dietary recall to elicit information on the intake of nutrients as calories, proteins, fats, carbohydrates, calcium and iron. The subjects had to report of all the meals consumed throughout the previous day and the consumption of sweets, beverages, pickles, snacks, etc. was also recorded with addition sugar or salt, if any. The standardised cups and spoons were shown before the respondents who were then encouraged to respond to the quantity, number and size of the food item consumed on its basis. The nutrient content of the diet was calculated by the ICMR food composition tables as described in the 'Nutritive Value of Indian Foods' (Gopalan et al 2004) by using DietCal software.

3. Food choice questionnaire

The questionnaire was used to procure data on factors affecting food choice of football players. Health, mood, convenience, sensory appeal, natural content, price, weight control, ethical reasons etc. were the main components included in the questionnaire (Appendix).

3.1.8: Fitness assessment

SAI Football skill test battery was used to elicit information on fitness. The test consists of the following three test items:

1) 30 metre running with football

This test was used to assess the speed and football control while running by the players.

Equipments: A stopwatch, 6 footballs, marking powder and measuring tape.

Protocol:

- ✓ Two straight lines, 30 metre apart were marked on the field.
- ✓ The players were instructed by coach to stand behind a marked line without touching line along with football placed on line.
- ✓ On the signal Go, players were asked to run with ball as fast as possible to reach the 30 metre finish line, by pushing the ball with leg control and by making a minimum of four inches with the ball at each touch.
- ✓ Time was measured from the interval of starting "Go" until both ball and the player reached to the finish line.
- ✓ Players had to continue this until they failed to reach the line before the beep for the second time.
- ✓ Each subject was given two attempts at an interval of 30 seconds and the best performance was recorded.

2) Kicking Accuracy Test

This test was aimed to assess the kicking efficiency of the football players..

Equipments: A football goal post, inflated footballs, marking powder, a tape and two ropes.

Protocol:

- ✓ The goal post was divided into three equal parts by fixing two ropes.
- ✓ A football was placed at the penalty mark (11 metre distance from goal line).
- ✓ The subjects were given ten attempts (4 to kick the ball in left part, 4 to right part and 2 to middle part of the goal) in the following sequence: First 2 kicks into the right part followed by 1 kick in the middle part of goal followed by 2 kicks to left part, and repeating the same pattern for the remaining 5 kicks.

- ✓ The ball was required to cross the goal line in the air to have desired speed and strength in the kick.
- ✓ The number of correct kicks into designated parts of the goal was recorded.

3) Juggling Test

The juggling test was used to assess the balance ability, agility, reaction ability and sense of touch of the ball.

Equipments: Three footballs

Protocol

- ✓ The players were instructed to keep the ball in the air by juggling continuously and were also informed that they can use any part of the body except hand while juggling (foot, thigh, chest, head).
- ✓ For starting the juggling, the players were allowed to throw the ball in air or bounce the ball on floor and start juggling till the subject is able to juggle the ball without dropping it on the ground.
- ✓ The number of touches made by subjects continuously was converted into points.

Table 3.2.8.1: SAI football skill test scoring table

Age (years)	30 Metre running test	Kicking test (No.)	Juggling test (No.)	Score
10	6.40 and less 6.41 to 6.50 6.51 to 6.60	6 5 4	8 7 6	3 2 1
11	6.20 and less 6.21 to 6.30 6.31 to 6.40	7 6 5	10 9 8	3 2 1
12	6.00 and less 6.01 to 6.10 6.11 to 6.20	8 7 6	12 11 10	3 2 1
13	5.70 and less	9 8	15 14	3 2

	5.71 to 5.80 5.81 to 5.90	7	13	1
14	5.50 and less 5.51 to 5.60 5.61 to 5.70	9 8 7	20 18 16	3 2 1

4) Sit and Reach Test

The objective of this test was to monitor the development of the athlete's lower back and hamstring flexibility.

