ASSOCIATION BETWEEN TELEVISION FOOD ADVERTISEMENTS AND HIGH FAT SALT SUGAR (HFSS) FOOD CONSUMPTION AMONG SCHOOL AGE CHILDREN

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ASSOCIATION BETWEEN TELEVISION FOOD ADVERTISEMENTS AND HIGH FAT SALT SUGAR (HFSS) FOOD CONSUMPTION AMONG SCHOOL AGE CHILDREN

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CERTIFICATE

This is to certify that the research work present in this thesis has been carried out independently by Ms. Vaibhavi Shinde under the guidance of Dr. Shonima Venugopal in pursuit of the Degree of Masters of Science (Family and Community Sciences) with major in Foods and Nutrition (Dietetics) and this is her original.

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LIST OF ABBREVATIONS

ADA	American Diabetic Association
BMI	Body Mass Index
BP	Blood Pressure
CVDs	Cardio Vascular Diseases
DALYs	Disability Adjusted Life Years
FSSAI	Food Safety and Standards Authority of India
GBD	Global Burden of Diseases
HDL	High Density Lipoprotein
HFSS	High Fat Salt and Sugar
IOTF	International Obesity Task Force
LDL	Low Density Lipoprotein
LIG	Low Income Group
MIG	Middle Income Group
MS-ATP	Metabolic Syndrome-Adult Treatment Panel
MS-IDF	Metabolic Syndrome-International Diabetes Federation
MWCH	Ministry of Women and Child Development
NCDs	Non-Communicable Diseases
NFHS	National Family Health Survey
RDA	Recommended Dietary Allowances
SDI	Socio Demographic Index
T2DM	Type 2 Diabetes Mellitus
TRP	Television Rating Points
UIG	Upper Income Group
VLDL	Very Low-Density Lipoprotein

ABSTRACT

ABSTRACT

Childhood obesity previously was considered to be a problem of developed countries, but its prevalence has been found to be increasing in middle and low-income countries. In India a large proportion of overweight children coexist along with an enormous proportion of malnourished children. It is predicted that there will around 17 million obese children in India by 2025. Urbanisation, sedentary lifestyle, dietary factors, socio-economic factors, parental education and occupation are some of the important factors linked to obesity. Diet is one of the important precursors of overweight, obesity and development of non-communicable diseases. Regular consumption of high in fat, salt and sugar (HFSS) foods like noodles, pizza, chocolates, chips etc which are low on nutrients has become a common feature in the diets of children. Easy availability and access to HFSS food is a contributing factor to the increasing burden of childhood obesity. Being obese in childhood places children at risk of becoming obese adults and having associated conditions like diabetes, cardiovascular disease and cancer. In order to control the consumption of HFSS foods by children there is a need to intensify efforts to sensitize children about making healthy dietary choices in order to avoid the development of obesity and its associated disease conditions.

Thus, with this background, the present study was planned with the following objectives:

1) To analyse the type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels. 2) To study the association between television food advertisements and consumption of HFSS food by school age children. 3) To assess the physical activity pattern of school age children using 3-day physical activity recall. 4) To study sedentary behaviour (watching TV, playing video games, using internet for leisure, sitting while talking on the telephone or texting etc) in school age children.

In phase I, five channels popular across kids and five channels popular across genres was selected according to TRP and responses given by children during pre-testing of questionnaire. The selected channels popular across kids are Disney channel, Hungama, Cartoon Network, Pogo and Nick. Selected

channels popular across genres were Star plus, Colors, Sony, Sab and Star gold. Majority of the food advertisements showed on Disney channel (44.6%), Hungama (67.8%), Cartoon Network (74.2%), Pogo (76%) and Nick (74.9%) were of HFSS foods like pop rings, instant noodles, candies, breakfast cereals like chocos, biscuits, cookies, cake and ice-creams respectively. On general viewing channels like Star Plus, Colors, Sony, Sab and Star Gold 58.5%, 63.5%, 58.5%, 48.7% and 66.3% advertisements were related to HFSS food products from total food products showed on television. Though the proportion of food related advertisements on general viewing channel was slightly less as compared to kid's channel. Majority of the advertisements telecasted on kid's channels were related to candies and chocolates (22.86%), followed by biscuits and cakes (20.98%) and ready to eat food (19.7%) respectively. Around 21.98% advertisements have humor effects, followed by celebrity endorsement (15.75%), free gifts like toys inside the products (13.81%) and jingles (13.14%) to attract children.

In phase II, the association between television food advertisements and consumption of HFSS food by school age children was assessed among children who gave their consent to take part in the study. Data was collected using a self-administered online questionnaire. Information related to anthropometric measurements, 3-days physical activity recall, sedentary behaviour, HFSS food consumption and 3-day breakfast consumption pattern of children was collected. From 319 total subjects 5.3% subjects were under thin category, 61.1 % subjects were normal, 26% were overweight and 7.5% subjects were obese. Around 70.6%, 81.7%, 71.9% and 83.33% of thin, normal, overweight and obese children reported HFSS food consumption in the last 24hours respectively. About 66.8% subjects reported that they get information related to HFSS food through television advertisements and 59.3% subjects said that they like to try out the new food products showed in television advertisements. Different properties are used by the advertisers to attract children towards the product. Around 40.9% subjects reported that they are attracted toward humor effects shown by television advertisements followed by animation (40.1%), visual effects (36.5%) and jingles (30.1%). Almost 55.9% children have not heard about HFSS foods. Children were

spending more amount of time in watching television on a holiday (2.4 hours) as compared to a school day (1.3 hours). Screen time was observed to be greater than or equal to 5 hours among 90.3% subjects on school day as compared to holiday (58.5%). Around 36.93% subjects were consuming HFSS food products in breakfast. Low physical activity was observed among subjects. A large proportion of obese subjects (40%) were leading a sedentary lifestyle followed by normal subjects (32.86%), overweight subjects (30.15%) and thin subjects (25%). Only 2.79% normal subjects, 3.17% overweight subjects and 6.6% obese subjects were leading a physically active lifestyle. No significant difference was found in PAL values with respect to nutritional status. Girls were significantly more active in comparison to boys ($p<0.001$). Younger children were found to be significantly more active than older children ($p<0.001$).

Thus, it can be concluded that a lot of advertisements related to HFSS foods are being telecasted on different channels and this could be associated with an increased consumption of HFSS foods by children which in turn may lead to an increase in the prevalence of obesity among children. Thus, there is a need to enforce existing laws regulating advertising of HFSS food products. In order to reduce the consumption of HFSS foods among children, a need is felt to make children aware about the ill effects of HFSS foods. Children should be encouraged to increase physical activity and reduce sedentary behaviour.

INTRODUCTION

INTRODUCTION

In the past decades of 20th century, population has shown a huge shift in their diet, they have increased the intake of processed foods, eating outside and high usage of edible oil and sugar-sweetened beverages. The lifestyle of people has also been changed, with increase in sedentary behavior and reduction in daily physical activity. The effects of these transitions were not recognized early until diseases like hypertension, diabetes and obesity began to increase worldwide. Now a rapid increase has been seen in the number of people suffering from overweight and obesity from rural and urban areas of low income countries to population in countries with high income (Popkin et al, 2011).

According to a statement given by The Obesity Society, "[o]besity is a multi-casual chronic disease recognized across the life-span resulting from long-term positive energy imbalance with development of excess adiposity that over time leads to structural abnormalities, physiological derangements, and functional impairments. The diseases of obesity increase the risk of developing other chronic diseases and is associated with premature mortality. As with other chronic diseases, obesity is distinguished by multiple phenotypes, clinical presentations and treatment responses" (Jastreboff et al, 2019). Overweight and obesity is abnormal or excessive fat accumulation in the body which is risk for health. Obesity is the result of an imbalance between daily energy consumption and energy expenditure. Obesity is caused by many factors which can be genetic, cultural, societal, reduced physical activity, insomnia, poor food habits, endocrine disorders, medications, and an imbalance in energy metabolism (Lopez et al, 2006).

It was calculated that by 2008 there would be 1.5 billion overweight and obese adults all over world. Another estimate made according to new data shows that in 2030 there would be 2.16 billion overweight adults and 1.12 billion obese adults worldwide (Kastorini et al, 2011). World Health Organization has declared obesity as one of the most neglected disease. According to World Health Report of 2002 overweight is the fifth most serious factor for both developed countries and low mortality developing countries. A report by

International Obesity Task force (IOTF) in the year 2000 shows that 10% of the young people aged 5-17years were overweight globally, from this 10% population 2-3% young people were obese (WHO 2000). According to the World Health Organization obesity has tripled since 1975. In 2019, 38.2 million children below 5years of age were overweight or obese. Since 2000 the number of overweight children under 5 years of age has been increased nearly by 24% in Africa. From all the overweight children below 5years of age half of them lived in Asia. In 2016 it was found that more than 34 million children of 5-19 years age group were overweight or obese. Prevalence of overweight and obesity has been increased drastically among children of 5-19years of age group from 4% in 1975 to 18% in 2016. Around 18% girls and 19% boys of 5-19years of age group were overweight in 2016. In 1975 below 1% children and adolescents of 5-19 years were obese, while in 2016 more 124 million children were reported to be obese (WHO 2016). Figure 1.1 shows that according to atlas of childhood obesity China will be having the highest number of obese children of age group 5-19years in 2030 followed by India with 27,481,141 obese children (Atlas childhood obesity, 2019).

1.1 NATIONAL PREVALENCE OF OBESITY

In a systematic review done by Ahirwar and Mondal, it was found that there was a constant rise in the prevalence of obesity in India from the year 1998 to 2018 due to sedentary lifestyle and intake of calorie dense food and obesity has a direct linkage to cardiovascular diseases. High prevalence of obesity was seen in population residing in urban areas, high socioeconomic states and in South India (Ahirwar and Mondal, 2019).

A study by Asthana et al was done to understand the prevalence of underweight, overweight and obesity among Indian women through a comparison between NFHS 2,3 and 4 data. The study reported that overall prevalence of overweight and obesity has been increased among women over different survey years. Higher burden of obesity was seen in urban areas (9.1%) as compared to rural areas (3.1%) (Asthana et al, 2019).

FIGURE 1.1 PREDICTED NUMERS OF OBESE CHILDREN BY 2030

Predicted numbers of children with obesity in 2030

Numbers of children age 5-19 years old living with obesity, predicted for the next decade.

Year	2020	2025	2030
World	**158m**	**206m**	**254m**

Countries predicted to have over 1 million school-age children and youth living with obesity in 2030.

Country	Number of persons with obesity, aged 5-19, 2030	Country	Number of persons with obesity, aged 5-19, 2030
China	61,987,920	Vietnam	1,939,173
India	27,481,141	Ethiopia	1,926,697
United States of America	16,986,603	Saudi Arabia	1,864,250
Indonesia	9,076,416	Malaysia	1,770,631
Brazil	7,664,422	Sudan	1,757,471
Egypt	6,818,532	Morocco	1,757,152
Mexico	6,550,276	Yemen	1,646,485
Nigeria	6,020,182	Venezuela	1,611,444
Pakistan	5,412,457	Colombia	1,583,123
South Africa	4,146,329	Syrian Arab Republic	1,552,255
Bangladesh	3,555,050	Kenya	1,463,954
Iraq	3,477,305	France	1,368,893
Turkey	3,389,941	Uganda	1,345,197
Philippines	3,376,420	Germany	1,318,415
Iran	3,023,603	United Kingdom	1,309,702
Algeria	2,703,722	Italy	1,307,765
Russian Federation	2,550,607	Myanmar	1,288,929
DR Congo	2,421,404	Afghanistan	1,286,177
Argentina	2,248,509	Guatemala	1,262,281
Tanzania	2,185,879	Canada	1,109,002
Thailand	2,152,598	Peru	1,079,543

WORLD OBESITY

Source: Atlas of Childhood Obesity, 2019

Incidence of overweight and obesity among children was considered primarily a disease of developed countries with higher income (Gupta et al, 2013). However, developing countries like India are also joining this pool due to increase in the change of food habits and life styles of people. India has a contradiction of being considered to be a fast weight gaining nation and is also struggling with malnutrition. This can be due to the new emerging socio-economic trends in childhood obesity in India (Chatterjee, 2002). There are various long-term effects of childhood obesity as it continues with adulthood along with different kinds of health risks (Wright et al, 2001). According to different studies the prevalence of childhood overweight ranges from 4% to 22% in India (Vohra et al, 2011; Gupta et al, 2011). Many factors are responsible for the increased numbers of overweight and obese children in India like lack of physical activity, increase in sedentary behavior like watching television or screen time, socio-economic status and living in urban areas. India is the third most obese country in world. According to National Family Health Survey-3, 15% of females and 14% male adults are considered as obese in India (Shete and Wagh, 2018).

Obesity among children and adolescents is related to various health conditions like cardiovascular diseases, accelerated atherosclerotic processes, elevated blood pressure (BP), atherogenic dyslipidemia, atherosclerosis, metabolic syndrome, type II diabetes mellitus (T2DM), cardiac structural and functional changes and obstructive sleep apnea (Raj, 2012). In South India the prevalence of overweight has been increased from 4.94% in 2003 to 6.57%. Mostly the overweight children were from urban regions and private schools. Incidenee of systolic and diastolic hypertension was found in 17.34% of overweight children (Raj et al, 2007).

Another study conducted in Chennai among school age children and adolescents shows higher prevalence of overweight or obesity among private school as compared to government schools according to IOTF criteria and Khadilkar criteria. More girls were found to overweight or obese as compared to boys similarly the prevalence of overweight or obesity was seen higher among adolescents in comparison to children (Jagadesan et al, 2014). A study was

conducted in Mysore to know the prevalence of underweight, overweight and obesity among children of age group 5-16years. Higher prevalence of obesity was observed among boys of 5-7years of age group in comparison to girls and among children from private schools as compared to government schools. The prevalence of obesity was found to be 3.4%, overweight to be 8.5% and underweight was 17.2% (Premanath et al, 2010).

A study by Mahajan (2018) shows the prevalence of overweight and obesity among school children of age group 6-12years in Puducherry. The prevalence of overweight and obesity was found to be 4.41% and 2.12% among children while female children belonging to urban areas and private schools were more prone to become overweight and obese.

1.2 REGIONAL PREVALENCE OF OBESITY

Due to a nutrition transition characterized by improved dietary habits, improvement in socio-economic status and increase in sedentary life style, a rise in the prevalence of overweight and obesity among the populations has been observed. The prevalence of overweight and obesity in Surat, Gujarat among students of age group 14-16 years was found more in students of upper income group (UIG) as compared to middle income group(MIG) and low-income group(LIG). A strong association was found between parent's education and their occupation, BMI and mode of transportation to school (Gamit et al, 2014). Another study by Alok et al shows high prevalence of obesity among adolescents of age group 14-16years in urban (14.6%) area as compared to rural areas (12.8%) of Surat City. Urban males were at higher risk of being overweight and obese (Alok et al, 2012).

A study conducted in Bhavnagar district by Mehta et al, reported 11.53% prevalence of obesity among first-year medical students. The prevalence of obesity was high among boys (7.69%) as compared to girls (3.84%). Around 7.70% subjects from the population were living a sedentary lifestyle (Mehta et al, 2016). The prevalence of obesity and overweight among children of age group 10-15years in Ahmedabad was found to be higher among less active group children as compared to high active group children, higher in group of

children who spent >2hours daily in front of television and computer, who took daily calories above RDA and those who were having parents' history of obesity (Thaddanee et al, 2016). The prevalence of overweight was 33.88% and obesity was 10.67% among school children of Mehsana District (Shah et al, 2013). Panchal et al found in their study, the prevalence of overweight and obesity was higher amongst children who was less active, who spent >2 hours daily in front of television and computer, who consume calories above recommended dietary allowance and among the students who consume more junk food (Panchal et al, 2019).

According to a study by Charan et al conducted among school going children of Surat city, total prevalence of hypertension was found to be 6.48%. The prevalence of obesity was higher in hypertension (8.7%) as compared to normotensive (1.1%). Many factors were found to be positively associated with childhood hypertension like family history of diabetes, ischemic heart diseases and obesity (Charan et al, 2011). A study by Vadera et al was conducted in Jamnagar city to know the prevalence of overweight and obesity among adults and the effects of dietary factor on the weight of the population. They have reported prevalence of overweight and obesity to be 22.04% and 5.04% in urban population. Dietary habits like total energy intake and snacking habit was found to be positively associated with weight gain (Vadera et al, 2010).

A study was conducted by Eshwar et al among school children of age group 8-18years in Rajkot City. Prevalence of overweight and obesity according to three different growth standards was found. The prevalence of obesity was found to be 14% according to Indian Association of Pediatrics (IAP), 11.1% as per WHO standards, and 5.1% by IOTF standards.

1.3 FACTORS CAUSING OBESITY

Many factors are responsible for weight gain in children and these multiple factors interact with each other to put the child at the risk of obesity. Globally, changes in the eating habits of the people with greater dependence on convenienee food and processed food, lack of consumption of fruits and vegetables and exercise are the contributing factors in the development of

obesity among children and adolescents. As a result of these changes taking place there is an increase in the cases of type 2 diabetes mellitus among children and adolescents of USA and many other countries (Kiess et al, 2003).

Factors like behavioral pattern of children such as preferring food high in fat, high percent fat intake, low levels of physical activity and high levels of sedentary behavior are responsible to put the children at risk of obesity (Davison et al, 2001). The dietary pattern of the children is the central factor for the development of obesity in children, as excess intake of calories relative to the energy expenditure of the child will result in storage of energy in body in the form of fat leading to excessive level of fat in the body (Bray and Popkin, 1998). Study shows that more preferences towards food high in calories may serve as risk factor for the development of obesity as these food leads to consumption of excess fat and energy while consumption of fruits and vegetables may serve as protecting factor for the development of obesity (Ricketts, 1997).

With the passage of years, the price of food has been decreased substantially relative to income and thus become more affordable to people. The concept of food has been changed totally to a marker of lifestyle and pleasure from a means of nourishment. Increasing physical activity is not the way to have an energy rich, poor nutritive diet. To counteract the calories of a single large sized children's meal one needs to do 1-2 hours of extreme vigorous activity (Styne, 2005).

Some other factors which contribute for the development of overweight and obesity among people includes economic development of the people which leads to increase in the purchasing power of the people due to which they can consume unhealthy foods which are rich in fat, salt and sugar, nutritional transition, improved socio-economic status and high sedentary lifestyle (Misra and Ganda, 2007). With increase in demand and use of personal vehicles, physical activity and exercise pattern of the children has been decreased drastically leading them to more sedentary lifestyle and making them obese (Musaiger, 2004; Anderson et al, 2006).

A study by Anuradha et al was conducted to know the prevalence of overweight and obesity among adolescent school going children and its relation with social and environmental factors. The prevalence of overweight and obesity was found to be 11.2% and 8.2% among boys while it was 10.3% and 4.8% among girls. High level of significance was found between obesity and parents education, sleep duration of child and income of the family (Anuradha et al, 2015). Another study conducted by Goyal et al on adolescent school going children of 12-18years age group shows higher prevalence of overweight (boys-14.3%, girls-9.2%) and obesity (boys-2.9%, girls-1.5%) among boys as compared to girls. The prevalence of obesity was reported to be more in families with high income group in comparison to families with middle income group while lowest prevalence of obesity was observed among low income group. Various factors like sleeping in afternoon, eating outside home in weekends, physical activity like exercise, sports, consuming energy dense food and family history of diabetes are the factors which are found to be associated positively with obesity (Goyal et al, 2010).

Time spent as leisure-time sitting is also linked to an increased risk for becoming overweight and obese (Bauman et al, 2012). Even individuals with normal BMI who lead more sedentary lifestyle are at greater risk for suffering from obesity related chronic health conditions and death as compared to physically active and fit overweight and obese individuals (Blair and Brodney, 1999; Lee et al, 1999). National Institute of Health, US stated that watching television for more than two hours per day is definite risk for obesity (National Institute of Health, US). A study by Thakor conducted in Ahmedabad among school children of Ahmedabad city have found overall prevalence of overweight and obesity to be 5.62% and 9.99% respectively. The prevalence of overweight and obesity was seen high among less active group children, children spending greater than 2 hours in front of television and among children who were consuming daily calories higher than RDA (Thakor, 2019).

1.4 CONSEQUENCES OF OBESITY

Obesity itself can be considered as a serious disorder apart from the different metabolic complications arising from it. Excess amount of body fat is followed

by systemic and functional abnormalities which have an impact on the lifestyle of individual, including many complications like gastrointestinal reflux diseases, gallbladder diseases, osteoarthritis, obstructive sleep apnea/obesity hypoventilation syndrome, psychiatric and eating disorders, anxiety and depression and poor physical performance. Obesity can also be a leading cause of some chronic diseases like T2DM, CVDs, joint and muscular disorders, psychological issues, respiratory problems which all together can affect the daily lives of the people and increase the mortality risk of obese individuals (Jastreboff et al, 2019).

Central obesity is linked with different kinds of metabolic disorders like dyslipidemia, hypertension, hyperglycemia and obesity (central abdominal obesity) collectively called metabolic syndrome as it is a constellation of comorbidities which increase the risk of development of T2DM by five times (Grundy, 2004; Alberti et al, 2009; Markey and NCD Risk Factor Collaboration, 2017). A principal causative factor of metabolic syndrome is obesity and the accumulated fat has increased oxidative stress which is an important pathogenic mechanism of obesity associated metabolic syndrome (Furukawa et al, 2017).

According to a study by Tandon et al, among Indian adolescent of urban region and it association with Indian adolescents. The prevalence of metabolic syndrome was found to be 4.3% according to MS-ATP (Adult Treatment Panel) criteria and 3% according to MS-IDF (International Diabetes federation) criteria. The prevalence was seen higher among girls as compared to boys. The most common factors among both MS-ATP and MS-IDF was found to be central obesity, followed by hypertriglyceridemia, low levels of HDL cholesterol, hypertension and dysglycemia (Tandon et al, 2013).