Protocol:

- ✓ Players were asked to remove their shoes and place the foot against the box.
- ✓ After that they had to place one hand on top of the other and slowly bend forward and had to reach along the top of the ruler as far as possible holding the stretch for two seconds.
- ✓ The investigator had to record the distance reached by the player finger tips in (cm).
- ✓ They were asked to perform the test three times and the average of the three distances was used to assess the performance.

Table 3.2.8.2: Health Norm Ranges for the 90 degree Sit and Reach Test

Age (years)	Boys	Girls
10	4-10	4-10
11	6-13	6-12
12	10-15	7-12
13	12-17	8-12
14	15-20	8-12

FITNESSGRAM Test Administration Manual, Fourth edition, by The Cooper Institute, 2007

5) Harvard Step test modification for school children

This test was used to assess the cardiovascular endurance of the players.

Equipments: a stopwatch, 14 inch high bench, tape recorder, pulse oximeter

Protocol:

- ✓ The players were asked to step up by starting the stopwatch at the signal "Go" and step down in consonance with counting the pace up-up-down-down, 30 times a minute for upto 3 minutes for children between 8-15.
- ✓ After the exercise was performed, exactly after 1 minute the pulse rate was recorded

Table 3.2.8.3: Step up test score

Age	Score	Condition
8-10 years	Upto 55 56 57 and above	Poor Average Good
11-15	Upto 60 61 62 and above	Poor Average Good

Source: Brouha and Ball (1952)

3.2.9: Body composition assessment

Four spot formula by Durnin and Womersley was used to get body composition data of the players by using skin fold measurements.

1) Triceps skinfold width

It is the thickness of the double layer of skin plus subcutaneous fat on the posterior side of the upper arm over the triceps muscle, in the middle of upper-arm.

Protocol:

- ✓ Subjects were asked to stand at ease, with hanging naked arms.
- ✓ The midpoint of the upper arm was marked. The skin and subcutaneous fat fold was picked at about 1 cm above the marked level on the posterior side of upper arm over the triceps muscle.
- ✓ The jaws of calliper was applied on the fold and readings were noted from the dial of calliper about two seconds after leaving the smaller arm of calliper when the reading was stable.

2) Biceps skinfold width

At the level of the mid-point between the acromiale and the radiale, on the mid-line of the anterior (front) surface of the arm (over the biceps muscle).

Protocol:

- ✓ Subjects were asked to stand at ease, with hanging naked arms.
- ✓ A vertical pinch, parallel to the long axis of the arm, was made at the landmark.
- ✓ The skin and subcutaneous fat fold was picked at about 1 cm above the marked level and then the jaws of calliper was applied on the fold and readings were noted from the dial of calliper about two seconds after leaving the smaller arm of calliper when the reading was stable.

3) Supra-iliac skinfold width

It is the thickness of the double layer of skin plus subcutaneous fat over the iliac spine,on the left lateral side of the abdomen.

Protocol:

- ✓ A skinfold was lifted about 1 cm above and 2 cm medial to the anterior superior iliac spine on the left side.
- ✓ The jaws of calliper was applied on the fold and readings were noted from the dial of calliper about two seconds after leaving the smaller arm of calliper when the reading was stable.

4) Subscapular width

It is the thickness of double layer of skin plus subcutaneous fat on the anterior side at the middle of thigh exactly at the level of thigh circumference measurement.

Protocol:

- ✓ The subjects were asked to sit on table with naked middle thigh with legs hanging freely.
- ✓ The skinfold was picked at a level about 1 cm superior to marked middle point of thigh.
- ✓ The jaws of calliper was applied on the fold and readings were noted from the dial of calliper about two seconds after leaving the smaller arm of calliper when the reading was stable.

Table: Body composition classification

Classification	Body Fat (%)
Very High	25% or more
High	20 % or more but < 25%
Normal	10 % or more and less than 20%
Low	Less than 10 %

Table 1: Tools and Techniques (Phase-I)

Parameter	Indicators	Methods
Sociodemographic	-	Pre-tested questionnaire
Nutritional status	Anthropometry	Standard method for height, weight, waist circumference and hip circumference
	Body composition	Skinfold thickness
	Dietary intake	24-hr dietary recall (1 day) and semi structured food frequency questionnaire
	Food choice	semi structured questionnaire
Fitness status	Cardiorespiratory endurance	Harvard Step test modification for school children
	Flexibility	Sit and Reach Test
	Skill	SAI football skill test

PHASE II: MARKET SURVEY OF PROCESSED FOODS AND SPORTS SUPPLEMENTS

3.1.1: Market survey of processed foods

The exploratory phase of the study included inspection of processed packaged foods in the famous retail store (N=1) of Vadodara to meet the following objectives.

- To examine in detail various components of food labels of processed packaged foods and sports supplements.
- To evaluate reported various components of food labels for their compliance with Food Safety and Standards Act (FSSA) of India and Codex Alimentarius.

Figure 3.1.1: Schematic diagram representing survey of processed packaged foods

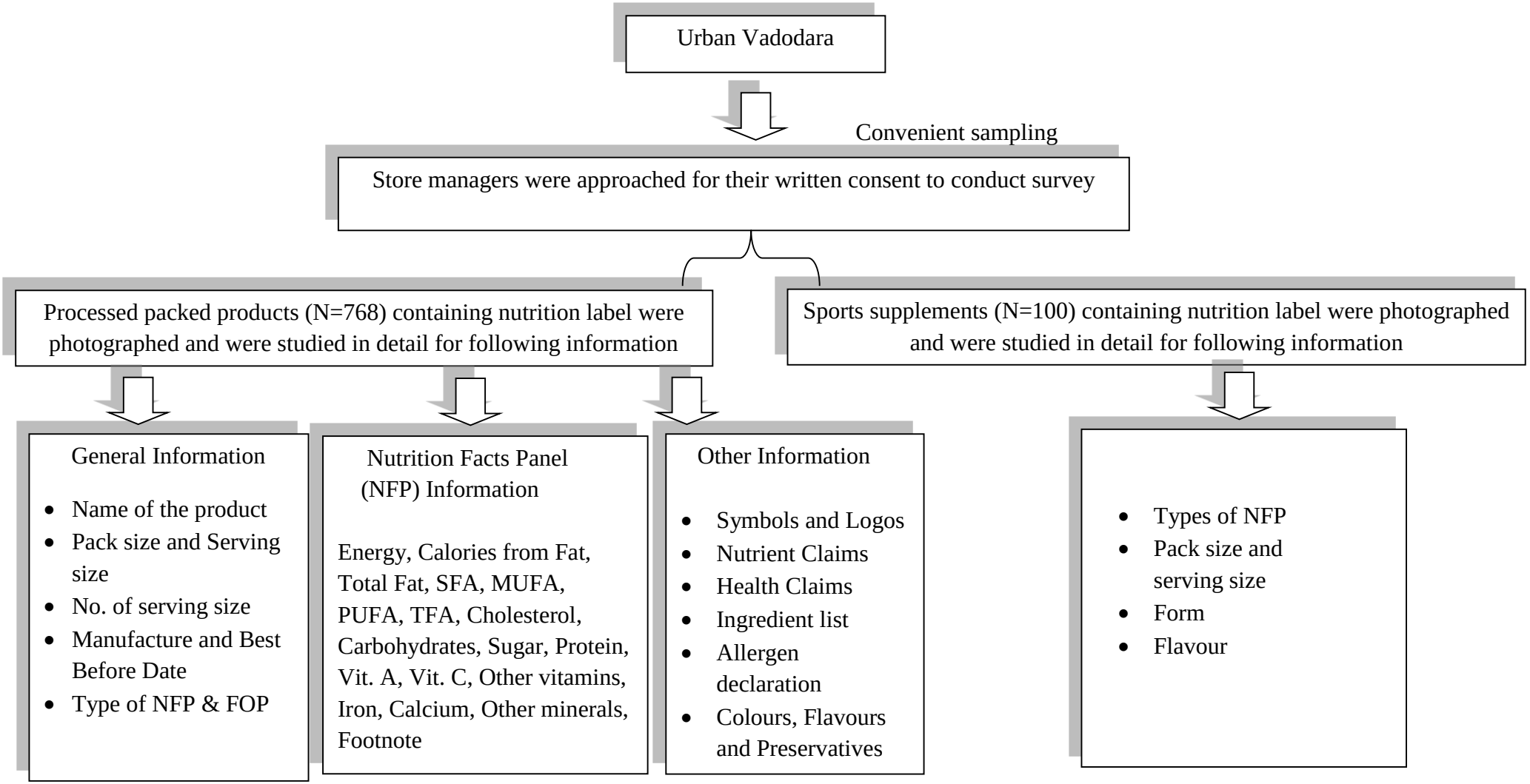