Type 1, type 2, maturity onset diabetes of the young, gestational diabetes, drug or chemical induced diabetes and diabetes related to damage in pancreas are all different classifications of diabetes mellitus. All these forms especially T2DM is linked to the presence of varying forms of obesity (ADA, 2014). Obesity around the abdomen area or abdominal obesity is one of the strongest risk factors responsible for the development of T2DM. T2DM among children has been increasing globally. T2DM was seen more in Asian children who were

overweight and obese. The first case of type 2 diabetes in UK was found in 2000 followed by eight obese girls of 9-16 years age group who were from Pakistani, Indian and Arabic origin (Ehtisham et al, 2000). In North India children suffering from T2DM were either obese or having abdominal obesity (Vikram et al, 2006).

According to a study by Franks et al conducted on American Indian children to know the effect of childhood obesity and other cardiovascular risk factors on adults. They reported that obesity, glucose intolerance and hypertension was positively associated with greater number of premature death due to endogenous causes (Franks et al,2010). According to a study conducted by Saha et al in-Kolkata city among children of 6-11 years age group, overweight and obese children have elevated blood pressure, altered lipid fraction and higher C-reactive protein as compared to non-obese children. Other than these insulin resistance, low levels of high density lipoprotein and hypertriglyceridemia was observed to be more in obese children. The prevalence of metabolic syndrome was reported to be 14.1% among obese children (Saha et al, 2011).

School children suffering from obesity and hypertension are having a huge impact on public health. A study from Gangtok, India reported prevalence of obesity to be 2.04% and overweight to be 14.5% as per WHO criteria. From all the subjects 5.62% were hypertensive and 24.11% were pre-hypertensive and majority of them were overweight (Kar and Khandelwal, 2015). A study conducted in Ludhiana among adolescent school children of age group 11-17years reports a rise in the prevalence of hypertension among younger age groups in urban area. The blood pressure keeps elevating frequently among obese individuals as compared to lean subjects. These is probably due to changes in the life style, altered eating habits, increase in the intake of energy dense food and lack of physical activity (Mohan et al, 2004). A study by Jagadesan et al conducted in Chennai among school age children and adolescents shows higher prevalence of hypertension among overweight or obese (20.4%) children as compared to non-obese children (5.2%) (Jagadesan et al, 2014).

Around 20-30% children suffering from obesity have increased systolic or diastolic blood pressure Data collected from past indicates that atherosclerotic cardiovascular disease starts in early childhood and is influenced by multiple factors like genetic as well as modifiable factors like environmental factors including obesity (Hayman et al, 2007). Childhood obesity is the steadiest factor for predicting adult heart diseases (Haji et al, 2006).

A study by Paralikar et al was conducted to know the effects of obesity on the pulmonary function of obese adolescent boys. They reported that lung function impairment was positively associated with the obesity. With increasing obesity among adolescents, the pulmonary functions deteriorate (Paralikar et al, 2012).

According to a survey conducted in North Carolina among overweight or obese children and young adults of age group 3-19years for the assessment of various cardio metabolic risk factors due to the severity of obesity. The survey reported that higher the severity of obesity higher will be the risk of decreased HDL cholesterol, increased systolic and diastolic blood pressure, increased triglycerides and glycated hemoglobin levels (Skinner et al, 2015). The common pattern observed for dyslipidemia in obesity is with high levels of triglycerides, low levels of HDL cholesterol and high or mildly increased LDL cholesterol. This pattern of dyslipidemia was observed in NHANES data among 42.9% children with BMI >95th percentile (Center for Disease Control and Prevention, 2010).

1.5 HIGH FAT SALT AND SUGAR FOODS (HFSS FOODS)

Definition of HFSS Foods in the context of school canteen and school children:- “HFSS foods may be defined as foods (any food or drink packaged or non-packaged) which contain low amounts of proteins, vitamins, phytochemicals, minerals and dietary fiber but are rich in fat (saturated fatty acids), salt and sugar and high in energy (calories) that are known to have negative impact on health if consumed regularly or in high amounts”. Diet is one of the important factors related to overweight, obesity and development of NCDs. The practice of regular consumption of food which is high in fat, salt, sugar and low in nutrient contents, e.g., noodles, chocolates, burgers, pizza,

pastries, patties, popcorn, etc. may have adverse effect on the health of children. The factors contributing to childhood obesity are easy availability and access to unhealthy food in school canteens and its vicinity (Ministry of Women and Child Development 2015).

According to 2011 dietary guidelines for Indians more preference should be given to traditional and home-made foods; and to avoid replacing meals with snack foods. Food items like burgers, pizza, fries, chocolates, ice-creams, etc. are not healthy food options to meet the nutrients needs so they should be consumed sparingly. Such food items are referred as Junk Foods and categorized as HFSS foods i.e. food which are high in fat, salt and sugar by WHO. Various factors responsible for the change in consumption patterns among all the classes of Indian society are globalization, rising per capita incomes, rapidly changing lifestyles and changing agriculture patterns. The nutritious balanced diet is getting replaced by HFSS foods at the cost of health. According to a study, the fast food industries are growing rapidly in India. Each year there is 40% increase in the industry of fast food (Goyal and Singh, 2007).

The HFSS food is getting popular among children and adolescents due to factors like easy to access, taste of the food, cheap price, friends' pressure, aggressive marketing and advertisements. A study was conducted to find out the eating pattern of school going children in 43 different schools of Delhi. In this study students studying in 6-12th standard was enrolled and they mentioned that advertisements play an important role while purchasing food (NIPCCD, 2008).

According to a study by Khongrangjem et al 31.87% subjects were having inadequate knowledge about the effects of intake of fast food. Majority of the subjects (72.5%) responded delicious taste of the food as the main reason for the consumption of fast food (Khongrangjem et al, 2017). A study conducted in north Chennai shows that children of 15 years of age were having high intake of fast food almost more than three times per day and were spending more than 100 rupees per day on junk food. Almost 98.1% children reported that they were getting influenced by the food outlets to consume more junk food which were present in and around their school (Purushothaman et al, 2015).

To reduce the consumption of food high in fat, salt and sugar FSSAI had launched Eat Right Movement on 10th July, 2018. The basic idea of Eat right moment was to slowly and steadily reduce the amount of fat, salt and sugar consumption from the daily food. In a video campaign actor Rajkumar Rao the pro bono ambassador of FSSAI recited the campaign tagline – 'Aaj se thoda kam'. WHO had started a new campaign named 'Replace Trans Fat'. It is an action package which provides a strategic approach for eliminating industrially produced trans-fat from national food supplies with the goal of global elimination of trans fat by 2023. Increased intake of trans fat is associated with increased risk of coronary heart disease mortality and events (WHO 2020).

The rise in obesity is increasing due to lack of physical activity as well as high intake of food items high in fat, salt and sugar (Institute of Medicine (IOM), 2006). Food advertisements are mainly promoting HFSS food and drink products to children and adolescents which is increasing the preferences and demands of the children towards their parents for purchasing the products advertised on television (Hasting et al, 2003, Institute of Medicine, 2006). Even health authorities agree that one of the main reasons for the consumption of unhealthy food among children is the unhealthy messages conveyed to the children through different television advertisements (Brownell and Horgen, 2004; IOM, 2006). Food industries are investing a major amount of money in advertising of food products on television (Harris et al, 2019). Food industries are also investing in different forms of advertisements like digital marketing, sponsorships, marketing among children in schools and in store marketing or packaging (FTC, 2012, Friedman 2017).

Every single day in US, children are viewing at least 15 television advertisements related to food (Federal Trade Commission, 2007) and almost 98% of these television food advertisements are promoting food products high in fat, salt and sugar (Powell et al, 2007). According to a study by Harris et al on the effects of television advertisements on eating pattern of the children and adults they have reported that children consumed 45% more food products when they have been exposed to different television food advertisements (Harris et al, 2009).

A study conducted in Singapore by Huang et al, reported that almost 33% advertisements shown on television were related to food or retail food outlets, which gives an average of 4.5 food advertisements telecasted per hour. Around 34% food advertisements were related to candy and confectioneries followed by 26% retail food outlets and 14% of milk and milk products. Among retail food outlets 45% advertisements account for fast food (Huang et al, 2011). According to a study by Katke on the impact of television advertisements on the health of the child and family spending in India, a positive association was found between buying behavior of children and hours spent on watching television and its impact on family expenditure (Katke, 2007).

A study was conducted in India among 100 adolescent girls studying in 9^{th} -12^{th} class to know the impact of television advertisements on their buying behavior. The results reported that television advertisements played an important role among girls for purchasing a new product. Many of the subjects wanted to buy the new products shown in television advertisements. Girls utilized their pocket money for shopping and the main products they purchased were food, cosmetics, gifts and cards (Kotwal et al, 2017).

1.6 PURPOSE OF THE STUDY

There is an association between junk food consumption and the rising prevalence of childhood overweight and obesity. Junk foods are high in fat, salt and sugar with low nutritive value. The HFSS food is getting popular among children and adolescents due to factors like easy to access, taste of the food, cheap price, friends' pressure, aggressive marketing and advertisements. Advertisements featuring products like snacks, toys, confectionaries, cookies and fast food are specifically targeted at children, in order to motivate them to try new brands and buy more. Various factors responsible for the change in consumption patterns among all the classes of Indian society are globalization, rising per capita incomes, rapidly changing lifestyles and changing agriculture patterns. The nutritious balanced diet is getting replaced by HFSS foods at the cost of health. To reduce the consumption of food high in fat, salt and sugar FSSAI had launched Eat Right Movement on 10th July, 2018. The FSSAI Eat Right Movement aims to create a new food culture by encouraging businesses

and consumers to reduce the amount of fat, salt and sugar from foods. This study aims to study the association between television food advertisements and consumption of high in fat, salt and sugar foods by school age children after initiation of the FSSAI Eat Right Movement.

1.7 OBJECTIVES OF THE STUDY

1. To analyze the type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels.

2. To study the association between television food advertisements and consumption of HFSS food by school age children.

3. To assess the physical activity pattern of school age children using 3-day physical activity recall.

4. To study sedentary behavior (watching TV, playing video games, using internet for leisure, sitting while talking on the telephone or texting etc.) in school age children.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

2.1 Global Scenario of Childhood Obesity

Childhood obesity has become one of the leading international challenges. World Health Organization has declared obesity as one of the most neglected diseases. According to World Health Report of 2002 overweight is the fifth most serious factor for both developed countries and low mortality developing countries. A report by International Obesity Task force (IOTF) in the year 2000 shows that 10% of the young people aged 5-17years were overweight globally, from this 10% population 2-3% young people were obese (WHO 2000). According to the World Health Organization obesity has tripled since 1975. According to a report of 2010 it was calculated that 42 million children below 5years of age were overweight and from these 42 million children 35 million children belong to developing countries. The prevalence of childhood obesity may be at a steady state in developed countries but it has shown a sharp increase in developing countries of Asia and Africa. In Asia, China has the highest number of children (15 million) suffering from obesity which is followed by India (14 million) (WHO 2016). It was found in 2016 that more than 1.9 billion adults of age 18 and above were overweight and from these 1.9 billion adults 650 million adults were obese. More than 340 million children and adolescents aged 5-19years were overweight and obese in 2016. A steep rise in the prevalence of overweight and obesity was seen among children and adolescents from 4% in 1975 to 18% in 2016 among age group of 5-19 years children (WHO 2020).

In United states, the rate of childhood obesity has been increased to more than double for preschool-aged children (2 to 5 years) and adolescents (12 to 19 years) and have increased to more than triple for school-aged children (6-11years) since 1980s (Koplan et al, 2005). The prevalence of overweight in Canada tripled from 11% of boys and 13% of girls in 1981 to 33% and 27% in 1996 (Ogden et al, 2008). In Brazil the prevalence of overweightamong6-18years age group has been increased from 4.1% to 13.9% between the year 1975 and 1997. In China it was seen that the prevalence of overweight and obesity has been raised from 6.4 % to 7.7% in just 6 years (1991-1997). The

prevalence of overweight among older children and adolescents was seen to be doubled in USA from 15.4% to 25.6% from 1971-1974(Wang et al, 2002). According to a study done in Australia the prevalence of overweight and obesity was 25% among children aged 2-18 years (Olds et al, 2008). A study of Indonesian adolescents showed the obesity rate of 10% (Collin et al, 2007). In Spain, researchers found that in some regions the rates of overweight and obesity was up to 32% among 4 years old children (Cattaneo et al, 2009).

It is estimated that worldwide there are more than 22million obese children under the age of 5years and one in ten children is overweight (Kosti and Panagiotakos, 2006). The prevalence of childhood obesity is seen more in the Middle East, Central and Eastern Europe (James 2004). According to a review from developed countries, prevalence of overweight in youth of 10-16years was >15% in North America (Canada, USA), Great Britain and some South Western European Countries (Greece, Italy, Malta, Portugal, Spain) and the prevalence of overweight was seen between 10-15% in Nordic (Denmark, Finland, Norway, Sweden) and other European countries. In Egypt 14% of adolescents and 25% of 6-11years old children were found to be overweight and obese (Qazi et al 2010). In South Arabia it was seen that one child from every six children was found obese in the age group between 6 to 18 years (AINuaim et al, 1996).

2.2 Indian Scenario of Childhood Obesity

India is the third most obese country in the world. According to National Family Health Survey-3, 15% of females and 14% male adults are considered as obese in India (Shete and Wagh, 2018). According to a study conducted by Lobstein and Jackson on estimates of obesity and comorbidities in school aged children in 2025, it was calculated that there are going to be 17 million obese children in India till 2025 (Lobstein and Jackson 2016). In India large proportion of overweight children coexist along with the proportion of malnourished children. The problem of overweight and obesity among children is not restricted to urban areas only but it is also spreading its wings among children and adolescents of rural areas (Shukla et al, 2016). According to the analysis of the data collected by National Family Health Survey 2015-2016, Vennu et al found that nationally prevalence of overweight (14.6%) was more than obesity (3.4%). Compared to

other states and UT, Uttarakhand (14,620) had a higher prevalence of overweight per 100,000 population followed by West Bengal (6400), Uttar Pradesh (4190), Tripura (3825), Telangana (3750) and Tamil Nadu (3670). Andaman and Nicobar Islands had the lowest prevalence of overweight (3915) and obesity (655) (Vennu et al, 2019).

Gupta et al conducted a study to know about the secular trends in prevalence of overweight and obesity between 2006 to 2009 among 14-17 years Indian adolescents of urban Asia. They found that the prevalence of obesity has been raised from 9.8% in 2006 to 11.7% in 2009 among adolescent Indian children (Gupta et al, 2011). A study was conducted by Laxmaiah et al to study about the factors which are affecting the prevalence of overweight and obesity in 2007 among urban adolescents in Hyderabad. They found that the prevalence of overweight and obesity was found to be 7.2% and 1.3% among adolescents aged between 12-17 years (Laxmaiah et al, 2007). The prevalence of overweight/obesity was reported to be 2.2% among adolescents in the rural area of Wardha District in Maharashtra (Deshmukh et al, 2006). A study by Kotian et al in 2010conducted in Mangalore city of Karnataka found the prevalence of overweight and obesity as 9.9% and 4.8% amongst adolescent school age children. A school based cross sectional study was conducted on 1000 adolescents having equal number of boys and girls by Agarwal et al in Ludhiana, Punjab in 2008. They found that prevalence of overall obesity was 3.4%; however, more number of boys (15%) were overweight in comparison to number of girls (10.2%).

The prevalence of overweight/obesity in children was found to increase from 16% in 2002 to 24% in 2006 by Bharadwaj et al in Delhi in 2008. A study was conducted to know about the prevalence of overweight and obesity among school children in urban areas of Udupi in South India. They found that the prevalence of overweight was 10.8% and obesity 6.2% (Gautam and Jeong, 2019). Another study from Central India found that the prevalence of overweight was 3.1% among children between 10 and 17 years age group while 1.2% of children were obese (Bharati et al, 2008). A study conducted in Kanpur shows a low prevalence of overweight 4% and obesity 2% when it was related

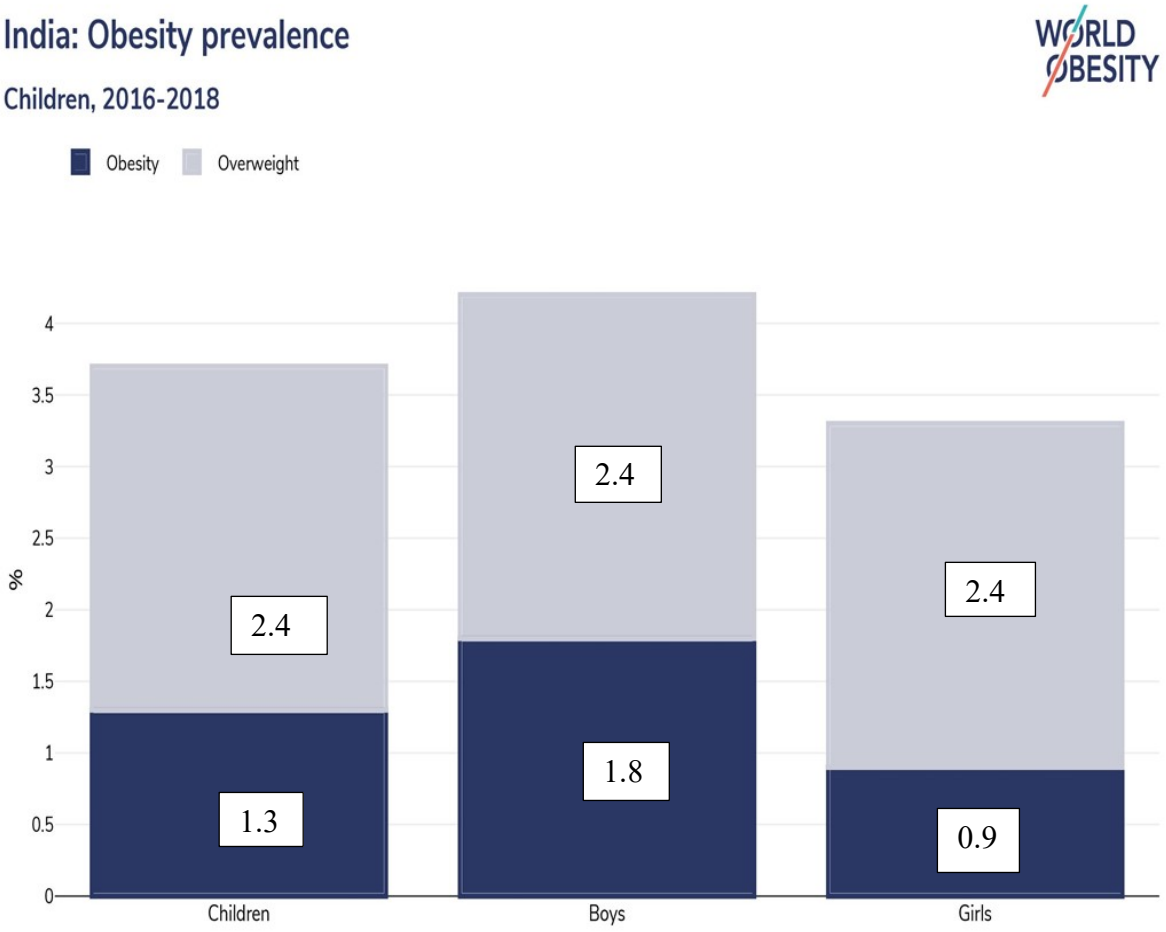
with other studies of North India, the difference in prevalence of overweight and obesity was considered due to the changes in the local dietary habits among children (Yadav et al, 2019). Gupta et al conducted a systemic review and reported that the prevalence of overweight in India ranged from 6.1%to 25.2% while the prevalence of obesity ranged from 3.6% to 11.7% among children of 5-19 years age group (Gupta et al, 2012). In 2010 it was estimated by Khadilkar and Khadilkar that as per IOTF classification the combined prevalence of overweight and obesity was 19.6% while this estimation was 27% according to WHO definition among children of 5-18years age group through the data obtained from 14 different cities of India like Agartala, Ahmadabad, Chandigarh, Chennai, Delhi, Hyderabad, Kochi, Kolkata, Madurai, Mumbai, Mysore, Pune, Raipur, and Surat (Khadilkar and Khadilkar, 2015). Higher prevalence of overweight was seen among boys 17% and 15.8% among girls of age group between 13-18 years from Chennai by Ramachandran et al, 2002. In Pune the prevalence of overweight was found to be 27.5% for boys and 20.9% for girls among children of age group 9-16 years (Rao et al, 2007).

As shown in the Figure 2.1 the prevalence of overweight and obesity among children of 0-19years in India was observed to be 2.4% and 1.3%. The prevalence of obesity was seen to be higher in boys (1.8%) in comparison to girls (0.9%). Figure 2.2 shows the prevalence of overweight and obesity among children of 10-19years in India. Around 9.4% boys and 12.7% girls were overweight and 5.7% girls and boys were obese in 2011-2012 (World Obesity Federation, 2021).

2.3 Regional Prevalence of Childhood Obesity

In a study conducted in South Gujarat, the prevalence of overweight and obesity was found high in students of upper income group as compared to middle income group and low-income group. A strong association was found between obesity among children and parent's education and occupation, BMI and mode of transportation to school (Gamit et al, 2014).

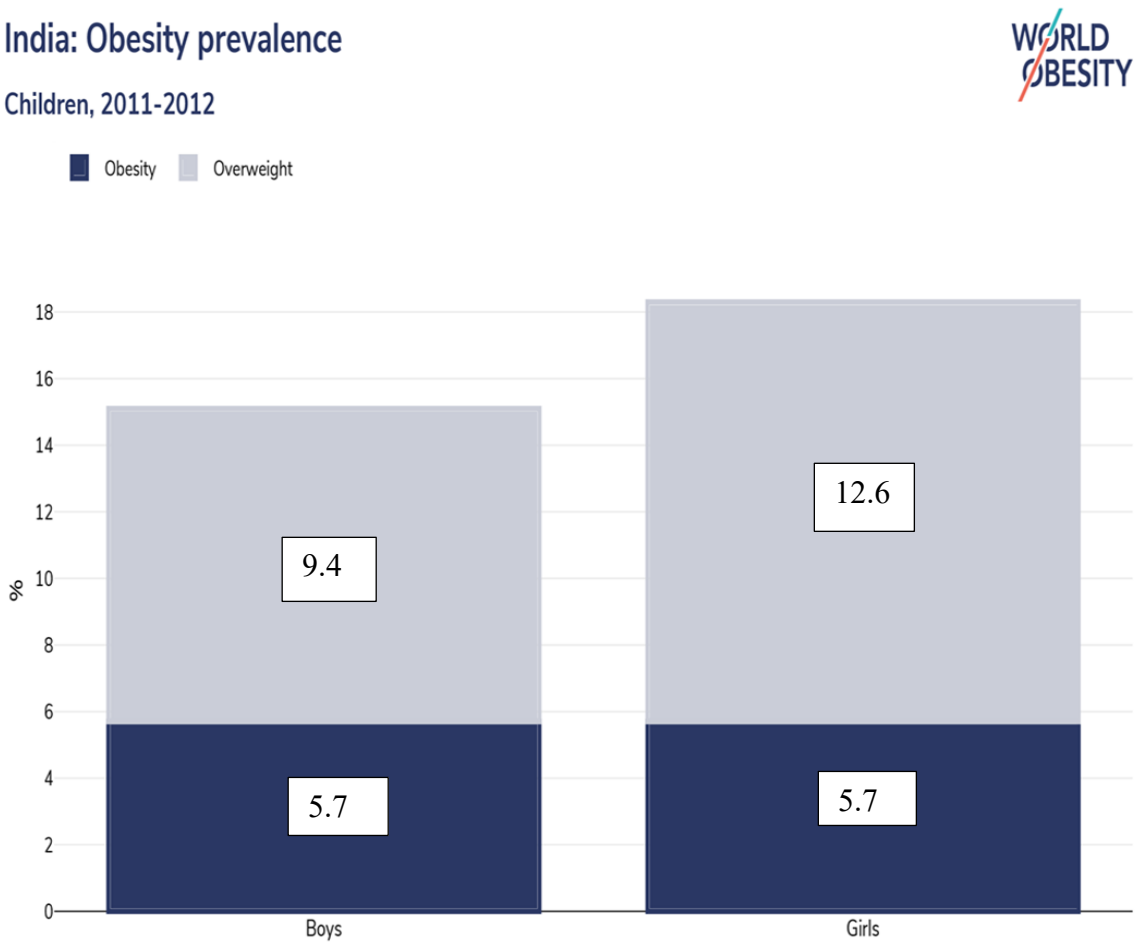
FIGURE 2.1 PREVALENCE OF OBESITY AMONG CHILDREN (0-19YEARS) IN INDIA



Survey type:	Measured
Age:	5-9
Sample size:	112316 (0-19 years)
Area covered:	National
References:	Ministry of Health and Family Welfare (MoHFW), Government of India, UNICEF and Population Council. 2019. Comprehensive National Nutrition Survey (CNNS) National Report. New Delhi.
Notes:	Overweight BMI-for-age ≥ 1SD ≤ 2SD Obesity BMI-for-age ≥ 2SD
Cutoffs:	WHO

Source: World Obesity Federation, 2021

FIGURE 2.2 PREVALENCE OF OBESITY AMONG CHILDREN (10-19 YEARS) IN INDIA



Survey type:	Measured
Age:	10-19
Sample size:	1900
Area covered:	Urban only
References:	Rohilla R, Rajput M, Rohilla J, Malik M, Garg D, Verma M. Prevalence and correlates of overweight/obesity among adolescents in an Urban City of North India. J Family Med Prim Care [serial online] 2014 [cited 2019 Oct 29];3:404-8. Available from: http://www.jfmpc.com/text.asp?2014/3/4/404/148127
Cutoffs:	IOTF

Source: World Obesity Federation, 2021

A study was conducted in Ahmedabad to know about the prevalence and determinants of obesity and overweight. They found that the prevalence of obesity was 5.62% and overweight was 9.99% respectively. The prevalence of obesity and overweight was seen more among children who were less active in comparison to children who were more active and among children who spent more than 2 hours in front of television and computer, who took daily calories above RDA and those who were having parent's history of obesity (Thaddanee et al, 2016). A study by Parekh et al on the prevalence of overweight and obesity in adolescents found that prevalence of obesity increased significantly from 12.8% in rural area to 14.6% in urban area of Surat. Urban males were significantly at risk of being overweight and obese than rural males (Parekh et al, 2012).

Goyal et al found higher prevalence of obesity and overweight among adolescent boys 6.7% and 15.1% while it was little less in girls;6.4% and 13.35% respectively in Surat city (Goyal et al, 2011). A study conducted by Brahmbhatt and Oza in Ahmedabad city among 10-19years age group found less prevalence of overweight 6.2% and obesity 2.6% among females in comparison to the prevalence of overweight and obesity among males which was 7.1% and 2.9%. Overweight and obesity was mainly associated with higher socio-economic status, inadequate sleep duration at night, lack of physical activity and consumption of junk food (Brahmbhatt and Oza, 2012). Panchal et al found in their study that the prevalence of overweight and obesity was 11.0% and 6.1% among students of 18-23years age group from randomly selected 5 colleges of Vadodara and Patan city. The prevalence of overweight and obesity was seen to be more among less physically active people, students who spent greater than 2 hours daily in front of television and computer, who consume calories above recommended dietary allowance and among the students who consume more junk food (Panchal et al, 2019).

A study carried out by Shah et al among school children of Mehsana District found that the prevalence of overweight and obesity was 33.88% and 10.67% respectively. The prevalence of overweight and obesity was seen to be more in males as compared to females (Shah et al, 2013). A study carried out among

urban and rural school going adolescents of Vadodara by Pathak et al, found that the prevalence of obesity and overweight was 17.6% and 20.2% respectively. More urban males 65.22% and females 62.26% were either overweight and obese in comparison to 15.78% rural males and 3.92 % females (Pathak et al, 2018).

2.4 Pathophysiology of Obesity

Overweight and obesity is abnormal or excessive fat accumulation in the body which is a risk for health. The distribution of fat in the body differs with respect to the location of fat. Men have more amount of abdominal fat while females have greater amount of gluteal fat and thus they are having larger hip circumference. With increase in abdominal fat in men and women the risk of obesity increases and obesity promotes many co-morbid conditions like type-2 diabetes, hyperinsulinemia, dyslipidemia, pediatric metabolic syndrome, cardio vascular diseases and many other. There are many factors responsible for causing obesity like excessive energy intake, physical inactivity, socio-economic factors, television watching and psychological factors (Bray, 1992). Obesity can be considered as amplification of normal adiposity and plays an important part in the pathophysiology of diabetes mellitus, hypertension, atherosclerosis and dyslipidemia, mainly because it secrets too much adipokines. Obesity is also considered to be a major factor causing metabolic dysfunction, including lipid and glucose dysfunction. At a greater extent obesity mainly influences organ dysfunction which includes functions like liver, pulmonary, cardiac, endocrine and reproductive functions. After affecting all the organs obesity finally affects the immune function due to the effects of the secretion of inflammatory adipokines. Obesity is also a major risk factor causing many types of cancer (Strong et al, 2005, James et al, 2004). Obesity is one of the cause of polycystic ovarian syndrome. In polycystic ovarian syndrome adipocyte secretagogues increases the abnormalities related to metabolism of hyperandrogenemia, insulin resistance and also increases the incidence of T2DM in polycystic ovarian disorder (Franks, 1995). According to a study by Baurer et al (2014) overweight or obesity children of 6-8years age group have shown reduced executive cognitive performance on neuropsychological

evaluations. They have also reported difference among the structure of brain related to learning, memory and executive functions (Baurer et al, 2014). Obesity during childhood is associated with high risk of cardiovascular events occurring during adulthood. Hypertension being the most common effect of obesity, obese children are having three times more chances of being hypertensive than non-obese children. The comorbidities related to endocrine system due to obesity are impaired glucose tolerance, type 2 diabetes mellitus, metabolic syndrome, and polycystic ovary syndrome. The prevalence of impaired glucose tolerance among obese children ranges from 7% to 25%. The risk of early onset of polycystic ovarian syndrome and hyperandrogenism was high among obese adolescent girls. Among 40% obese children fatty liver was found (Scott et al, 2017).

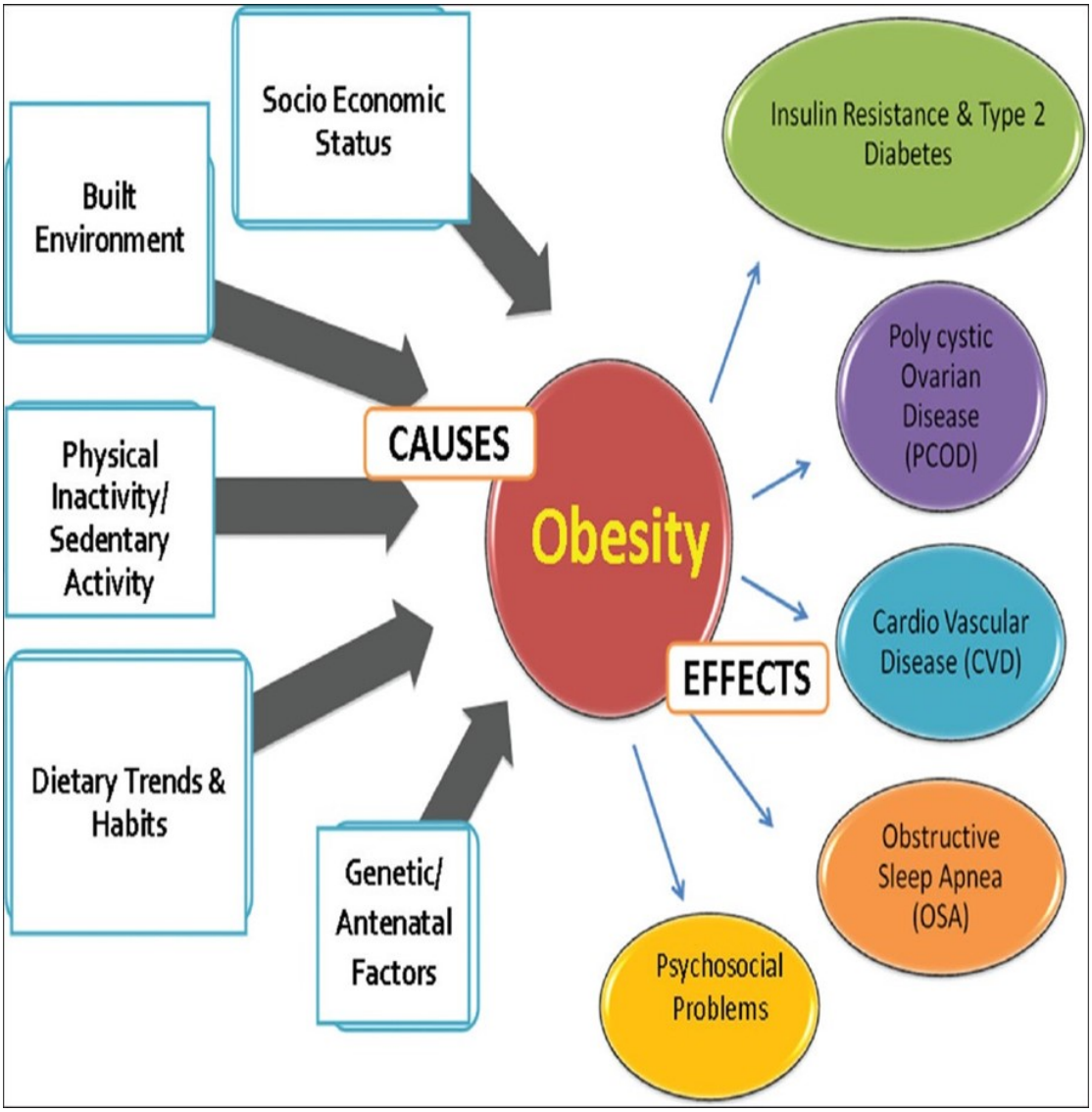
2.5 Factors Causing Childhood Obesity

Many factors are responsible for causing obesity including age, gender and socio-economic status. Clear gender difference is observed in many countries with more women being obese than men (Kelishadi et al, 2003). In developed countries levels of obesity are seen higher in lower socio-economic groups while the situation is reversed in developing countries (Wang et al, 2006). The dramatic changes in the lifestyle of people due to transition from rural to an urban area is also linked to increased levels of obesity. Obesity occurs when energy intake exceeds energy expenditure (Ebbeling et al, 2002). Figure 2.3 shows various causes of childhood overweight and obesity like socio-economic status, environment, sedentary activity, dietary habits and genetic factors. It also shows different consequences of overweight and obesity such as insulin resistance, polycystic ovarian diseases, CVD, obstructive sleep apnea and psychosocial problems (Ranjini et al, 2014).

Socio-economic Factors

There are many links of childhood obesity associated with socio-economic factors. Urban background, familial economic status, education of parents and job details are the important factors. Urbanization is the strongest risk factor of

FIGURE 2.3 CAUSES AND CONSEQUENCES OF CHILDHOOD OBESITY

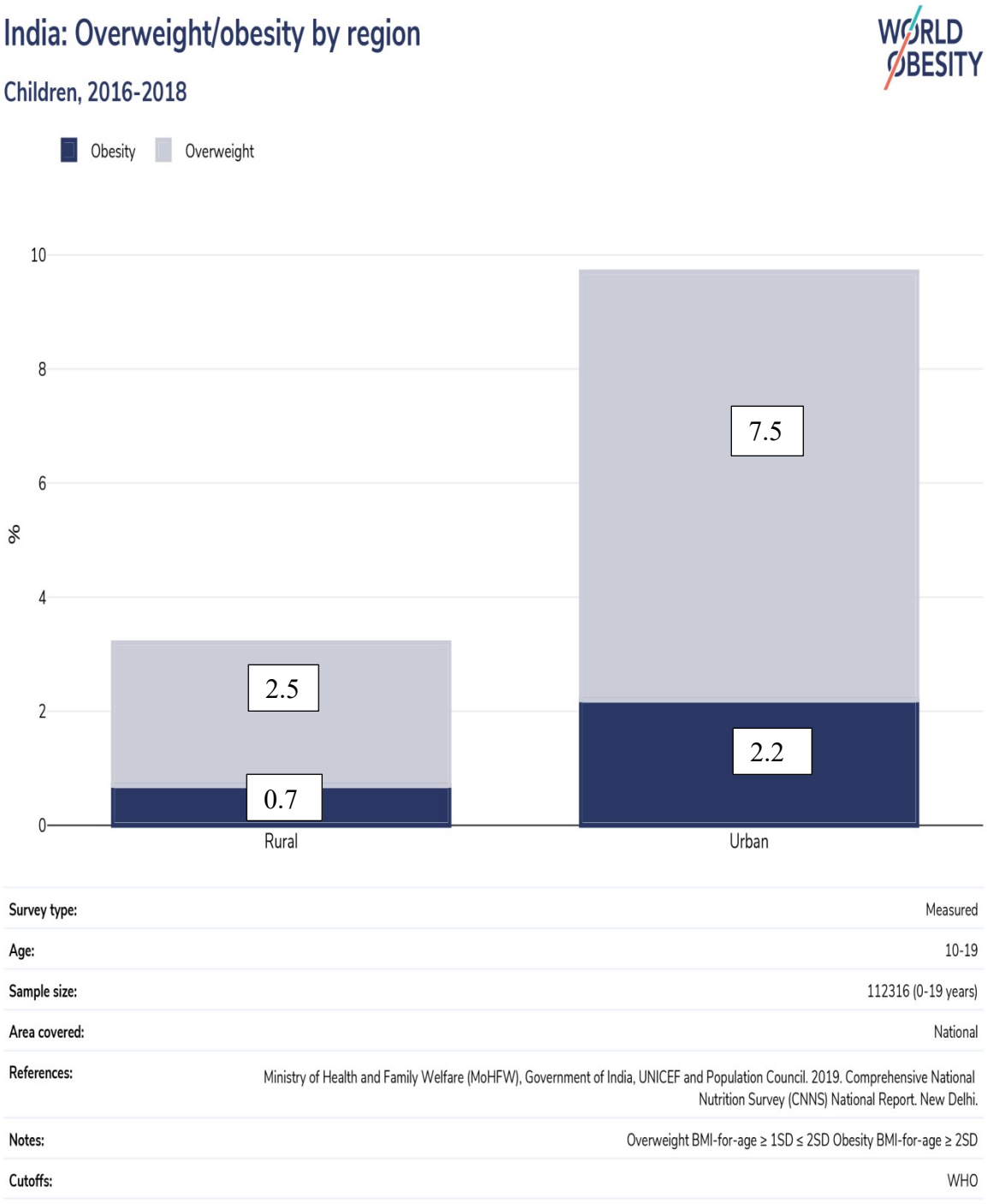


(Source: Ranjini et al, 2014**)**

obesity in India. Obesity is three times more prevalent in urban areas than rural area. As the development of roads and satellite television took place in rural areas it blurred the difference between cities and villages. Youths are migrating from villages to cities for education and they take back the urban food habits to their villages which is making Indian villages urbanized in their habits (Yajnik, 2004). In a study conducted by Bharathi et al 3.046 OR was found for obesity among school going children in urban area in comparison to rural area (Bharti et al, 2008). Higher socio-economic status is another risk factor of obesity. The Global Burden of Disease (GBD) collaborator group have found higher prevalence of obesity in countries with higher socio-demographic index (SDI). An increment of 20% was seen among obesity of children of low SDI countries between 1980 to 2015 among both the sexes (GBD, 2017). According to a study by Chhatwal et al a straight connection was found between socio-economic status and overweight/obesity among children from three different schools of Ludhiana, Punjab. The prevalence of obesity was found to be 15.5% among children from higher income group, 2.7% among children from middle income group and 0% among children from lower income group (Chhatwal et al, 2004). Eagle et al found in a study that as the average American household income of a family decreased, frequency of intake of fried food and watching TV or video time/week increased. A decrease in consumption of vegetables and moderate/vigorous physical exercise was observed (Eagle et al, 2012).

Kaur et al, concluded that three times higher number of overweight (15.3%) and obese children (6.8%) were seen among high-income schools in comparison to children from low-income group (Kaur et al, 2008). In Delhi the prevalence of overweight/obesity among children of 14-17years of age was 29% in private schools and 11.3% in government aided schools (Bharadwaj et al, 2008). In Udupi range of overweight/obese children according to BMI were 6.9%, 10.9% and 31.2% for government, aided and unaided/private schools respectively (Gautam and Jeong, 2019). In Chennai Ramchandran et al, found that the prevalence of overweight/obesity was 4.5% in schools with low income and 22% in better income schools (Ramchandran et al, 2002). According to Figure 2.4 high prevalence of overweight and obesity was

FIGURE 2.4 PREVALENCE OF OVERWEIGHT AND OBESITY ACCORDING TO REGION IN INDIA



Source: World Obesity Federation, 2021

observed among children living in urban area (7.5% and 2.2%) in comparison to children living in rural area (2.5% and 0.7%) (World Obesity Federation, 2021)

Diet

Nutritionally adequate and balanced diet is very important for the proper growth and development in children and adolescents. But it has been seen that small percentage of children meet the criteria of consuming most of the food groups. In a survey it was found that only 23.6% children consume cereals or millets adequately and almost 66% children showed low frequency in intake of cereals and millets. In consumption of vegetables only 40.3% children were consuming vegetables in appropriate frequency and 45% children have low frequency of consumption of vegetables. The consumption of fruits among children was also low, only 18% children consumed fruits in adequate quantity. High frequency was seen for the consumption of sugar sweetened beverages, salted packages and sweet packaged food. Almost 92.1% children consumed sugar-sweetened beverages, 94.3% children consumed salted packaged food and 95.1% children were consuming sweet packaged food. It was seen that 53.2% children were consuming packaged food or beverages at least once a day. Every other child was consuming salted packaged food (53.2% children) like chips and noodles, sweet packaged food (55.8% children) like chocolates and ice-cream and sugar-sweetened beverages (49.3% children) like carbonated drinks, soft drinks, juices and milk-based products averagely more than twice a week. Fast food like pizzas, burgers, fries, wraps, puff etc. are ultra-processed food items or they are made from ultra-processed ingredients and packed for sale, marketers are aggressively advertising these food items (Bhushan et al, 2017). With the passage of years, the price of food has been decreased substantially relative to income and thus become more affordable to people. The concept of food has been changed totally to a marker of lifestyle and pleasure from a means of nourishment. Increasing physical activity is not the way to have an energy rich, poor nutritive diet. To counteract the calories of a single large sized children's meal one needs to do 1-2 hours of extreme vigorous activity (Styne, 2005). The total calorie intake at population level is difficult to measure accurately. A

change or imbalance in calorie intake over a long period of time can lead to obesity (Willet, 1998).

In recent years obesity has been linked with increased consumption of fast food. Families with both parents working outside home, select the places of fast food as they are often liked by their children and are often inexpensive. Fast food contains higher number of calories with low nutritional values (Niehoff, 2009). Ebbelling (2004) conducted a study to examine the eating habits among lean and overweight adolescents. It was found that both the groups consumed more calories while eating fast food at a restaurant as compared to home setting but the lean group of people compensated the higher caloric intake by adjusting their caloric intake before or after the fast food meal in compensation or anticipation for the excess calories they consumed (Ebbelling, 2004). Many studies have also shown weight gain as a result of regular consumption of fast food (Sahoo, 2015). A study found that consumption of sugary beverages was related to increase in the BMI by small amount among children aged 9-14 years from 1996-1998. Sugary drinks were found as a potential factor contributing to obesity. Sugary drinks were often limited to soda but sweet juices and beverages do fall in this category. Sugary drinks are less filling than food, hence people consume it quickly and, in more quantity, which eventually results in a higher caloric intake. Another contributing factor to childhood obesity is the consumption of snack foods. Snack food mainly includes foods like chips, baked food and candy. Snacking has shown an overall increase in caloric intake. Along with snacking portion size is also a contributing factor to obesity. From past decades portion sizes have increased drastically. Consuming large portion sized food, in addition to frequent snacking on food which is high in calories contribute to an excessive intake of calories which result in energy imbalance and cause obesity (Andersonand Butcher, 2006).