Table 3.1.1.1: Processed Packaged foods examined for food labelling

No.	Food Groups	Food Categories	No. of Products
1	Beverages (N=73)	Fruit and vegetable juices	44
		Soft drinks	6
		Coffee and tea	7
		Electrolyte and Sports Drink	5
		Fruit drink mix	11
2	Bread & bakery products (N=110)	Biscuits	98
		Cakes, muffins & pastry	12
3	Cereal and cereal products (N=163)	Cereal bars	47
		Noodles	20
		Breakfast cereals	62
		Pasta	30
		Rice	2
		Maise	2
4	Confectionery (N=83)	Chocolates	83
5	Convenience foods (N=62)	Soup	13
		Ready meals	49
6	Dairy (N=41)	Cheese	15
		Yoghurt products	7
		Milk	19
7	Fruit and vegetables (N=33)	Vegetables and fruits	9
		Jam and spreads	24
8	Snack foods (N=56)	Crisps and snacks	56
9	Sauces and spreads (N=147)	Sauces	82
		Mayonnaise/dressings	34
		Spreads	31
	TOTAL		**(N=768)**

In total 768 products were enlisted and were categorized into 10 food groups and further into 25 food categories based on George institute for global health as shown in table 3.1.1.1. One grocery store agreed and participated in survey. Each processed packed product was photographed and was entirely examined in detail regarding food labelling. Standardized proforma (Annexure) was used to elicit the data for the information like serving size, size of packet, Nutrition Facts Panel, Symbols and Logos, Nutrient Claims, Health claims, Ingredient list, Allergen declaration, Colours, Flavours and Preservatives etc.