Activity Level

One of the most significantly linked factors to obesity is sedentary lifestyle. According to a study from Oceania, sedentary life style like sitting for >=3 hours per day have increased the odds of being overweight/obese (Pengpid and Peltzer, 2015). A finding independent of ethnicity, family, community, socio-

economic factors and individual factors has shown that more frequent participation in sports corelated well with greater accretion of fat free mass. According to Bosch et al lower fat mass index is also a result of walking or cycling to school (Bosch et al, 2019). To know about the prevalence of obesity among school children of a military station in North-Eastern India Kunwar et al conducted a study and found that prevalence of obesity among the children of Garrison school was lower as they laid greater emphasis on games and physical activity (Kunwar et al, 2018).

Television Watching

The prevalence of obesity increases by 2% with each additional hour spent in front of television (Anderson and Butcher, 2006). In recent years television viewing has increased dramatically among young children and adolescents. As the time spent in front of television increased, the time spent in performing physical activity decreased. Research shows that the number of hours children spent while watching television corelates with the consumption of most advertised goods, which includes sweetened cereals, sweets, sweetened beverages and salty snacks (Anderson and Butcher, 2006; Kapil and Bhadoria, 2014). According to a study by Govindan et al watching TV for more than 2 hours per day was remarkably associated with obesity (Govindan et al, 2013). National Institute of Health, US stated that watching television for more than two hours per day is definite risk for obesity (National Institute of Health, US). With the increase in hours of watching televisionis correlated directlywith the increase in consumption of food that are frequently advertised on TV for example sweets, cookies, chocolates, sweetened cereals and salted snacks (Story et al, 2002).

Psychosocial Factors

A study by Pengpid and Peltzer in Oceania looked at impact of various factors like loneliness, lack of close friends, anxiety and worrying, suicidal ideation and bullying on the matter of overweight/obesity taking place among school age children. The OR for being overweight with the factor of lack of close friends

was 0.72 and with the factor of suicidal ideation OR was 1.42. The link with other factors was not remarkable (Pengpid and Peltzer, 2015).

2.6 Consequences of Childhood Obesity

At least 30% of obesity begins from childhood and 50-80% of obese children become obese adults later in life (Bharti et, 2008). The GBD collaborator group found that those with a BMI in the range of 20-25kg/m2 have the lowest risk of death. Obesity is linked to greater and earlier mortality (GBD, 2017). Complications of childhood obesity in adults are metabolic syndrome, hyperinsulinemia, dyslipidemia, hypertension, cardiovascular diseases. According to figure 2.5increase in the levels of plasma free-fatty acids and cytokines, liposomes and ectopic adipose tissue can contribute to various disorders like insulin resistance, systemic inflammation and overactivity of sympathetic nervous system. Various metabolic and anatomic effects like development of T2DM, non-alcoholic fatty liver diseases, obesity related dyslipidemias, elevated blood pressure and osteoarthritis are the result of excess adiposity in the body. The chains of these different mechanisms and related diseases are some contributing factors to obesity related heart failure (Gadde et al, 2018).

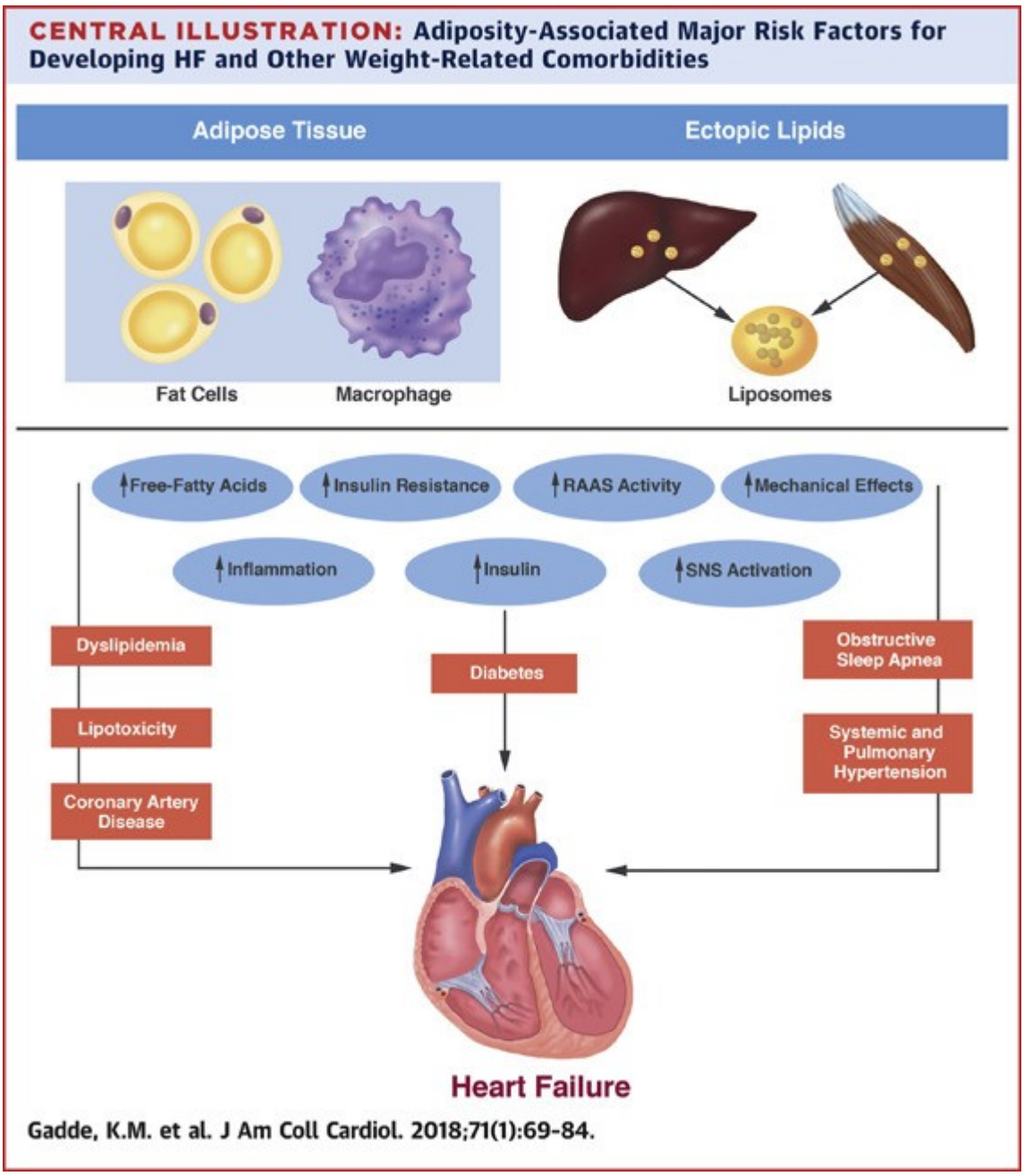
Hyperinsulinemia

According to a study about 1/3rd of urban Asian children suffer from insulin resistance. The odds for hyperinsulinemia in overweight was 4.7 OR, with children having high percentage of body fat 6.4 OR, with high hip ratio 4.7 OR and 4.5 OR for total of four skin fold thickness. Percentage body fat and sum of four skin fold thickness (Sigma 4SF) were considered as independent predictors of hyperinsulinemia through multiple logistic regression analysis with OR being 3.2 and 4.5 (Misra et al, 2004).

Pediatric Metabolic Syndrome

As the prevalence of obesity in children is increasing the prevalence of pediatric metabolic syndrome, hypertension and type 2 diabetes are also

FIGURE 2.5 CONSEQUENCES OF OBESITY



increasing simultaneously among children. In the pathogenesis of hypertension, coronary artery diseases and polycystic ovarian syndrome, insulin resistance has been implicated (WHO, 1999). The prevalence of metabolic syndrome among school children of Shimla in Himachal Pradesh were 3.2% with odds of metabolic syndrome being remarkably linked to high monthly income of family, male sex, sedentary lifestyle and snacking in evening (Gupta et al, 2018). Another study in Chandigarh by Singh et al showed the prevalence of metabolic syndrome among adolescents of age group 12-17years as 4.2% and they were unable to find any other dissimilarity among the sexes (Singh et al, 2007).

Dyslipidemia

Closely 17% of obese adolescents in America have unusual non-HDL-cholesterol. Class III obesity is directly linked to different factors like high total cholesterol level (19%), high triglycerides (29%) and low HDL-cholesterol (<=19%) (Skinner et al, 2015). The common pattern observed for dyslipidemia in obesity is with high levels of triglycerides, low levels of HDL cholesterol and high or mildly increased LDL cholesterol. This pattern of dyslipidemia was observed in NHANES data among 42.9% children with BMI >95th percentile (Center for Disease Control and Prevention, 2010). A positive relation was found between BMI and levels of VLDL and LDL-cholesterol among obese children and adolescents (Guida et al, 1989). Obesity is consistently associated with low HDL cholesterol (Anderson et al, 1987). A study conducted by Arief and Amiruddin (2020) in Indonesia among adolescents of age group 17-19years have reported that adolescents with central obesity have much lower HDL levels in comparison to adolescents with normal abdominal circumference and obese adolescents have much lower HDL levels as compared to normal adolescents. Another study by Elmaoğulları et al (2015) on obese children of age group 2-18years reported that almost 42.9% children were suffering from dyslipidemia with 21.7% subjects having hypertriglyceridemia, 19.7% had low HDL levels, 13.7% had high LDL levels and 18.6% had hypercholesterolemia. High prevalence of dyslipidemia was observed among older age group and subjects with high BMI. Hepatosteatosis was found to be common among subjects suffering from dyslipidemia.

Childhood Diabetes

Around 80% children in Japan accounts for type 2 diabetes. The prevalence of type 2 diabetes among children increased drastically between 1976 and 1995 from 0.2 to 7.3 per 100,000 children in Japan (Kitagawa et al, 1998). Ehtisham et al found in a study that prevalence of type 2 diabetes among white UK children was less as compared to that of South-Asian children. Factors other than ethnicity like family history of obesity and diabetes, female preponderance and pubertal onset were having some connection with type 2 diabetes (Ethisham et al, 2004). Bhatia (2004) reported that type 2 DM accounted for 10% of diabetes cases found among children between 10-18 years of age. Ripamonti et al found that among Italian children the prevalence of impaired glucose tolerance was 11% among 398 obese children (Ripamonti et al, 2003). The prevalence of impaired glucose tolerance and type 2 diabetes mellitus among 520 obese children in Germany was 2.1% and 1.5% as found by Wabitsch et al (2004).

Hypertension

Obesity in childhood is linked with the development of hypertension in future. The risk of high Blood Pressure (BP) in later life is linked with elevated or increased BMI in infancy (Falkner et al, 2006, Perng et al, 2016). Risk of hypertension increases by 2 times with obesity and 4 times with severe obesity among children of age group 3-17years (Parker et al, 2016). The prevalence of hypertension was from 3 to 5% among children living in US but it rose to 25% in children with obesity (Flynn et al, 2017). In a study conducted by Vedavathy to know the prevalence of hypertension in school age children between the age of 11-19years, they found that 3.6% of the students were having pre-hypertension and stage I hypertension. The prevalence of pre-hypertension and hypertension was significantly higher in children with BMI >23kg/m2. It was found that family history of hypertension and obesity was directly linked with the pre-hypertension and stage I hypertension among children (Vedavathy, 2016). According to a survey conducted by Gupta and Ahmed on 3851 children of 5-15 years age group, 292 children were found to be obese. The prevalence of hypertension among obese children was found to be 0.34% and 0.16% among

normal BMI children (Gupta and Ahmed, 1991). A study from Kanpur shows 1.14% and 2.57% prevalence of pre-hypertension and hypertension among school children of age group 10-16 years. Among all children, children falling under overweight category 6.25% were pre-hypertensive and 12.5% children were hypertensive while 14.28% and 42.5% obese children were found to be pre-hypertensive and hypertensive children respectively (Yadav et al, 2019). According to an epidemiological survey conducted in Delhi among school age children 11.69% boys and 11.4% girls were found to be hypertensive. In this study an assertive connection was found in between two variables like hypertension and BMI (Laroia et al, 1989). A study from Ludhiana shows the prevalence of hypertension among obese children was 3.5% and among normal children the prevalence was 0.23% (Anand and Tandon, 1994).

Cardiovascular Diseases

According to Bibbins et al (2007) it was estimated that recent prevalence of adolescent overweight will give rise to future adult obesity by 5-15% till 2035, which will result in addition of 1,00,000 CVD cases. The association of CVD with obesity is normally secondary to hypertension and atherosclerosis. Atherogenesis is the result of sub-intimal deposition of LDL cholesterol particle. The combination of atherogenicity and childhood obesity is an ideal scenario for CVD to occur. When high levels of small LDL cholesterol particles circulate in the body with decreased clearance by LDL receptors, it increases the risk of their entrapment in the sub endothelial matrix (Juonala et al, 2008). Sub-clinical vascular inflammation may also be a contributing factor for the development of CVD. Among Indian adolescents increased levels of CRP protein have been seen among 13% of all subjects, 22% of people with higher weight and 25% of people suffering from obesity. A strong association was seen between CRP levels with body fat percentage, Waist-Hip ratio, waist circumference and triceps skin-fold thickness (Arya et al, 2006).

2.7 High Fat, Salt and Sugar Foods (HFSS Foods)

Diet is one of the important factors related to overweight, obesity and development of NCDs. The practice of regular consumption of food which is

high in fat, salt, sugar and low in nutrient contents, e.g., noodles, chocolates, burgers, pizza, pastries, patties, popcorn, etc. may have adverse effect on the health of children. The factors contributing to childhood obesity are easy availability and access to unhealthy food in school canteens and its vicinity (Ministry of Women and Child Development, 2015).

Definition of HFSS Foods in the context of school canteen and school children:- "HFSS foods may be defined as foods (any food or drink packaged or non-packaged) which contain low amounts of proteins, vitamins, phytochemicals, minerals and dietary fiber but are rich in fat (saturated fatty acids), salt and sugar and high in energy (calories) that are known to have negative impact on health if consumed regularly or in high amounts" (Ministry of Women and Child Development, 2015).

Ministry of Women and Child Development (MWCD) is given the responsibility to tackle the issues related to nutrition and specifically to under-nutrition among children, pregnant and lactating mothers and adolescent girls with the help of various schemes. Considering the responsibility assigned they are also responsible to address the issues related to junk food consumption, an important contributor to childhood obesity. To control the consumption of food high in fat, salt and sugar by children in school's various guidelines have been made on the sale of "HFSS Foods and Non-standardized or Proprietary Foods in School Canteens or in the vicinity of schools by private vendors.

1. The sale of HFSS food should be banned in school canteens. HFSS food should not be sold by private vendors and street vendors during school time i.e. 7 A.M to 4.00 P.M within vicinity of 200 meters.
2. The sale of proprietary foods by shops and restaurants to school children in uniform within vicinity of 200 meters from school should not be permitted.
3. The non-proprietary foods can be categorized based on color coded system according to the nutritional value of food in school canteen such as:
    a) The Green category (with a Green Flag) should always be on the menu, e.g. Vegetables and legumes, fruits, grain (cereal) foods; mostly whole grain, lean meat, egg, fish etc. low or reduced fat milk, soy drinks and water.

b) The Yellow category (with a Yellow Flag) for the select carefully group, e.g., baked vegetable-based snacks, ice creams, milk-based ices, dairy desserts etc.
c) The Orange category should not be recommended on the canteen menu, e.g., all confectionary items, energy drinks, carbonated and sweetened beverages, fried packaged and non-packaged foods, chocolates, potato fries etc., and should not be sold in school canteens.

4. In school canteens use of hydrogenated oils should be banned totally and usage of oils which are high in saturated fats should be limited in the preparation of food item which is to be served to children. Oils like blended oils and those high in monosaturated fatty acid/polyunsaturated fatty acid should be used.
5. School should make an initiative to make a School Canteen Management Committee for making available quality and safe food in schools where the students/Head Boys/Head Girls/School Monitors/Prefects should be involved to ensure strict implementation of the guidelines.
6. Appropriate arrangement should be made by School Management Committee for the display of contact numbers of Doctors/ Medical Officers who can be contacted for any health-related emergency at various important places such as notice boards, First-Aid room, Labs, canteen etc. (Ministry of Women and Child Development, 2015).

Children and adolescents should consume a balanced and healthy diet with sufficient nutritious foods for proper growth and development. According to 2011 dietary guidelines for Indians more preference should be given to traditional and home-made foods; and avoid replacing meals with snack foods; it is very important to perform adequate physical activity along with reducing the intake of sugar and processed food for maintaining optimum body composition, normal BMI and to reduce the risk of chronic disease related to diet. Food items like burgers, pizza, fries, chocolates, ice-creams, etc. are not healthy food options to meet the nutrients needs so they should be consumed sparingly. Such food items are referred as junk foods and categorized as HFSS foods i.e. food which are high in fat, salt and sugar by WHO. According to WHO 1% of total calories should come from trans fatty

acid and the recommendation of salt <5gms per person per day to prevent people from CVDs and according to Indian scenario, NIN recommends that consumption of salt should not exceed6 gm per day per person and saturated fatty acid intake should not exceed 8-10% of total energy. But junk food exceeds the limits of saturated fatty acid and salt, hence is one of the reasons to cause wide range of NCDs (Ministry of Women and Child Development, 2015).

Various factors responsible for the change in consumption patterns among all the classes of Indian society are globalization, rising per capita incomes, rapidly changing lifestyles and changing agriculture patterns. In recent years India has also been influenced by western eating habits which has resulted in a marked increase in the availability and consumption of fast food and aerated beverages among Indian population. Availability of ready to serve food has increased and has become more prevalent and acceptable to people due to shifting work demographics, lack of time, inflation, long working hours, eating out and irregular eating patterns. The nutritious balanced diet is getting replaced by HFSS foods at the cost of health (Ministry of Women and Child Development, 2015). According to a study, the fast food industries are growing rapidly in India. Each year there is a 40% increase in the fast food industry (Goyal and Singh, 2007). According to National Sample Survey (NSS) report India is in the list of top ten consumers of fast food in the world (NSS 66th Round, 2012). A rapid increase is seen in the consumption of salt, sugar and fat. Per capita consumption of sugar among people has been increased from 22g/day in 2000 to 55.3g/day in 2010; salt intake ranges from 9to 12g/per capita/day; and total fat consumption has increased from 21.2g/day in 2000 to 54g/day in 2010 (Bhansali et al, 2015). The consumption of packaged and processed food is steeply increasing in every household in both rural and urban areas. Domestic demand of processed foods, savory snacks and sugar sweetened beverages are linked to household disposable income of middle class people living in India and a driving force for the consumer goods market (Pingali and Khwaja, 2004). North India (38%) has recorded highest sale of packaged food followed by

West (36%), South (28%) and East &Northeast (21%) in 2011 (ASSOCHAM, 2015).