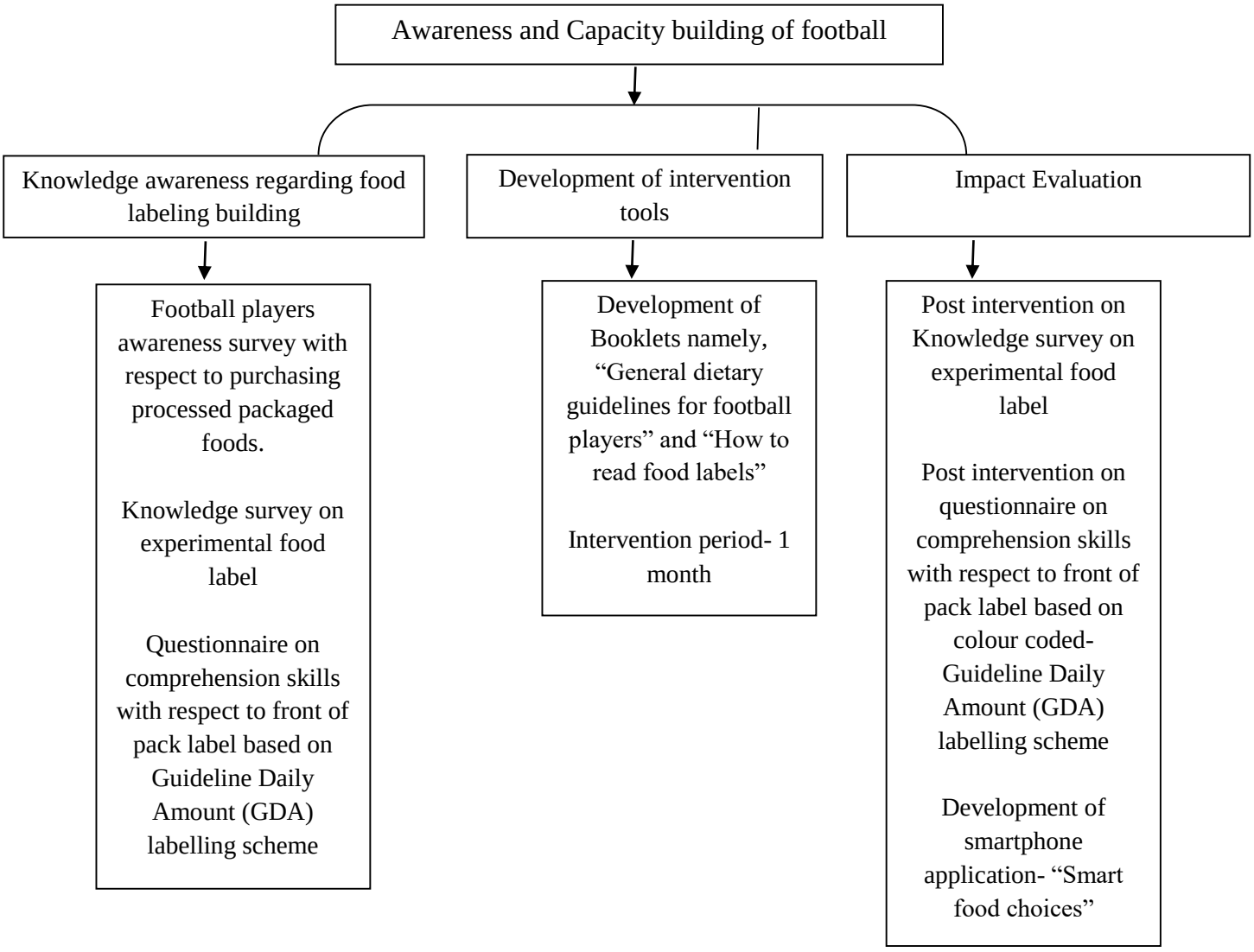
3.1.2: Market survey of sports supplements

The store managers were approached for their written consent to conduct the survey. Five stores from Vadodara, gave consent for the study. Sports supplements (N=100) were categorized based on major nutrient content. It was carried out in the stores in Vadodara, in order

- To enlist various types of the supplements across the brands.
- To explore types of the supplements available in market

PHASE III: FOOTBALL PLAYERS AWARENESS AND CAPACITY BUILDING ON FOOD LABELING

Figure 3.3.1: Schematic diagram representing football players awareness and capacity building on food labelling.



This phase of the study was conducted in three sub-categories as given below:

3.3.1: Players awareness and practices survey regarding food labeling

The survey was done in order to elicit information regarding players knowledge and practices with respect to choice of processed packaged foods and understanding of food labels. A thorough assessment was carried out for all the players (N=250) with the help of a pre-tested questionnaire (appendix 6). The questionnaire consisted of four major sections; selection of processed packaged foods, knowledge regarding various components of food labels and comprehension skills on both, Guideline Daily Amount (GDA) labelling scheme and various types of NFP. It consisted of close ended multiple choice responses or simple yes or no responses. For the assessment of KAP, the scores enlisted in the tables were assigned and a total KAP score was further categorised as low, average or high (table 3.4). Four different types of Nutrition Facts Panel (Table:) were included in questionnaire. They were different with respect to nutrient information and format. Players had to decide which one is healthier.

Table: Knowledge index on various components of food labels.