To reduce the consumption of foods high in fat, salt and sugar FSSAI launched the Eat Right Movement on 10th July, 2018 to create a new food culture by encouraging businesses and consumers to cut down on trans-fat, salt and sugar in their food. In a video campaign started by FSSAI whose pro bono ambassador was actor Rajkumar Rao the campaign tagline – 'Aaj se thoda kam' was recited. The idea is to slowly and steadily reduce the amount of fat, salt and sugar from the food that you eat. WHO has started a new campaign named 'Replace Trans Fat'. It is an action package which provides a strategic approach for eliminating industrially produced trans-fat from national food supplies with the goal of global elimination of trans fat by 2023. Increased intake of trans fat is associated with increased risk of coronary heart disease mortality and events (WHO 2020). To accomplish this goal edible oil industry, bakers and halwais in India including Halwai Association and Hotel and Restaurant Association of Northern India have also pledged to do every possible thing from their side with the pledge 'India@75 – freedom from trans-fat by 2022'. As per the regulations edible oils will not have trans-fat >2% and final food or bakery products should not have trans-fat more than 0.5%. (FSSAI 2018). Many companies from packaged food industry like Nestle, Mapro, MTR, Britannia, Bikanerwala, Patanjali, Bagrry's, Hindustan Unilever, Weikfield, Kraft Heniz, Del Monte, Haldiram, Kellogg's, ITC and Marico have signed up voluntary commitments to reduce salt and sugar in their food products by 2020. HUL agreed to reduce the salt levels to enable intake of salt upto 5g per day. For example, in their tomato ketchup there would be 15 to 50% of reduction of sodium by 2020 to meet the mark of 750mg/100g of ketchup. They also committed to reduce the amount of sugar in their children's frozen desserts to a maximum of 12g per portion by 2020 (FSSAI 2018). As per new guidelines by FSSAI 2021 for - India@75: Freedom from trans fats by 2022, industrial trans-fat should be limited to not more than 3% in all fat and oil by January 2021 and not more than 2% by January 2022. All the industrial food products in which edible oils and fat is used as ingredient should not

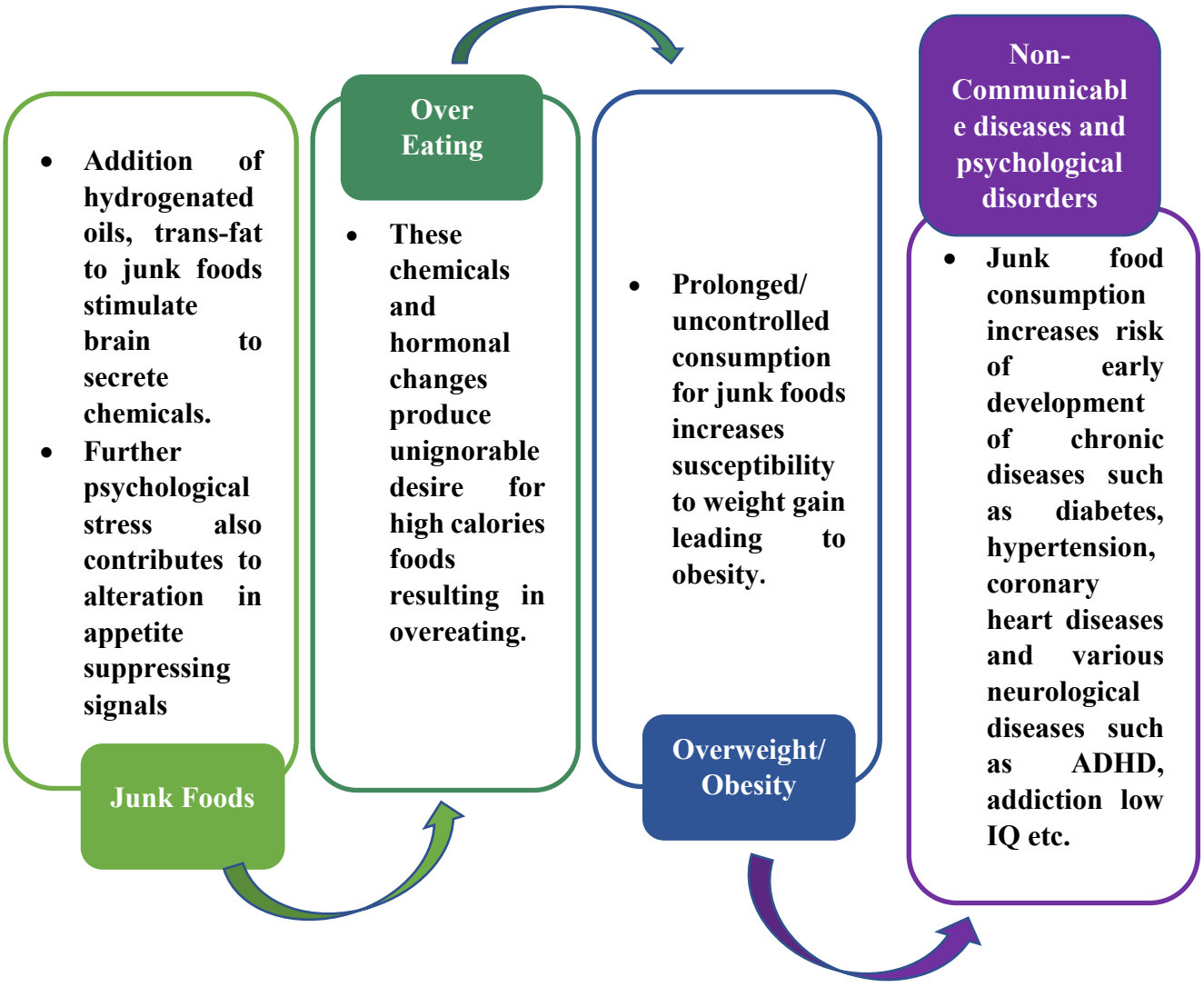
contain trans-fat more than 2% by mass of the total oils/fats present in the product from 1st January 2022 (FSSAI, 2021). Figure 2.6 shows about the intake of HFSS food and its contribution in mechanism of various diseases.

2.8 Consumption of Junk Food by Children

Gupta et al (2018) carried out a study to know the junk food consumption among school aged children of rural Himachal Pradesh. The study was a community based cross-sectional study conducted in government schools in children in the age group of 12-18 years. In this study they found that 153 (36%) school age children consumed junk food in last 24 hours. From 153 students who consumed junk food in last 24 hours 44% (68) were males and 56% (85) were females. As per socio-economic status the consumption of junk food was higher in high socio-economic status (48%) and middle socio-economic status (45%) and least in low socio-economic status (6%). They found that most popular junk food items among school age children were chips (71%), chocolates (14%), bakery products (13%), soft drinks (7%) and sugar sweetened beverages (5%).

Joseph et al (2015) carried out a study to know the association between fast food consumption and overweight among high school boys of Mangalore city. The study was a cross-sectional study conducted on 345 boys of 3 private schools of Mangalore city. The result they found was 292(97.3%) children were consuming fast food. The source of information related to fast food for the children was TV commercials 193(64.3%), friends 161(53.71%), and parents 62(21.9%). Most of the students 64(21.9%) preferred eating fast food over usual food made at home and the various reasons stated by them were being bored with home food 73(57%), curiosity 64(50%), favorite leisure time activity 32(25%), peer influence 30(23.4%), easy availability 10(7.8%), influenced by TV advertisements 10(3.3%) and quick to eat and finish as told by 2 participants. The proportion of overweight and obese children was seen greater among children who

FIGURE 2.6 HFSS FOOD INTAKE AND MECHANISM OF DISEASES



Source: Ministry of Women and Child Development, 2015

consumed fast food once or more times in a day compared to less frequent consumers of fast food.

Varma and Chaturvedi (2019) carried out a study to evaluate the consumption of fast food and prevalence of obesity among school children of Bhopal city. Total 240 students were enrolled, from 240 students 100 over-weight and obese children (60 boys and 40 girls) were selected for further study. The results showed that there was a significant relation between fast food intake and body weight of children. Fast food like pizza, burger, chinese and sandwiches were more popular and most frequently consumed by children. Consumption pattern of fast food by boys showed that 8% boys consumed fast food once in a week, 13% consumed it twice a week, 22% consumed it 3-4 times in a week and 17% consumed it more than 4 times in a week. The prevalence of overweight and obesity among boys and girls of 13-15years of age was found to be 28% and 19%. The prevalence of overweight and obesity among boys and girls of 15-19years of age was found to be 26% and 27%. They found that overweight and obese children were having high consumption of fast food.

Shete and Wagh (2018) conducted a cross sectional study to estimate prevalence of obesity and its risk factors in adolescent school children in Western Maharashtra, India. As per BMI 82 (39.6%) students were underweight, 82 (39.6%) students were normal weight, 25 (12.1%) students were overweight and 18 (8.7%) were obese. They found that 143 (69.1%) children were spending more than 4 hours in a day in front of mobile/TV/laptop and remaining 64 (30.9%) children were spending less than 4 hours in a day. They also found that 3 (1.45%) children were consuming junk food daily whereas 160 (77.29%) children were consuming junk food more than once in week and 32 (15.46%) children consumed it once in a week and 12 (5.8%) were having junk food occasionally. Association between eating of junk food and BMI was found to be highly significant as 3 participants consuming junk food daily were found to be

overweight and 18 participants consuming junk food more than once in a week were found to be obese.

Karki et al (2019) carried out a study to know the prevalence and associated factors of childhood overweight/obesity among primary school children in urban Nepal. Multivariable logistic regression showed the results that sex of children, educational qualification of mother, excess junk food intake, type of transport used to travel to and from school and sedentary behaviors on weekend were significantly related to childhood obesity/overweight. They found that 1 in every 5 children were consuming hot chips, fries and potato crisps 3-4 times a week, 17% of children were consuming confectionaries and ice-cream more than 5 times a week and more than 56% children were drinking >250ml of soft drinks per week. They also found that almost 33% children were watching TV for >3hours during weekends. Most preferred activities of children during weekends were watching TV, using mobiles, iPads, playing computer or online games.

Goyal et al (2011) conducted a study to know the factors causing overweight and obesity among affluent adolescents of age group 12 to 15 years of Surat City. The complete prevalence of obesity and overweight was found to be 6.55% and 13.9% The prevalence of overweight and obesity was seen more among boys in comparison to girls. They have observed that children consuming carbonated drink daily or more than thrice a week has 19.7 times more chances of becoming overweight and obese. Similarly, children having snacks outside home daily or more than three times a week have 4.19 and 1.97 times more chance of becoming overweight and obese. The chances of children becoming overweight and obese is twice when they consume junk food more than once daily.

Agrawal et al (2019) conducted a study to know about the prevalence and determinants of intake of junk food among school going children of Rohtak district. It was a cross-sectional study conducted among 200 children studying in a government school of Rohtak. They found there was high prevalence (84.5%) of junk food consumption among school children in last

24-hours. Out of 200 subjects 169 have consumed junk food in last 24 hours. The consumption of junk food was higher among males as compared to females. Most popular junk food items among children were chips (68.05%), followed by soft drinks (66.86%), chocolate (56.80%), bakery products (46.75%) and others (25.44%). They found that junk food was consumed mainly as snacks by the children from the shops available outside the school after the school-hours.

Goel et al (2013) conducted a study to know about the increasing proclivity for junk food consumption among adolescent girls of age group 16-18 years in district Kurukshetra, India. It was found that 50%, 36.25% and 13.75% girls were receiving pocket money in the range of Rs. 100-800, Rs. 801-1000 and more than Rs. 1000. It was observed that majority of the subjects spent 20% of their pocket money on junk food. More than half of the respondents (66.25%) were skipping meals. Most commonly skipped meals were breakfast (79%), followed by lunch (67%) and dinner (52%). The most preferred junk food among girls was potato chips (100%), chocolate (92.5%) was the most liked sweet and carbonated drinks (91.25%) was mostly consumed by girls followed by tea (80%).Results revealed that meal skipping, more intake of junk foods, carbonated drinks were some of the unhealthy eating habits found among the adolescent girls. They also found that girls were having excess amount of energy, protein and fat but the intake of micronutrients like iron and beta-carotene was inadequate which can be one of the causes of girls being overweight.

George et al (2012) conducted a study to evaluate the prevalence of overweight and its influencing factors in rural adolescent school going children of age group 13-18 years in Kerala, India. The prevalence of overweight and obesity was found to be 19% and 15% among boys and girls while the prevalence of obesity was found to be 6% and 8% respectively. Various factors were studied to know their association with childhood obesity like, educational status and occupation of parents, socioeconomic status, individual characteristics like age, sex, eating habits, time spent for watching TV, hours of sleeping, having junk food and time spent on outdoor and indoor games. Among all the factors sleeping habit and habit of

consumption of high energy food were found to be more important factors of childhood obesity.

Dhruv et al (2011) conducted a study to examine the snacking pattern of people living in Vadodara city. The prevalence of overweight was found to be 21.7% and of obesity was 48.3% among all the participants using Asia Pacific classification. Among the subjects 43.3%, 40% and 21.7% were having a family history of diabetes, hypertension and hypercholesteremia. Among the participants major snacking products which they consumed were fried snacks (68.3%), bakery products (51.7%) and deep-fried snacks (45%). The consumption of bakery and shallow fried food was the highest (35%) which was followed by deep-fried foods (28.3%). The most preferred snack items were biscuits (48.3%), mamra (33.3%) and bhakhri (28.3%) and the least preferred snacks item were sweets and some fresh and steamed foods (1.7%).

Patnaik et al (2011) conducted a cross-sectional study to find out the prevalence of overweight and obesity among school going children and to assess the risk factors related to obesity in a private school of Orissa, India. The overall prevalence of overweight and obesity was found to be 14.1% and 14.53%. The prevalence of overweight and obesity was found significantly more in children with family history of obesity (39.79%), not playing outdoor games (40.8%), not doing regular exercise (33.9%), watching TV and computer >2hours per day (32.5%) and regular consumption of junk food (42.86%).

Sen and Verma (2015) conducted a study to know the link between eating habits and childhood obesity among 600 school going children of age group 6 – 11 years from four different schools of Bhopal district They found that overall prevalence of overweight and obesity was 13.5% and 13%. Factors like consumption of junk food, picky/poor eaters, snacking without permission of parents, easy availability of cookies at home were significantly associated with childhood overweight and obesity. The

prevalence of obesity was found to be more among higher income group and nuclear families.

2.9 Effects of advertisements on the consumption of Junk Food by Children

Kaushal and Dudeja (2017) conducted a study to know the prevalence of misleading food advertisements in India. At the end 1200 advertisements in total were collected from different media, like 900 (75 %) advertisements from TV, 120 (10%) from magazines and 180 (15%) from newspaper. These advertisements were reviewed against the guidelines given by FSSA 2006. They found that prevalence of misleading food advertisements was 60% which is 720 out of 1200 advertisements. The average number of advertisements related to food shown on television was 15+-3.55 per hour. Most of the food advertisements shown on TV was related to foods high in fat, sugar and salt (HFSS). The food products were promoted using different advertisement properties like 57% advertisements used gifts, followed by 19% used picture of celebrity on the package, 14% false claims and 10% advertisements used appealing cartoon characters to attract viewers.

Gupta et al (2017) carried out a study to assess the repetition and type of food advertisements on mostly watched popular television channels by school-going young adolescents in Delhi. The prevalence of overweight and obesity among the subjects was 15.2% and 1.5%. Only 23.3% children were consuming breakfast regularly before going to school and 91% were consuming fast food daily. According to the survey response, Discovery channel, MTV and Disney channel was the most favorite channel viewed at the time slot between 8 and 10 pm. In the time period of 36 hour spread over three weeks a total of 403 food related advertisements was recorded. From these 403 advertisements 235 were food related advertisements, 106 of beverages and 62 were of food outlets. Among 235 advertisements related to food items 163 were of candies, chocolates or confectionaries, 35 were salty snacks, 31 related to dairy products and only six advertisements were about cereals and none for fruits/vegetables. Around 40 advertisements used

animation or celebrity to attract customers. Not a single advertisement displayed the nutritional content of the food.

Tousi and Altinkaya (2017) carried out a study to know the effect of TV food advertisements on children aged 8 to 11 years Thestudy concluded that all the four factors food advertising, TV advertising, school advertising and musical advertising have effects on the children's consumption behavior. TV advertisements and musical advertising have greater effect on children's consumption behavior.

Shakthipriya and Ramesh (2013) conducted a study on influence of television advertisements on unhealthy food preferences among children. They concluded that children's choice of food is being influenced by various marketing techniques. Television advertisements are playing an important role in influencing the behavior of children. Scientific evidence has proved that there is positive association between unhealthy television food advertisements and children's choices of food consumption.

Vijayapushpam et al (2014) conducted a study to analyze food advertisements comparatively between children television channels and mainstream channels in India. Four television channels were selected for the study according to the television rating points (TRP). From these four popular channels two channels popular among children and two channels popular among everyone was selected. Totally 1602 food advertisements were telecasted on the four different channels during the sample period. They found that majority of the advertisements of foods like chocolate, sweet products, biscuits and potato chips were telecasted for greater number of time on children's channel as compared to mainstream channel which shows that manufacturers of these products are targeting mainly children. On mainstream channel 63% advertisements were related to health/energy drinks as they are mostly viewed by adults including house-wives and parents. They concluded that majority of the advertisements shown on the children and mainstream channels were not fostering good health despite of the health claims made.

A study by Dasgupta and Nandhi (2016) analyzed the perception of the parents related to various food related advertisements directed towards children and also studied the impact of unethical practices of food advertising and its impact on perception of parents. After analysis they concluded that impact of unethical food advertising practices was greater among male parent as compared to female parent in children's food product advertisements while the impact of endorser on purchasing decision of the food products has greater impact on female parent as compared to male parent. They also found that families were eating more pre-prepared foods because of its convenience to cook and eat. There was also lack of clarity seen between terminologies (lean vs fat) among the customers.

Galdolage and Wijesundara (2007) carried out a study to review the impact of television advertisements on children in Sri Lanka They found that television was not only providing entertainment but also forcing young children to demand for the items. This has resulted in adverse effects in the way in which children interpret and understand the message shown to them. So as the impact of TV advertisingit was observed that children have spoiled their habitual actions, leading to pester, increase the family budget, making demand for less nutritious food products which are linked to obesity and poor health and to imitate celebrities.

Hussain et al (2015) carried out a study to find out the impact of television advertising on child health, to study television advertising with the buying behavior and its impact on family spending and to indicate the reason of the food/brand preference of the children in Southern Punjab, Pakistan. The results showed that there was a positive significant relationship among all the variables. There was a great influence of television advertisements on the minds of children and this influences their purchasing behavior. They concluded that by getting influenced by the advertisements children force their parents to buy the product or themselves buy the product even if it is of bad quality.

Aktas (2006) conducted a study to examine the effect of television advertisements on children's food consumption while watching television and the desire of the children to purchase goods which they saw on television advertisements. During the study duration a total of 775 products were shown in the advertisements. From these 775 advertisements 347 advertisements were related to food. From all the food advertisements 28.53% were of candy/chocolates,23.9% of chips, 12.96% of milk and derivations of milk like cheese and yogurt and 11.64% of breakfast cereals. Not a single advertisement was related to fruit/vegetables, legume and eggs. They also found that children watched television approximately for 143 min during weekdays and 202 min during weekends and while watching television children were consuming the food which are high in fat and sugar. While purchasing goods they found that 2.6% children did not give any reaction towards the product they saw in advertisements, 13.5% pointed out the products they saw in advertisements, 40.3% children wanted to buy the product they saw in advertisements and 8.9% insisted to buy the products and cried for it.

2.10 Rationale of the study

Literature review reveals that there is an association between junk food consumption and the prevalence of childhood overweight and obesity. Junk foods are high in fat, salt and sugar with low nutritive value. Advertisements featuring products like snacks, toys, confectionaries, cookies and fast food are specifically targeted at children, in order to motivate them to try new brands and buy more. The FSSAI Eat Right Movement aims to create a new food culture by encouraging businesses and consumers to reduce the amount of fat, salt and sugar from foods (FSSAI 2018). The sale of HFSS food was banned in school canteens during school hours by private vendors and street vendors. There are however few studies on the association of television advertisements and HFSS food consumption in school age children and content of the television advertising after initiation of the FSSAI Eat Right Movement. Therefore, it was thought worthwhile to study the association between television food advertisements and HFSS food consumption by school age children.

2.11 Objectives of the Study

1. To analyze the type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels.

2. To study the association between television food advertisements and consumption of HFSS food by school age children.

3. To assess the physical activity pattern of school age children using 3-day physical activity recall.

4. To study sedentary behavior (watching TV, playing video games, using internet for leisure, sitting while talking on the telephone or texting etc.) in school age children.

METHODS AND MATERIALS

METHODS AND MATERIALS

At Global level the profile of disease is transforming rapidly catching the attention of health care professionals. This is seen more in low and middle-income countries which forms the major part of global population. Among these obesity is an epidemic of serious public health concern. Obesity contributes to almost 2.6 million deaths worldwide each year (Thaddanee et al, 2016, Wang et al, 2005). It was estimated that globally there were more than 22million obese students below 20 years of age and one in ten students was overweight (Ghonge et al 2015). A report by International Obesity Task force (IOTF) in the year 2000 shows that 10% of the young people aged 5-17years were overweight globally, from this 10% population 2-3% young people were obese (WHO 2000).

Obesity among children and adolescents have increased more than 2 times in the span of last 30 years. The prevalence of obesity among children of age group 13-19 years have increased from 5% to 20%. Overweight and obesity are the effects of calorie imbalance among individuals. It is very few calories burned in the exchange of the number of calories consumed. Obese children are likely to become obese adults and are at more risk of adult health problems like T2DM, CVDs, stroke and many other complications (Varma et al, 2019). Many factors are responsible for the overweight and obesity like lack of physical activity, sedentary lifestyle, dietary habits. With some changes in the lifestyle there has been an increase in the consumption of junk food among school aged children. Increase in the consumption of food items high in fat, sugar and salt is an important factor leading to overweight and obesity in India. Increase in consumption of junk food is also related to development of diet related NCDS, dyslipidaemia, musculoskeletal disorders, cancers and many other disorders (Sahoo et al, 2015, Reilly et al, 2003).

The role of media and advertisements is playing an important part in changing the dietary pattern of people (Vashishtha, 2010). They are equally responsible for influencing the food consumption pattern of both adults and children. Children being the easy target companies are promoting their food products

through advertisements with inclusion of gifts, cartoon character, humor, animation and celebrity endorsement with the food items (Vadehra, 2010).

Thus, the present study was planned to study the association between television food advertisements and HFSS food consumption among school age children and content of the television advertising after initiation of the FSSAI Eat Right Movement. The FSSAI Eat Right Movement aims to create a new food culture by encouraging businesses and consumers to reduce the amount of fat, salt and sugar from foods (FSSAI 2018). The sale of HFSS food was banned in school canteens during school hours by private vendors and street vendors. The study was approved by the institutional ethics committee for human research of Faculty of Family and Community Sciences, The Maharaja Sayajirao University, Baroda (No. IECHR/FCSc/2020/50) (APPENDIX I)

3.1 BROAD OBJECTIVE

To study the association between television food advertisements and HFSS food consumption among school age children

3.2 SPECIFIC OBEJCTIVES

1. To analyse the type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels.
2. To study the association between television food advertisements and consumption of HFSS food by school age children.
3. To assess the physical activity pattern of school age children using 3-day physical activity recall.
4. To study sedentary behaviour (watching TV, playing video games, using internet for leisure, sitting while talking on the telephone or texting etc) in school age children.

3.3 PLACE OF THE STUDY

The study was carried out in a purposively selected English Medium private school of urban Vadodara.

3.4 SELECTION OF SAMPLES

All the students studying from 6^{th} to 12^{th} standard was enrolled in the study (n=400 approximately).

3.5 STUDY DESIGN

The study was carried out in following two phases: -

PHASE I – Analysis of type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels.

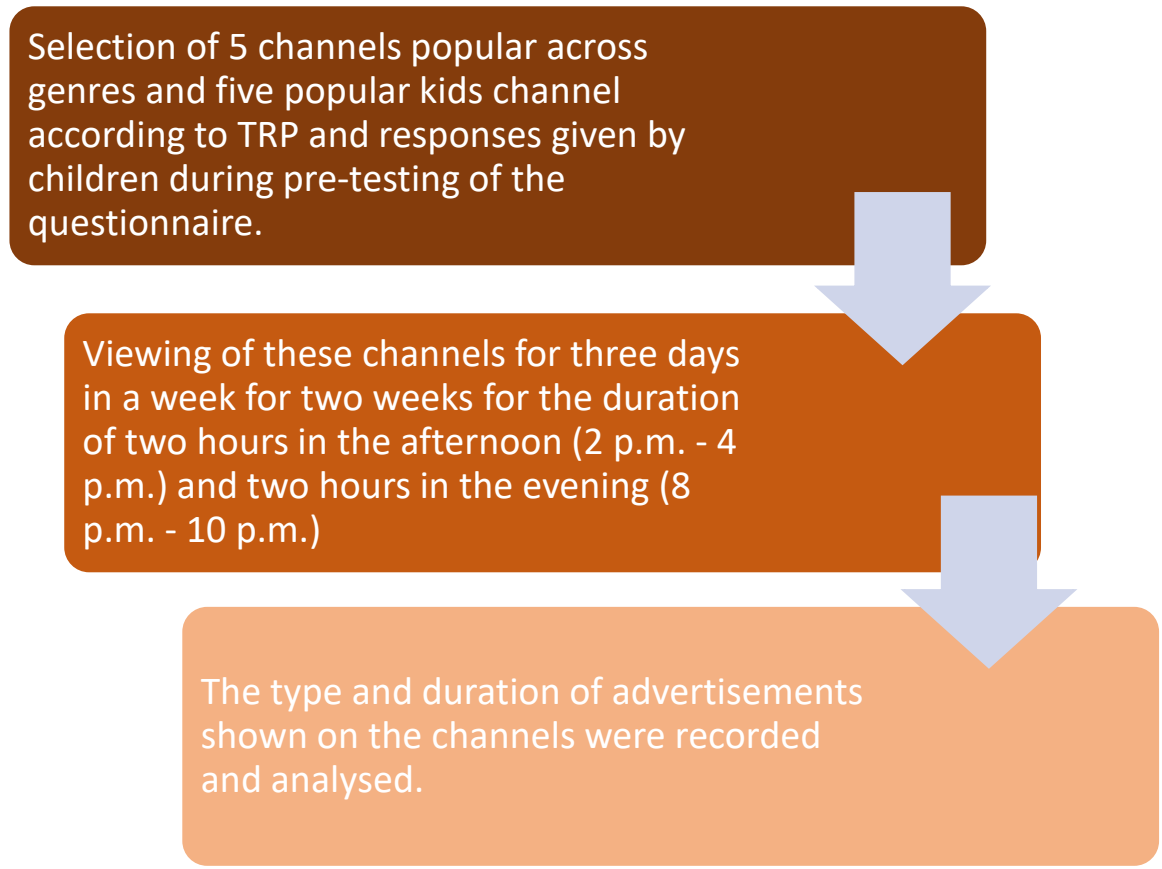
PHASE II – Association between television food advertisements and consumption of HFSS food by school age children.

PHASE I – ANALYSIS OF TYPE, FREQUENCY AND DURATION OF ADVERTISEMENTS SHOWN ON CHANNELS POPULAR ACROSS GENRES AND POPULAR KID'S CHANNELS.

Five channels popular across genres and five popular kid's channels were selected for the study according to the TRP ratings and responses given by children during pretesting of the questionnaire. Five selected channels popular across genres were Star Plus, Colors, Sony, Sab, Star gold and five selected channels popular among kids were Disney Channel, Hungama, Cartoon Network, Pogo and Nick. These five channels were viewed for three days in a week for two weeks for the duration of two hours in the afternoon from 2 p.m. – 4 p.m. and two hours in the evening from 8 p.m. – 10 p.m. On Sundays these channels were viewed in the morning from 10 a.m. – 12 p.m. and in evening from 8 p.m. – 10 p.m. The type and duration of advertisements shown on the channels were recorded and analysed.

FIGURE 3.1

PHASE I: ANALYSIS OF TIME, FREQUENCY AND DURATION OF ADVERTISEMENTS



PHASE II – ASSOCIATION BETWEEN TELEVISION FOOD ADVERTISEMENTS AND CONSUMPTION OF HFSS FOOD BY SCHOOL AGE CHILDREN.

After getting permission from the school authorities an online self-administered questionnaire was circulated among the school children along with all the instructions about the form. The questionnaire with attached assent form for the children was used to collect information related to anthropometric measurements, 3-days physical activity recall, sedentary behaviour (watching TV, playing video games, using internet for leisure, sitting while talking on the telephone or texting etc), HFSS food consumption and 3-days breakfast consumption pattern of children (Appendix III). A separate consent form for the parents was made with all the details of the study and their permission was taken prior to the collection of data from students (Appendix II). First the consent of the parents was taken and those children whose parents had given their consent were selected for the study.

ENROLMENT OF SUBJECTS

- Students studying in 6th to 12th standard were enrolled in the study from a Private English Medium school in Vadodara city.

INCLUSION CRITERIA

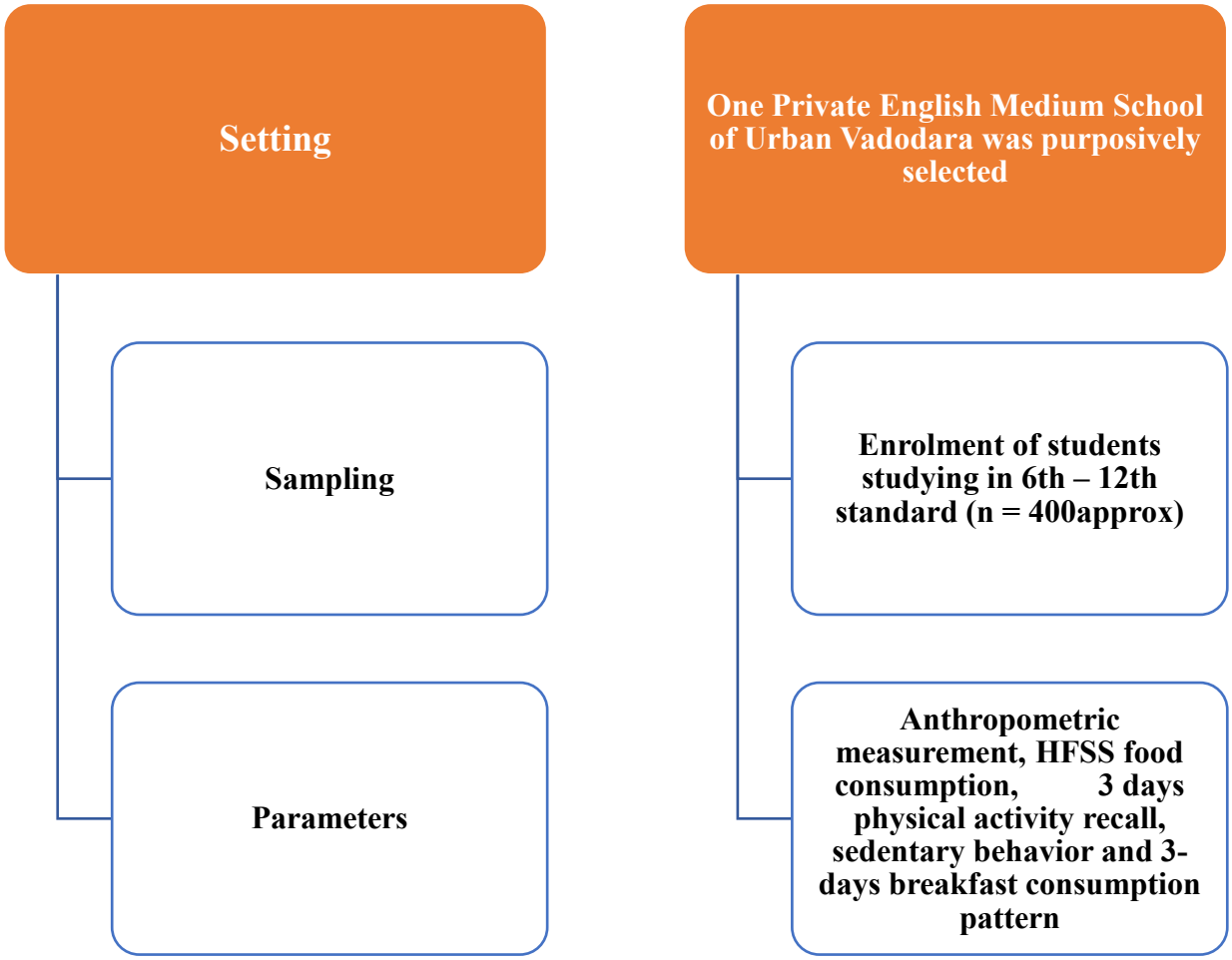
- Students studying in 6th to 12th standard were included in the study.
- Parental consent
- Child's assent

EXCLUSION CRITERIA

- Children suffering from any diseases
- Parental consent not obtained
- Child's assent not obtained

FIGURE 3.2

PHASE II: SELECTION OF SCHOOL AND ENROLLMENT OF SUBJECTS



DATA COLLECTION

Baseline Data

The baseline data of the subjects enrolled from phase II were collected using a self-administered online questionnaire. An online questionnaire was developed and circulated among children. Data related to their background information, anthropometric measurements, 3-days physical activity recall, sedentary behaviour (watching TV, playing video games, using internet for leisure, sitting while talking on the telephone or texting etc), HFSS food consumption and 3-days breakfast consumption pattern was collected. The Youth Compendium of Physical Activities was used to calculate metabolic equivalents (MET) for the different types of physical activities reported by the children. If a type of physical activity reported by the children was not available in the Youth Compendium, the METy values for that activity was taken from the adult compendium. Sedentary behavior of the children was collected for different activities like watching television, videos or DVDs or movies, playing (computer or video) games, using the internet, emailing or other electronic media for leisure, doing school-related video calls and many more for a typical school day and a holiday with an instrument used in the "Active Where" survey. Total time (in minutes) spent by the students on such activities was collected. Frequency of consumption of HFSS food among children was collected. Three-day breakfast consumption pattern of the children was collected. The name of the dish consumed along with the ingredients used for the preparation of that particular dish was to be recorded by the subjects (Appendix III).

METHODOLOGY FOR DATA COLLECTION

General Information data were collected for the following information using structured pre-tested questionnaire.

- Age
- Sex

- Date of birth
- Standard
- Type of Family
- Income
- Parent's Education
- Parent's Occupation

Anthropometric Measurements

Following anthropometric measurements were self-reported

- Weight
- Height
- Waist circumference
- Hip circumference

Classification of children according to their nutritional status was done with the help of WHO anthro plus software.

Data related to following information was collected using a pre-tested questionnaire

- HFSS food consumption
- Sedentary behaviour
- 3-days physical activity recall
- Breakfast consumption pattern

HFSS food consumption

Data related to the frequency of consumption of food high in fat, sugar and salt among subjects were collected using an online pre-tested questionnaire. Frequency of consumption of different food items high in fat (puff, pasta, samosa), high in sugar (carbonated drinks, fruits juices like maaza), high in sugar and fat (gulab-jamun, jalebi), high in salt (oats, soups, papad), high in salt and fat (chips, noodles) of the subjects were collected.

TABLE 3.1 METHODS AND TOOLS

Parameter	**Method/Tools**
General information	Pre-tested Questionnaire
Anthropometric Measurements	
Weight	Pre-tested Questionnaire
Height	Pre-tested Questionnaire
Waist circumference	Pre-tested Questionnaire
Hip circumference	Pre-tested Questionnaire
HFSS food consumption	Pre-tested Questionnaire
Sedentary behaviour	Pre-tested Questionnaire
3-days Physical activity recall	Pre-tested Questionnaire
3-day Breakfast consumption pattern	Pre-tested Questionnaire

Sedentary Behaviour

Data related to sedentary behaviour of the subjects were collected using an online pre-tested questionnaire. Sedentary behavior of the children was collected for different activities like watching television, videos or DVDs or movies, playing (computer or video) games, using the internet, emailing or other electronic media for leisure, doing school-related video calls and many more for a typical school day and a holiday with an instrument used in the "Active Where" survey. Total time (in minutes) spent by the students on such activities was collected.

Physical Activity

A 3-days physical activity recall of the students was collected using an online pre-tested questionnaire. Data of two school days and a holiday were collected from the subjects. The Youth Compendium of Physical Activities was used to calculate metabolic equivalents (MET) for the different types of physical activities reported by the children. If a type of physical activity reported by the children was not available in the Youth Compendium, the METy values for that activity was taken from the adult compendium. Met values of the activities like general exercise, stretching, travelling, yoga and planting were taken from adult compendium.

Breakfast Consumption Pattern

A 3-day breakfast consumption pattern of the subjects was collected using an online pre-tested questionnaire (APPENDIX IV). The subjects were asked to record what they consumed in breakfast for three days. The name of the dish consumed along with the ingredients used for the preparation of that particular dish was to be recorded by the subjects. The foods groups consumed by the children were classified into ten food groups using food groups classification given by minimum dietary diversity for women (Food and Agriculture Organization of the Unites Nations, 2021).

Statistical Analysis

The data was entered into Microsoft Excel Spreadsheet, cleaned, verified for statistical analysis. The data was segregated appropriately and the calculation of the following was done.

- Mean and standard deviation
- Percentages
- "F" test and Student "t" test was used to find out significance between and within the groups.

  The result was considered to be significant it the p-value of the analysis is less than 0.05.

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

Individuals of all the age group are getting affected by obesity and it is becoming a major public health problem. In developed countries levels of obesity are seen higher in lower socio-economic group while the situation is reversed in developing countries. The dramatic changes in the lifestyle of people due to transition from rural to an urban area is also linked to increased level of obesity. Obesity occurs when energy intake exceeds energy expenditure. Obesity and overweight have a close relationship with diabetes, heart diseases, malignancy, asthma, back pain and depression. There are many factors leading to obesity like lack of physical activity, lifestyle changes, prolonged television viewing, playing computer games and also nutritional factors such as consumption of fast food / junk food, consumption of calorie dense food and also the family history of obesity.

Diet is one of the important factor related to overweight, obesity and development of NCDs. The practice of regular consumption of food which is high in fat, salt, sugar and low in nutrient contents, e.g., noodles, chocolates, burgers, pizza, pastries, patties, popcorn, etc. may have adverse effect on the health of children. The factors contributing to childhood obesity are easy availability and access to unhealthy food in school canteens and its vicinity. Television food advertisements play an important role in influencing children decision to a major extent. Substantially scientific evidences have proven that there is a positive relation between unhealthy food advertisements and children's choices of consumption. In this context, the present research aims to study the association between television food advertisements and HFSS food consumption among school age children.

The study was carried out in following two phases: -

PHASE I – Analysis of type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels.

PHASE II – Association between television food advertisements and consumption of HFSS food by school age children.

PHASE I – ANALYSIS OF TYPE, FREQUENCY AND DURATION OF ADVERTISEMENTS SHOWN ON CHANNELS POPULAR ACROSS GENRES AND POPULAR KID'S CHANNELS.

Five channels popular across genres and five popular kid's channels was selected for the study according to the TRP ratings and responses given by children during pretesting of the questionnaire. These five channels were viewed for three days in a week for two weeks for the duration of two hours in the afternoon (2 p.m. – 4 p.m.) and two hours in the evening (8 p.m. – 10 p.m.). On Sundays these channels were viewed in the morning from 10 a.m. – 12 p.m. and in evening from 8 p.m. – 10 p.m. The type and duration of advertisements shown on the channels were recorded and analysed. Five selected channels popular across genres were Star Plus, Colors, Sony, Sab and Star gold. While five selected channels popular among kids were Disney Channel, Hungama, Cartoon Network, Pogo and Nick.

TELEVISION ADVERTISEMENTS

Advertisements are one of the effective tools of integrated marketing communication which attracts consumers towards the product and motivate them to buy the products (More, 2004). Advertisements showing products like snacks, toys, confectionaries, cookies and fast food are targeting children and motivating them to try new brands and buy more. Strong association was found between children and television advertisements with different advertisement properties to attract children (Blosser and Robert, 1985, Halan, 2003).

Table 4.1 shows the total number and duration of advertisements shown on kid's channels on weekdays and Sundays.

Five different kid's channels, Disney Channel, Hungama, Cartoon Network, Pogo and Nick were observed for 3days for 2weeks; 2hours in the afternoon (2-4p.m.) and 2hours in the evening (8-10p.m.) on weekdays and on Sundays it was 10-12a.m. in the morning and 8-10p.m. in the evening. Majority of the food advertisements on Disney channel (44.6%), Hungama (67.8%), Cartoon Network (74.2%), Pogo (76%) and Nick (74.9%)were of HFSS foods like pop rings, instant noodles, candies, breakfast cereals like chocos, biscuits,

TABLE 4.1 TOTAL NUMBER AND DURATION OF ADVERTISEMENTS BROADCASTED ON KIDS CHANNELS ON WEEKDAYS AND SUNDAY

	Total number of advertisements	Total number of food advertisements	% of food advertisements	Number of HFSS food advertisements	% of HFSS food advertisements
Disney Channel					
Weekdays	499 (139.58)	62 (21.79)	12.4	28 (8.16)	45.1
Sunday	252 (53.18)	30 (10.56)	11.9	13 (3.56)	43.3
Total	751 (192.76)	92 (32.35)	12.2	41 (11.72)	44.6
Hungama Channel					
Weekdays	454 (155.66)	60 (26.75)	13.2	38 (19.61)	63.3
Sunday	247 (95.42)	27 (12.82)	10.9	21 (10.66)	77.8
Total	701 (251.08)	87 (39.57)	12.4	59 (30.27)	67.8
Cartoon Network					
Weekdays	733 (237.92)	324 (114.15)	44.2	241 (76.25)	74.4
Sunday	275 (91.09)	134 (49.41)	48.7	99 (34.26)	73.9
Total	1008 (329.01)	458 (163.56)	45.4	340 (110.51)	74.2
Pogo					
Weekdays	649 (217.02)	318 (117.84)	49.0	240 (97.83)	75.5
Sunday	319 (103.95)	142 (51.75)	44.5	110 (43.58)	77.5
Total	968 (320.97)	460 (169.59)	47.5	350 (141.41)	76
Nick					
Weekdays	678 (206.22)	278 (103.28)	41.0	211 (80.97)	75.9
Sunday	294 (94.84)	117 (33.08)	39.8	85 (27.17)	72.6
Total	972 (301.06)	395 (136.36)	40.6	296 (108.14)	74.9
Grand Total	4400 (1394.88)	1492 (541.43)	33.9	1086 (402.05)	72.7

Figures in parentheses denote duration of advertisements in minutes

cookies, cake and ice-creams. Even on Disney Channel more than 40% of food related advertisements were of HFSS foods. Around 77.5% advertisements shown on Pogo channels were related to HFSS food. More number of HFSS food advertisements were telecasted on Sundays as compared to weekdays on channels like Hungama and Pogo. In Disney Channel and Hungama the number of food related advertisements were less but majority of them were related to HFSS food. It was observed that on channels like cartoon network, pogo and nick more than 40% of the advertisements were telecasted about food items like packaged food items, lollipop, cream biscuits and ice-creams. Other food advertisements were of health drinks like bournvita, complan, pediasure and of milk and milk products. There were no advertisements related to fresh fruits and vegetables which are rich in vitamins and minerals on kid's channel.

The results are in conjunction with the finding of a study by Aktas (2006) in which they found that a total of 344 advertisements related to food was shown in television advertisements out of total 775 advertisements. Most of the food advertisements were of candy/chocolate, chips, milk and milk products. Another study by Vijayapushpam et al (2014) shows that advertisements of chocolates/sweets, biscuits/cookies, chips was telecasted for more time on kid's channel as compared to general viewing channels. On mainstream channel 63% advertisements were related to health/energy drinks as they are mostly viewed by adults including house-wives and parents. They concluded that majority of the advertisements shown on the children and mainstream channels were not fostering good health despite of the health claims made.

According to a study by Harrold et al (2011) in UK it was reported that higher proportion of advertisements related to foods and drinks were telecasted during peak hours of children's television viewing time as compared to non-peak hours. Kid's channels were telecasting significantly higher proportion of unhealthy food products in comparison to family channels.

Table 4.2 shows the total number and duration of advertisements shown on general viewing channels on weekdays and Sundays.

Five different general viewing channels, Star plus, Colors, Sony, Sab and Star Gold were observed for 3days for 2weeks; 2hours in the afternoon (2-4p.m.)