Thrust areas	Minimum score	Maximum score
General information	0	9
Symbols/logos	0	1
Claims	0	3
Ingredients	0	3
Total Score	**0**	**16**

Table: Knowledge index on (GDA) labelling scheme

Thrust areas	Minimum score	Maximum score
GDA labelling scheme	0	16
Total Score	**0**	**16**

Table 3.4: Classification and category of KAP and (GDA) labelling scheme scores

Category	Percent Score
Poor	<25
Average	25-50
Good	50-74

B) Comprehension Skills

This section dealt with assessing information on players ability to comprehend food labels. Four different types of Nutrition Facts Panel were included in questionnaire. They were different with respect to nutrient information and format. Players had to decide which one is healthier.

Table 3.3.1.1 Description of Nutrition Facts Panel (NFPs)

NFPs	Type of NFPs
1	Per 100 g
2	Per 100 g and Per Serving
3	Per 100 g , Per Serving and % Daily value
4	Per serving and % Daily value

3.2.2: Development of intervention tools and capacity building of the subjects

The part of this phase dealt with development of Nutrition Health Education (NHE) material which was used as a ready reckoner for players in order to make a healthy food choice. A coloured pictorial booklet in english having two parts was prepared on ' A GUIDE TO SPORTS NUTRITION for football players' , one part of which contained information related to nutrition strategy formulation, food groups, food pyramid, nutritional requirements, pre-during-post game meals, etc. and second part of booklet contained information with respect to how to understand and comprehend food labels. Various aspects of food labeling namely, FOP labeling, BOP labeling, nutrition and health claims, ingredient list, NFP, allergy declaration, etc. were included. The booklet was given to all the players enrolled in the study.

Capacity building of the players was purposively done as the consumption of processed packaged foods was seen highest in this age group. New healthy food habits can be incorporated and continued throughout life time and unhealthy food habits can be modified easily at this age. Nutrition education videos regarding food labelling were shared to enhance their capacity building in order to make healthy choice. Videos included information regarding various components of food labels, types of health claims and nutrient claims, importance of symbols and logos, significance of order of ingredients in the ingredient list, allergen information, how to interpret various types of NFP and FOP, etc.

3.2.3: Impact evaluation after intervention

It was hypothesized that the booklet and videos will bring about the favourable changes in the knowledge score and aid in selection of healthy options. Under this section, the impact of intervention on knowledge and comprehension skills of the football players was assessed by using pre tested questionnaire (Annexure) For post data collection, colour coded Guideline Daily Amount (GDA) labelling scheme was used.

The filled in questionnaire were coded and statistically analysed using Microsoft Excel 2007. The results of pre and post intervention were compared to evaluate the change in knowledge and comprehension skills among the football players.

3.2.4 Development of Smart phone application

The smartphone application was developed with the title " Smart food choice " published on Google Play Store. The content was finalized based on the data procured from Phase I. The application was created with the help of software engineer. The details of the application are as follows:

❖ **Description**

The smart food choice application was developed to enable the consumers to make smart healthy food choices from the available options. Two options were available, either consumer can scan the barcode of the product or can use search option to compare the product and make smart decision.

❖ **Salient features of the application**

Smart food choice application was developed to help to get immediate, easy-to-understand nutritional information about processed packed products. Each product seen in the application had been rated for its amount of Total Fat, Saturated Fat, Sugar and Salt. The traffic light indicated whether a product is low (green), medium (amber) or high (red) in the above nutrients based on the concept of colour coded GDA labeling system. Grey colour would be displayed if data has not been reported by the manufacturer.

Statistical analysis

The data was entered in Microsoft Excel 2007 and analysed in SPSS 17.0 version (SPSS, Chicago, IL, USA) and Epi Info 3.4.1

- ✓ The quantitative (continuous) variables were presented as mean (student t test) ± standard deviation.
- ✓ Frequencies and percentages were used to derive the quantification of responses of categorical variables.

- ✓ Pearson correlation was used to define the strength of the association between variables (+1= perfect positive correlation, -1= perfect negative correlation).
- ✓ To assess the impact of intervention, paired t-test was used.