TABLE 4.2 TOTAL NUMBER AND DURATION OF ADVERTISEMENTS BROADCASTED ON GENERAL VIEWING CHANNELS ON WEEKDAYS AND SUNDAY

	Total number of advertisements	Total number of food advertisements	% of food advertisements	Number of HFSS food advertisements	% of HFSS food advertisements
Star plus					
Weekdays	716 (256.23)	206 (62.32)	28.8	122 (35.38)	59.2
Sunday	131 (47.98)	23 (5.38)	17.6	12 (2.23)	52.2
Total	847 (304.21)	229 (67.7)	27	134 (37.61)	58.5
Colors					
Weekdays	618 (198.49)	221 (72.06)	35.8	139 (47.56)	62.9
Sunday	68 (22.4)	23 (7.5)	33.8	16 (6.01)	69.6
Total	686 (220.89)	244 (79.56)	35.6	155 (53.57)	63.5
Sony					
Weekdays	713 (267.33)	248 (81.56)	34.8	150 (49.99)	60.5
Sunday	90 (34.26)	34 (10.76)	37.8	15 (4.83)	44.1
Total	803 (301.59)	282 (92.32)	35.1	165 (54.82)	58.5
Sab					
Weekdays	919 (284.02)	280 (97.83)	30.5	135 (56.44)	48.2
Sunday	142 (47.34)	28 (8.34)	19.7	15 (5.49)	53.6
Total	1061 (331.36)	308 (106.17)	29	150 (61.93)	48.7
Star Gold					
Weekdays	766 (258.85)	220 (80.13)	28.7	144 (49.65)	65.5
Sunday	170 (56.76)	44 (14.62)	25.9	31 (9.76)	70.5
Total	939 (315.61)	264 (94.75)	28.1	175 (59.41)	66.3
Grand Total	4336 (1476.66)	1327	30.6	779 (267.34)	58.7

Figures in parentheses denote duration of advertisements in minutes

and 2hours in the evening (8-10p.m.) on weekdays and on Sundays it was 10-12a.m. in the morning and 8-10p.m. in the evening. On Star Plus, Colors, Sony, Sab and Star Gold 58.5%, 63.5%, 58.5%, 48.7% and 66.3% advertisements were related to HFSS food products from total food advertisements respectively. Though the proportion of food related advertisements on general viewing channel was slightly less as compared to kid's channel like Cartoon Network, Pogo and Nick, majority of the food related advertisements on the general viewing channels were also of HFSS foods like chips, biscuits, chocolates, oats, instant noodles, carbonated cold drinks (thums-up, sprite), non-carbonated cold drinks (maaza, slice). Other food items advertisements shown were of beverages like tea, coffee, health drinks like protein X, Horlicks, Yakut, boost and different types of oils. On Sundays around 70.5% adds on star gold channel were related to HFSS food. In comparison to kid's channel less HFSS food related advertisements were telecasted on general viewing channel. In all the channels 58.7% food advertisements telecasted on television were related to HFSS food products.

A study by Danyang et al (2016) reported that from total 5527 advertisements 25.5% advertisements were related to food from which majority of the advertisements were of unhealthy food. Around 51.7% of all food advertisements were containing promotional characters and 59.1% had premium offers. According to a study by Mchiza et al (2013) in South Africa, 63% advertisements shown on television were related to food products. According to a study by Powell et al (2007) it was observed that around 97.8% and 89.4% advertisements related to food products viewed by children of age group 2-11 years and 12-17 years were high in fat, sugar, or sodium. Almost 97.6% advertisements were related to high sugar cereals seen by children of 2-11years age group (Powell et al, 2007).

Table 4.3 shows the classification of different types of food products shown on television advertisements. Majority of the advertisements telecasted on kid's channels from total food advertisements were related to candies and chocolates (22.86%), followed by biscuits and cakes (20.98%), ready to eat food (19.7%) like instant noodles, breakfast cereal chocos and 8.7% of food advertisements were related to chips, pop-rings, potato crackers. Food products like milk and derivations of milk (8.45%), oil (4.62%), tea/coffee (2.08%), health drinks like protein powder (5.16%), healthy food products like wheat flour, gram flour (7.44%) were shown less in comparison to other HFSS food product. Among general viewing channels majority of the food advertisements from total food advertisements were related to healthy food products (15.07%) like wheat flour, gram flour, followed by candies and chocolates (15%), biscuit and cakes (12.66%), health drinks like protein powders (12.21%) and ready to eat food (9.7%) like instant noodles, oats, mccain, etc. Food items like milk and derivations of milk (1.36%), chips or pop rings (3.2%), oil (5.43%), tea/coffee (7.01%) and ketchup/jam (5.12%) were telecasted less on general viewing channels as compared to other food products. On Kid's channels maximum number of advertisements were related to candies or chocolates (22.86%), biscuits or cakes (20.98%) and ready to eat food (19.7%) as compared to general viewing channels 15%, 12.66% and 9.7%. While on general viewing channels the number of advertisements related to health drinks like protein powder (12.21%), healthy food products (15.07%), oil (5.43%), tea/coffee (7.01%) were telecasted more in comparison to kid's channels 5.16%, 7.44%, 4.62% and 2.08%. Mostly advertisements related to carbonated cold drinks (5.43%), non-carbonated cold drinks (7.76%) and ketchups/jam/mayonnaise (5.12%) were telecasted on general viewing channels in comparison to kid's channels. Figure 4.1 shows the classification of different types of food products advertisements shown on television.

According to a study by Gupta et al (2017) it was reported that 58.4% advertisements telecasted on channels were related to food items while 26.7% were of beverages and remaining 15.3% were related to food outlets. Among

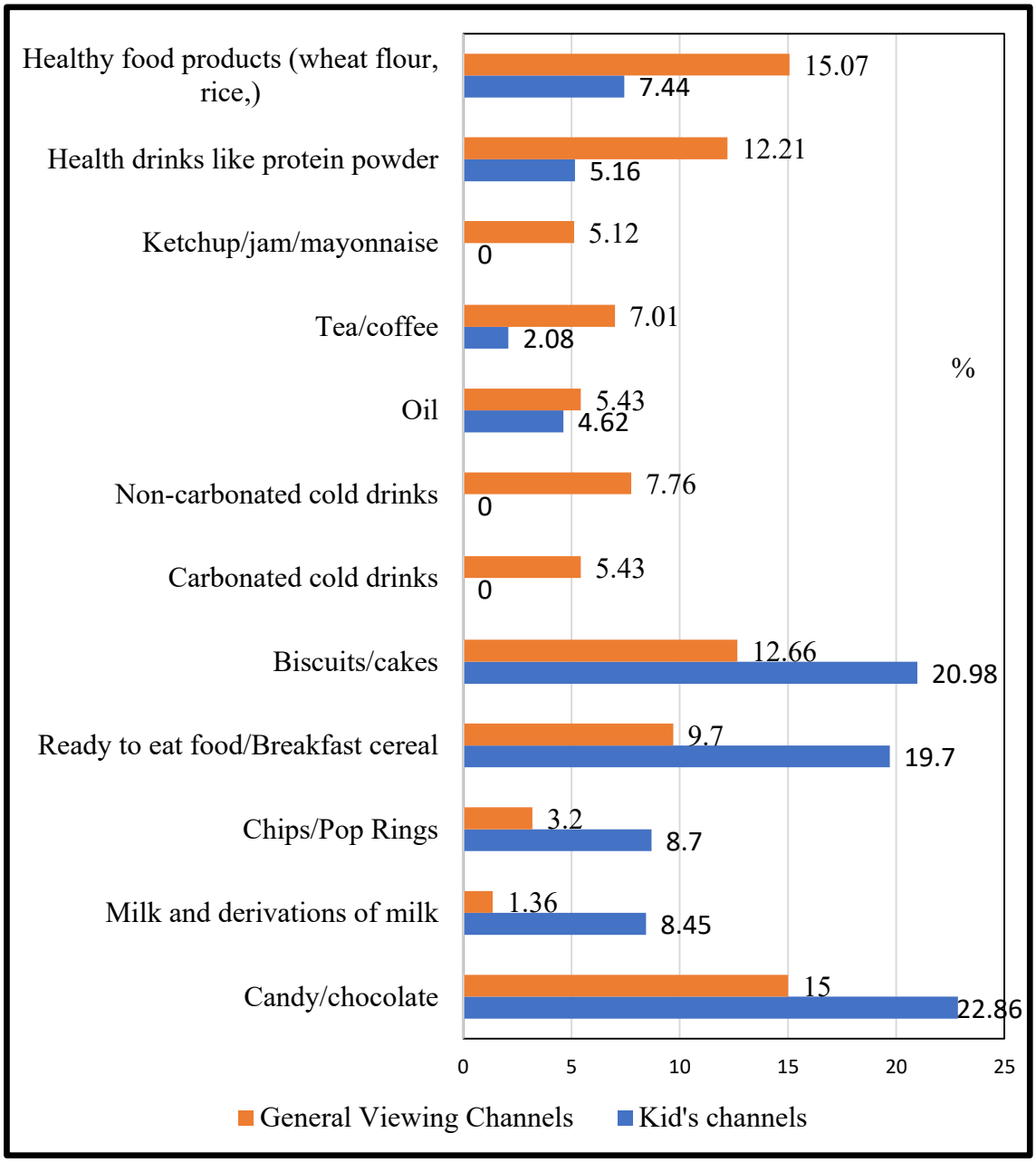
TABLE 4.3 TYPE OF FOOD ADVERTISMENTS SHOWN ON TELEVISION

N (%)

FOOD PRODUCTS	Kid's Channels (N=1492)	General viewing channels (N=1327)
Candy/chocolate	341 (22.86)	199 (15)
Milk and derivations of milk	126 (8.45)	18 (1.36)
Chips/Pop Rings	130 (8.7)	43 (3.2)
Ready to eat food/Breakfast cereal	294 (19.7)	129 (9.7)
Biscuits/cakes	313 (20.98)	168 (12.66)
Carbonated cold drinks	0 (0)	72 (5.43)
Non-carbonated cold drinks	0 (0)	103 (7.76)
Oil	69 (4.62)	72 (5.43)
Tea/coffee	31 (2.08)	93 (7.01)
Ketchup/jam/mayonnaise	0 (0)	68 (5.12)
Health drinks like protein powder	77 (5.16)	162 (12.21)
Healthy food products (wheat flour, rice,)	111 (7.44)	200 (15.07)

Figures in parentheses denote percentage

FIGURE 4.1 TYPE OF FOOD ADVERTISMENTS SHOWN ON TELEVISION



all the food items majority of the food products were candies, chocolates or confectionaries (69.3%), followed by salty snacks (14.8%), dairy products (13.2%) and only 6 advertisements were related to cereals and no advertisements of fruit and vegetables were telecasted on television. A study by Kearney et al (2020) shows that consumption of sugar and energy dense food among children have been increased when they were exposed to high sugar food advertisements. Long-time exposure to food advertising increases the intake of food shown in the advertisements among children. Especially advertisements related to high-sugar food and beverages promotes the consumption of food items high in sugar. According to a study by Powell et al (2011) it was observed that children of age group 2-5 years and 6-11years saw on an average 10.9 and 12.7 food related advertisements in 2009 while the exposure of fast food advertising have been increased by 21.1% among 2-5 years children and 30.8% among 6-11years children. Almost 86% advertisements seen by children were for products high in saturated fat, sugar, or sodium (Powell et al, 2011).

Table 4.4 shows the properties of advertisements used to attract attention of viewers. Around 21.98% advertisements shown on kid's channel have humor effects to attract children towards the product followed by other special effects like celebrity endorsement (15.75%), free gifts like toys inside the products (13.81%), jingles (13.14%) and nutrient claims (9.32%). Animation effects (8.11%), cartoon character (8.78%) and convenience to cook (5.36%) were used less to attract children in comparison to other special effects on kid's channels. While on general viewing channels almost 31.88% advertisements have celebrity endorsement to attract viewers toward their products, followed by humor (18.54%) and nutrient claims messages (18.24%). Other special effects like animation (2.11%), free gifts (1.43%), actions (2.41%), jingle (2.49%) and convenience to cook (3.09%) were used less in comparison to other special effects on general viewing channels. On Kid's channels 21.98% advertisements used humor effects to attract viewers while only 18.54% used humor effects on general viewing channels. Majority of the advertisements used celebrity endorsement (31.88%) to attract viewers on general viewing

TABLE 4.4 ADVERTISEMENT PROPERTIES USED TO ATTRACT ATTENTION OF VIEWERS N (%)

ADVERTISEMENT PROPERTIES	Kid's channels (N=1492)	General viewing channels (N=1327)
Humor/comedy	328 (21.98)	246 (18.54)
Animation	121 (8.11)	28 (2.11)
Cartoon Character	131 (8.78)	0 (0)
Celebrity endorsement	235 (15.75)	423 (31.88)
Free gifts	206 (13.81)	19 (1.43)
Actions/stunts	0 (0)	32 (2.41)
Jingle	196 (13.14)	33 (2.49)
Messages (nutrient content claims)	139 (9.32)	242 (18.24)
Convenient or easy to cook	80 (5.36)	41 (3.09)

Figures in parentheses denote percentage

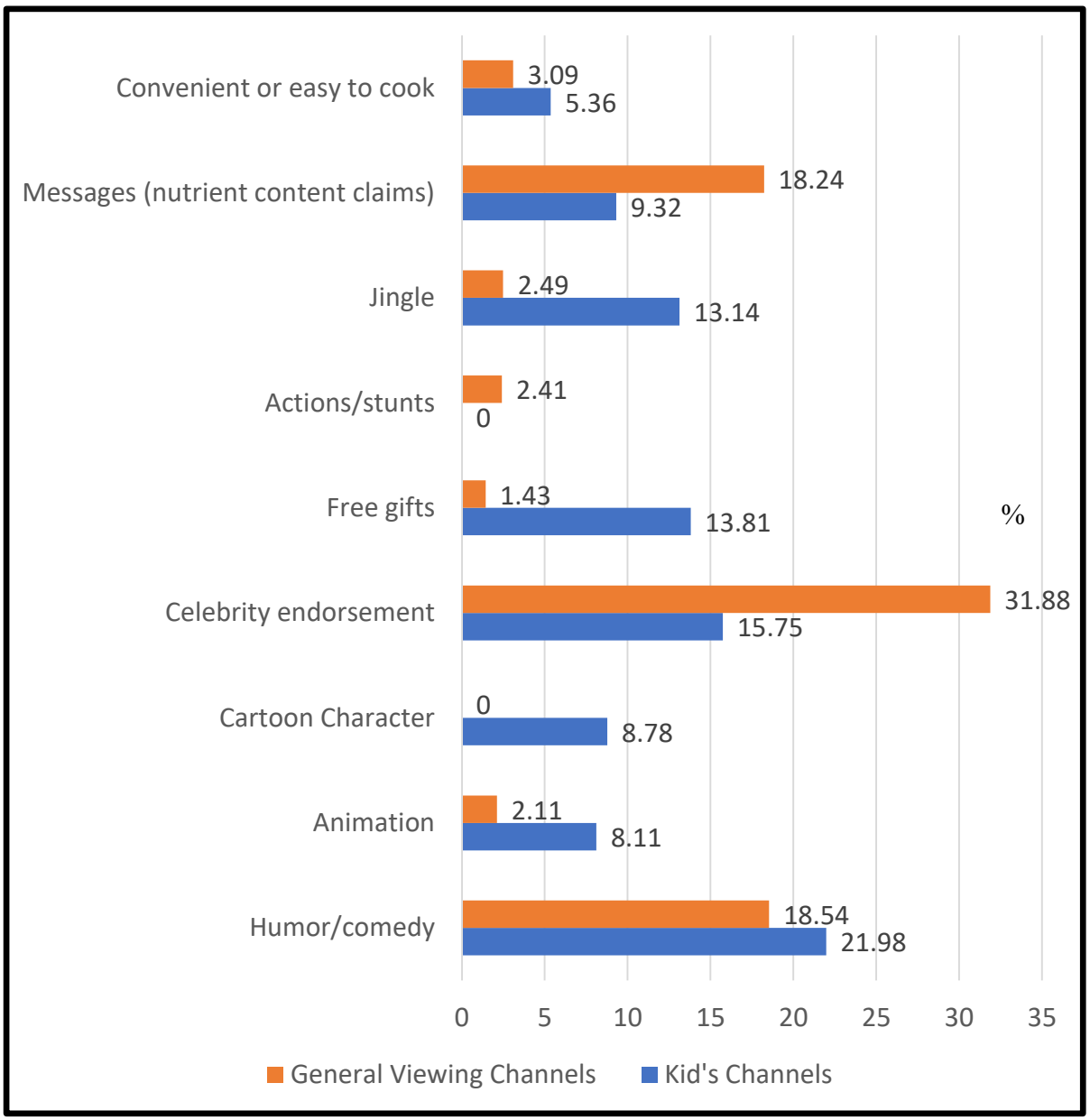
channels as compared to kid's channels (15.75%). Properties like Animation (8.11%) and cartoon characters (8.78%) were used more in kid's channels than general viewing channels 2.11% and 0%. More advertisements with nutrient content claims were shown on general viewing channels (18.24%) in comparison to kid's channels (9.32%). Figure 4.2 show the properties of advertisements used to attract attention of viewers.

According to a study by Boyland et al (2012) different properties like attractive appeals, premium offers, promotional or cartoon characters and celebrity endorsement were used to attract viewers to their product. Promotional or cartoon characters, celebrity endorsement and premium offer were used mostly for promotion of unhealthy food products than healthy food products. A study by Kelly et al (2008) reported that in Australia more unhealthy food products were shown on television during peak hours of children's television viewing time. It showed that during children popular programme 3.3 unhealthy food advertisements per hour containing premium offers were shown to attract children as compared to only 0.2 food advertisements per hour during adult programs. A study by Gupta et al (2017) reported 77% of advertisements used direct appeal to viewers for attracting them towards the products followed by 10% advertisements used either animation or celebrity endorsement to attract viewers. According to a study by Kaushal and Dudeja (2017), 57% food advertisements used gifts for the promotion of food products 19% used celebrity pictures on packets and 14% used false claims.

PHASE II – ASSOCIATION BETWEEN TELEVISION FOOD ADVERTISEMENTS AND CONSUMPTION OF HFSS FOOD BY SCHOOL AGE CHILDREN.

To study the association between television food advertisements and consumption of HFSS food among school age children a self-administered online questionnaire was developed and circulated among children to collect their anthropometric measurements, 3-days physical activity recall, sedentary behaviour (watching TV, playing video games, using internet for leisure, sitting while talking on the telephone or texting etc),HFSS food consumption

FIGURE 4.2 ADVERTISEMENT PROPERTIES USED TO ATTRACT ATTENTION OF VIEWERS



and 3-days breakfast consumption pattern of children.

BACKGROUND INFORMATION OF THE SUBJECTS

Table 4.5 shows the background information of the subjects. The mean age of the subjects was 14.4years. Majority of the subjects (62.4%) belonged to nuclear family. Around 26.44% girls and 33.52% boys belong to joint family. Based on an updated socioeconomic status classification given by Prasad (2020) 49.2% subjects belong to upper class family with per capita income above Rs. 7533, while 2.9% belonged to upper middle class (per capita income Rs.3766-7532) and 0.5% belongs to middle class with per capita income between Rs.2260-3765. Almost 49.51% girls and 48.82% boys were from upper class family. Around 47.4% subjects did not respond to these questions. Around 47.9 % fathers and 54.5% mothers of the subject had completed their graduation. Almost 37.3% father were having a private or government service followed by 32.3% subjects whose father were running a business and 17.7% fathers were having a professional service. Most of the mothers (54.8%) were housewife and 16.1% mothers were having a service in government or private sector.

CLASSIFICATION OF CHILDREN ACCORDING TO STANDARDS IN WHICH THEY STUDY

Table 4.6 shows the classification of children according to their respective standards. Around 14.81% subjects were from 6^{th}standard, 13.75% subjects from 7^{th}standard, 12.96% subjects from 8^{th}standard, 14.55% subjects from 9^{th}standard, 14.81% subjects from 10^{th}standard, 15.87% subjects from 11^{th}standard and 12.69% subjects were from 12^{th}standard.

ANTHROPOMETRIC DATA

Around 319 students gave their anthropometric measurements and they were classified according to their nutritional status as thin, normal, overweight and obese with the help of WHO anthro plus. Table 4.7 shows the nutritional classification of subjects. From 319 total subjects 5.3% subjects were under thin category, 61.1 % subjects were normal, 26% were overweight and 7.5% subjects were obese.

TABEL 4.5 BACKGROUND INFORMATION OF THE SUBJECTS N (%)

Variable	Girls (N=208)	Boys (N=170)	Total (N=378)
Age (Years)			
Mean ± SD	14.27 ± 2.17	14.32 ± 1.98	14.30 ± 2.09
Type of Family			
Nuclear	142 (68.26)	94 (55.29)	236 (62.4)
Joint	55 (26.44)	57 (33.52)	112 (29.6)
Extended	4 (1.92)	6 (3.52)	10 (2.7)
Not Responded	7 (3.36)	13 (7.6)	20 (5.3)
Total Family Income			
Upper	103 (49.51)	83 (48.82)	186 (49.2)
Upper middle class	8 (3.84)	3 (1.76)	11 (2.9)
Middle class	1 (0.48)	1 (0.58)	2 (0.5)
Not Responded	98 (47.11)	81 (47.64)	179 (47.4)
Parent's Education			
Father's Education			
Primary school	0 (0)	0 (0)	0 (0)
Secondary school	1 (0.48)	0 (0)	1 (0.3)
Higher secondary	2 (0.96)	4 (23.52)	6 (1.6)
Graduate	95 (45.67)	86 (50.58)	181 (47.9)
Master's degree	85 (40.86)	62 (36.47)	147 (38.9)
Others	11 (5.288)	6 (3.52)	17 (4.5)
Not Responded	15 (7.21)	11 (6.47)	26 (6.9)
Mother's Education			
Primary school	0 (0)	0 (0)	0 (0)
Secondary school	3 (1.44)	1 (0.58)	4 (1.1)
Higher secondary	5 (2.4)	6 (3.52)	11 (2.9)
Graduate	106 (50.96)	100 (58.82)	206 (54.5)
Master's degree	76 (36.53)	47 (27.64)	123 (32.5)
Others	4 (1.92)	3 (1.76)	7 (1.9)

Not Responded	14 (6.73)	13 (7.64)	27 (7.1)
Parent's Occupation			
Father's Occupation			
Business	67 (32.21)	55 (32.35)	122 (32.3)
Self-Employed	17 (8.17)	5 (2.94)	22 (5.8)
Service (Private/Government)	71 (34.13)	70 (41.17)	141 (37.3)
Professional (MBBS/Engineer/LLB/MBA)	40 (19.23)	27 (15.88)	67 (17.7)
Retired	0 (0)	0 (0)	0 (0)
Others	1 (0.48)	3 (1.76)	4 (1.1)
Not Responded	12 (5.76)	10 (5.88)	22 (5.8)
Mother's Occupation			
Home-maker	113 (54.32)	94 (55.29)	207 (54.8)
Business	11 (5.28)	13 (7.64)	24 (6.3)
Self-Employed	27 (12.98)	8 (4.7)	35 (9.2)
Service (Private/Government)	30 (14.42)	31 (18.23)	61 (16.1)
Professional (MBBS/Engineer/LLB/MBA)	14 (6.73)	15 (8.82)	29 (7.7)
Retired	1 (0.48)	0 (0)	1 (0.3)
Others	1 (0.48)	0 (0)	1 (0.3)
Not Responded	10 (4.8)	10 (5.88)	20 (5.3)

Figures in parentheses denote percentage

TABLE 4.6 CLASSIFICATION OF CHILDREN ACCORDING TO STANDARDS IN WHICH THEY STUDY N (%)

CLASS	GIRLS (N=208)	BOYS (N=170)	TOTAL (N=378)
6th Class	36 (17.3)	22 (12.94)	56 (14.81)
7th Class	32 (15.38)	20 (11.70	52 (13.75)
8th Class	21 (10.09)	28 (16.47)	49 (12.96)
9th Class	25 (12.01)	30 (17.64)	55 (14.55)
10th Class	28 (13.46)	28 (16.47)	56 (14.81)
11th Class	35 (16.82)	25 (14.7)	60 (15.87)
12th Class	31 (14.9)	17 (10)	48 (12.69)

Figures in parentheses denote percentage

TABEL 4.7 CLASSFICATION OF CHILDREN ACCORDING TO NUTRITIONAL STATUS N (%)

Variable	Boys (N=146)	Girls (N=173)	Total (N=319)
Thin	10 (6.8)	7 (4)	17 (5.3)
Normal	77 (52.7)	118 (68.2)	195 (61.1)
Overweight	42 (28.8)	41 (23.7)	83 (26)
Obese	17 (11.6)	7 (4)	24 (7.5)

Figures in parentheses denote percentage

Prevalence of overweight and obesity was seen high among boys (28.8% and 11.6%) as compared to girls (23.7% and 4%).Figure 4.3 shows the classification of children according to their nutritional status

The results obtained are in conjunction with some other prevalence studies carried among school children which shows that there is prevalence of overweight and obesity among school children. According to a study by Gamit et al (2014) the overall prevalence of overweight and obesity among 1079 school going adolescents of Surat city was 10.2% and 6%. They have found that majority of the overweight and obese subjects were from upper income group as compared to lower income group.

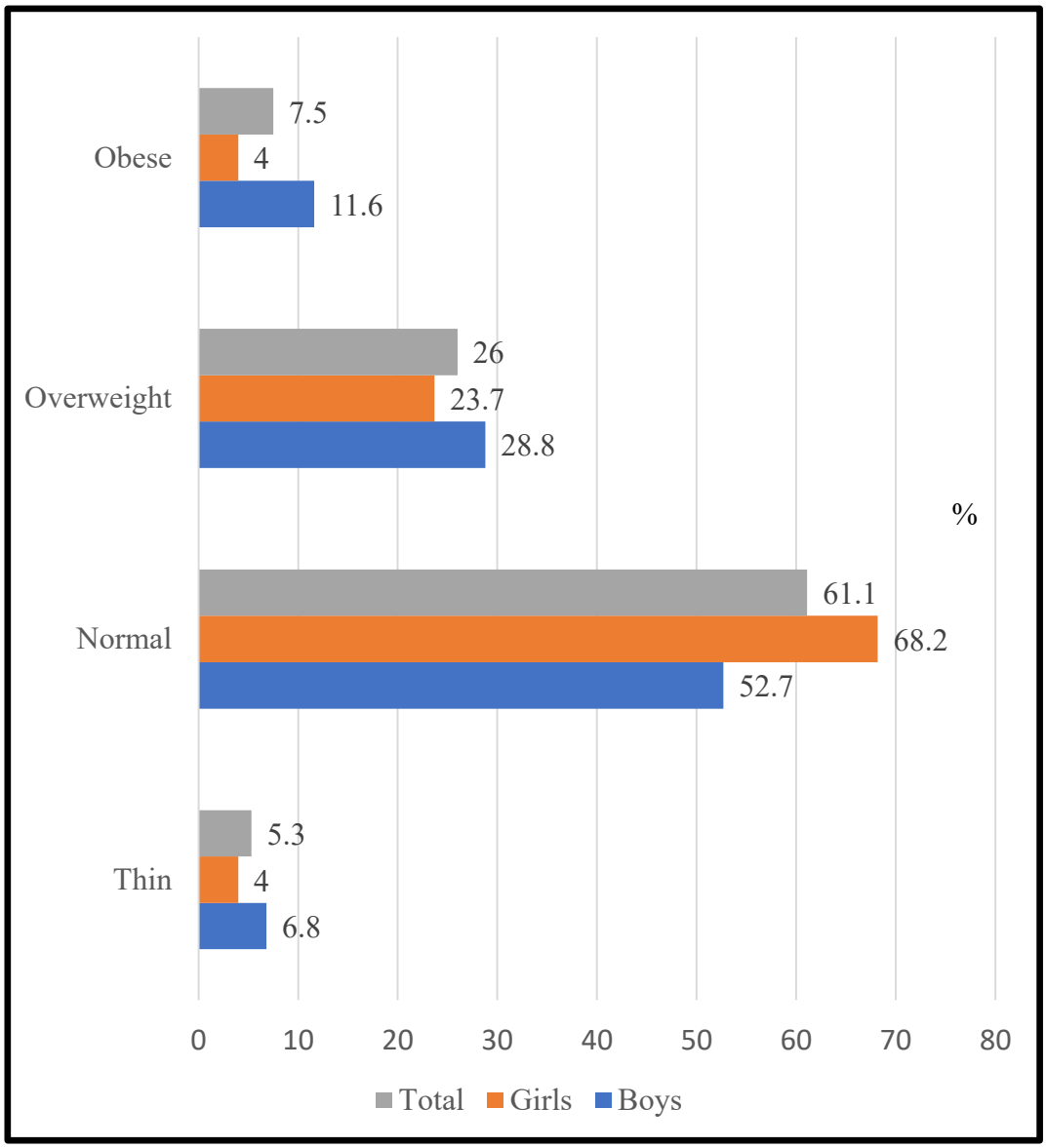
Another study by George et al (2012) done on 173 students of 13-18 years have shown 16% prevalence of overweight and 7% prevalence of obesity among the subjects.

HFSS FOOD CONSUMPTION AMONG CHILDREN

Change in the food habit has led to replacement of nutritious food by food products which are tasty and convenient like junk food or HFSS food. HFSS food provide minimum amount of nutrient with excessive amount of fat, sugar and salt (Anderson and Patterson, 2005).

High consumption of HFSS foods like noodles, burgers, sandwiches, biscuits etc. have become common among children (Singh and Singh, 2008). Regular consumption of HFSS foods have various effects on health like lack of energy, poor concentration, obesity, depression. heart diseases, high cholesterol, premature ageing, stunted growth and tooth decay (Chhibber, 2010).

FIGURE 4.3 CLASSFICATION OF CHILDREN ACCORDING TO NUTRITIONAL STATUS



FREQUENCY OF CONSUMPTION OF HFSS FOOD ITEMS

Table 4.8 shows the frequency of consumption of HFSS food items which are rich in fat, salt and sugar. Some observations were made about the consumption pattern of the subjects according to the different categories of food items present.

According to different categories of food item it was observed that about 25.85% and 16.99% children consumed brown bread and white bread which are high in fat at least once in a week. Around 8.36% subjects reported frequent consumption of egg items on daily basis. Around 40.37% and 29.4% of the subjects reported consumption of food rich in fat and sugar like chocolates and cream biscuits at least once in a week respectively. Almost 27.04%, 18.13%, 8.6% and 7.89% subjects reported consumption of foods like breakfast cereal, ketchups, jam and sweet pickle on daily basis. High consumption of food items rich in salt and fat was seen among subjects. Almost 38.68%, 33.44%, 32.9% and 17.61% reported consumption of khakhra, sev-mamra, salty biscuits and sour-pickle at least once in a week. Majority of the subjects (31.63%) reported frequent consumption of food items high in salt (Papad). Food items rich in salt and fat like noodles (21%), Sev (25%), Cheese spreads (18.59%) and mayonnaise (16.67%) were consumed at least once in week respectively. Foods high in sugar and fat like cake (25.39%) and pastry (20.57%) were consumed once in 15 days or in a month by the subjects. It was observed that diet coke was more consumed by the children on daily basis as compared to carbonated drinks. Around 6.19% subjects consumed diet coke and 7.82% subjects consumed carbonated drinks at least once in a week while. While regular chips (16.72%) was more consumed by the subjects as compared to baked chips (15.34%) on daily basis.

A study by Verma et al (2019) shows that almost 8% subjects consumed fast food once a week, 13% consumed fast food twice a week, 22% and 17% subjects consumed fast food frequently almost 3-4 times per week and more than 4times per week. According to a study by Antony and Bhatti (2013) on children of 13 - 17years age group it was reported that 66.8% subjects

TABLE 4.8 FREQUENCY OF CONSUMPTION OF HFSS FOOD ITEMS BY THE SUBJECTS N (%)

Food items	Daily or 4-5times per week	1-3 times per week	Once in 15days or in a month	Occasionally or never	At least once a week
Foods high in Fat					
Puff	8 (2.45)	11 (3.36)	81 (24.77)	227 (69.42)	19 (5.81)
Samosa	6 (1.84)	19 (5.83)	104 (31.9)	197 (60.43)	25 (7.67)
Vada-pav	6 (1.86)	17 (5.28)	77 (23.91)	222 (68.94)	23 (7.14)
Frankie	4 (1.24)	13 (4.04)	85 (26.4)	220 (68.32)	17 (5.28)
Sandwich(cheese)	13 (3.95)	24 (7.29)	158 (48.02)	134 (40.73)	37 (11.25)
Sabudhana-vada	2 (0.63)	16 (5.08)	55 (17.46)	242 (76.83)	18 (5.71)
Pani-puri	10 (3.04)	23 (6.99)	145 (44.07)	151 (45.9)	33 (10.03)
Chaat	5 (1.57)	16 (5.02)	74 (23.2)	224 (70.22)	21 (6.58)
Sev-usal	5 (1.54)	18 (5.54)	118 (36.31)	184 (56.62)	23 (7.08)
Kachori	6 (1.89)	10 (3.14)	53 (16.67)	249 (78.3)	16 (5.03)
Dabeli	2 (0.63)	14 (4.4)	69 (21.7)	233 (73.27)	16 (5.03)
Pasta	9 (2.77)	28 (8.62)	148 (45.54)	140 (43.08)	37 (11.38)
Pav-bhaji	12 (3.7)	14 (4.32)	180 (55.56)	118 (36.42)	26 (8.02)
Egg-items	27 (8.36)	45 (13.93)	54 (16.72)	197 (60.99)	72 (22.29)
Bhajiyas	9 (2.82)	17 (5.33)	114 (35.74)	179 (56.11)	26 (8.15)
Bataka-vada	5 (1.62)	12 (3.88)	64 (20.71)	228 (73.79)	17 (5.5)
Puri	9 (2.84)	23 (7.26)	130 (41.01)	155 (48.9)	32 (10.09)
Puna-misal	3 (1)	13 (4.32)	34 (11.3)	251 (83.39)	16 (5.32)
Bread (brown)	30 (9.23)	54 (16.62)	120 (36.92)	121 (37.23)	84 (25.85)

Bread (white)	18 (5.77)	35 (11.22)	95 (30.45)	164 (52.56)	53 (16.99)
Foods high in Sugar and Fat					
Gulabjamun	4 (1.27)	16 (5.08)	45 (14.29)	250 (79.37)	20 (6.35)
Kala jam	4 (1.29)	9 (2.9)	18 (5.81)	279 (90)	13 (4.19)
Bundi	5 (1.6)	15 (4.81)	39 (12.5)	253 (81.09)	20 (6.41)
Ladoo	9 (2.87)	13 (4.14)	58 (18.47)	234 (74.52)	22 (7.01)
Peda	5 (1.6)	11 (3.53)	46 (14.74)	250 (80.13)	16 (5.13)
Rasgulla	3 (0.97)	12 (3.87)	31 (10)	264 (85.16)	15 (4.84)
Rasmalai	3 (0.97)	10 (3.25)	21 (6.82)	274 (88.96)	13 (4.22)
Rabdi	4 (1.3)	11 (3.57)	19 (6.17)	274 (88.96)	15 (4.87)
Jalebi	5 (1.6)	10 (3.19)	51 (16.29)	247 (78.91)	15 (4.79)
Basundi	2 (0.66)	11 (3.61)	22 (7.21)	270 (88.52)	13 (4.26)
Ice cream	18 (5.61)	30 (9.35)	142 (44.24)	131 (40.81)	48 (14.95)
Chocolates	70 (21.41)	62 (18.96)	135 (41.28)	60 (18.35)	132 (40.37)
Puddings	4 (1.29)	14 (4.5)	51 (16.4)	242 (77.81)	18 (5.79)
Bun	9 (2.93)	21 (6.84)	142 (46.25)	135 (43.97)	30 (9.77)
Cakes	8 (2.48)	25 (7.74)	82 (25.39)	208 (64.4)	33 (10.22)
Pastry	8 (2.53)	19 (6.01)	65 (20.57)	224 (70.89)	27 (8.54)
Biscuits (cream)	53 (16.3)	43 (13.2)	94 (28.8)	136 (41.7)	96 (29.4)
Foods high in Sugar					
Fruit drinks-Mazza/slice/minute made/tropicana/real	21 (6.56)	24 (7.5)	81 (25.31)	194 (60.63)	45 (14.06)
Fruit crush/sherbets-Mapro/mala/rasna/tang	21 (6.69)	19 (6.05)	73 (23.25)	201 (64.01)	40 (12.74)
Red bull	4 (1.31)	7 (2.29)	16 (5.23)	279 (91.18)	11 (3.59)
Ketchups	58 (18.13)	54 (16.88)	110 (34.38)	98 (30.63)	112 (35)

Jam	27 (8.6)	32 (10.19)	59 (18.79)	196 (62.42)	59 (18.79)
Breakfast cereals	86 (27.04)	33 (10.38)	61 (19.18)	138 (43.4)	119 (37.42)
Sweet pickle	24 (7.89)	24 (7.89)	42 (13.82)	214 (70.39)	48 (15.79)
Sweet chutney	23 (7.47)	21 (6.82)	65 (21.1)	199 (64.61)	44 (14.29)
Regular carbonated beverages (e.g. Coke / Pepsi)	6 (1.95)	18 (5.86)	58 (18.89)	225 (73.29)	24 (7.82)
Foods high in Salt and Fat					
Noodles (e.g. maggi/yippee/chings)	24 (7.52)	43 (13.48)	165 (51.72)	87 (27.27)	67 (21)
Mayonnaise	19 (6.09)	33 (10.58)	102 (32.69)	158 (50.64)	52 (16.67)
Cheese spreads	21 (6.73)	37 (11.86)	89 (28.53)	165 (52.88)	58 (18.59)
Frozen food (e.g. Mccain, frozen pizza, paratha)	11 (3.58)	16 (5.21)	47 (15.31)	233 (75.9)	27 (8.79)
Fries	8 (2.59)	17 (5.5)	82 (26.54)	202 (65.37)	25 (8.09)
Kurkure	12 (3.86)	17 (5.47)	67 (21.54)	215 (69.13)	29 (9.32)
Khakhra	78 (24.53)	45 (14.15)	79 (24.84)	116 (36.48)	123 (38.68)
Soya sticks	17 (5.52)	33 (10.71)	89 (28.9)	169 (54.87)	50 (16.23)
Gathiya	19 (6.13)	33 (10.65)	64 (20.65)	194 (62.58)	52 (16.77)
Papdi	19 (6.19)	33 (10.75)	73 (23.78)	182 (59.28)	52 (16.94)
Chawanu	18 (5.88)	29 (9.48)	59 (19.28)	200 (65.36)	47 (15.36)
Sev	36 (11.69)	41 (13.31)	88 (28.57)	143 (46.43)	77 (25)
Sev-mamra	56 (17.83)	49 (15.61)	84 (26.75)	125 (39.81)	105 (33.44)
Burger (e.g. Mc Donalds, KFC, Burger king)	5 (1.61)	22 (7.07)	88 (28.3)	196 (63.02)	27 (8.68)
Pizza	11 (3.49)	25 (7.94)	100 (31.75)	179 (56.83)	36 (11.43)
Subway	6 (1.93)	17 (5.47)	60 (19.29)	228 (73.31)	23 (7.4)
Fafda	3 (0.99)	24 (7.89)	61 (20.07)	216 (71.05)	27 (8.88)
Khaman	4 (1.31)	20 (6.56)	65 (21.31)	216 (70.82)	24 (7.87)

Sour pickle	33 (10.96)	20 (6.64)	38 (12.62)	210 (69.77)	53 (17.61)
Chinese food	6 (1.95)	18 (5.84)	95 (30.84)	189 (61.36)	24 (7.79)
Biscuits (salty)	51 (15.7)	56 (17.2)	75 (23.1)	143 (44)	107 (32.9)
Foods high in Salt					
Soups	32 (10.19)	35 (11.15)	100 (31.85)	147 (46.82)	67 (21.34)
Papad	57 (18.21)	42 (13.42)	76 (24.28)	138 (44.09)	99 (31.63)
Oats	34 (11.07)	28 (9.12)	39 (12.7)	206 (67.1)	62 (20.2)
Instant soup	11 (3.64)	21 (6.95)	45 (14.9)	225 (74.5)	32 (10.6)
Baked Chips / Wafers (e.g. Too Yumm, Ruffles baked chips)	16 (5.11)	32 (10.22)	80 (25.56)	185 (59.11)	48 (15.34)
Regular Chips/ Wafers (e.g. Lays, Uncle chips)	20 (6.31)	33 (10.41)	108 (34.07)	156 (49.21)	53 (16.72)
Diet Food					
Diet carbonated beverages (e.g. Diet Coke / Diet Pepsi	7 (2.28)	12 (3.91)	29 (9.45)	259 (84.36)	19 (6.19)

Figures in parentheses denote percentage

consumed junk food from these 66.8% almost 50% subjects consumed junk food at least 1-5times per week. Goel et al (2013) conducted a study among adolescent girls of age group 16-18years and reported that almost 60.37% subjects were consuming junk food as a replacement of meal. The most preferred junk food item among subjects were potato chips (100%), chocolates (92.5%) and carbonated drinks (91.25%).

According to a study by Bohara et al (2021) almost 60.3% subjects consumed junk food for more than 4days in a week. Junk food consumption was seen higher among public school (65.1%) subjects as compared to private schools (56.3%) subjects. Majority of the subjects consumed salty snacks (58.7%) followed by sweet snacks (57. 5%).A study by Mahajan have reported that majority (40-50%) of subjects of age group 15-18years were consuming street food (pani-puri) daily or 3-6 times per week and almost 41% were consuming noodles frequently. Another study by Amin et al (2017) conducted among school and college students of 16-20 years have observed that almost 3.92% subjects were consuming fast food at least once in a week, 54.90% subjects consumed fast food twice a week and 15.68% consume it four times a week.

Table 4.9 shows the frequent (4-5 times per week) consumption of HFSS food items high in fat, salt and sugar according to nutritional status.

Around 15.94% and 11.11% overweight children consumed brown and white bread high in fat on daily basis. Food high in fat and sugar like chocolate was consumed frequently by 24.38% normal and 20% overweight subjects. Around 17.14% overweight subjects reported frequent consumption of cream biscuits. Frequent consumption of cheese sandwich (6.94%), pasta (5.8%), egg items (5.71%) and pani-puri (5.48%) was observed among overweight subjects. Among obese subjects 13.64% reported frequent consumption of chocolates. About 33.33%, 24.64% and 14.29% overweight subjects reported frequent consumption of food items like breakfast cereals, ketchups and jam. Major consumption of food items high in salt and fat was seen among obese children. Almost 40.91% obese subjects were consuming khakhra followed by sev-mamra (23.81%) and chavanu (14.29%) on daily basis. Overweight

TABLE 4.9 FREQUENT (DAILY OR 4-5 TIMES PER WEEK) CONSUMTPION OF HFSS FOOD ITEMS ACCORDING TO NUTRITIONAL STATUS N (%)

Food items	Thin (N=16)	Normal (N=189)	Overweight (N=82)	Obese (N=24)	Total (N=311)
Foods high in Fat					
Puff	0 (0)	4 (2.45)	3 (4.23)	0 (0)	7 (2.25)
Samosa	0 (0)	4 (2.44)	2 (2.86)	0 (0)	6 (1.93)
Vada-pav	0 (0)	2 (1.27)	3 (4.23)	0 (0)	5 (1.61)
Frankie	0 (0)	1 (0.64)	3 (4.17)	0 (0)	4 (1.29)
Sandwich(cheese)	0 (0)	8 (4.85)	5 (6.94)	0 (0)	13(4.18)
Sabudhana-vada	0 (0)	1 (0.63)	1 (1.56)	0 (0)	2 (0.64)
Pani-puri	0 (0)	6 (3.7)	4 (5.48)	0 (0)	10(3.22)
Chaat	0 (0)	4 (2.48)	1 (1.45)	0 (0)	5 (1.61)
Sev-usal	0 (0)	2 (1.25)	3 (4.23)	0 (0)	5 (1.61)
Kachori	0 (0)	3 (1.89)	3 (4.29)	0 (0)	6 (1.93)
Dabeli	0 (0)	1 (0.63)	1 (1.43)	0 (0)	2 (0.64)
Pasta	0 (0)	5 (3.03)	4 (5.8)	0 (0)	9 (2.89)
Pav-bhaji	0 (0)	4 (2.47)	4 (5.48)	0 (0)	8 (2.57)
Egg-items	0 (0)	19(11.73)	4 (5.71)	1(4.76)	24(7.72)
Bhajiyas	0 (0)	5 (3.13)	3 (4.41)	0 (0)	8 (2.57)
Bataka-vada	0 (0)	3 (1.94)	2 (2.99)	0 (0)	5 (1.61)
Puri	0 (0)	6 (3.77)	2 (2.9)	0 (0)	8 (2.57)
Puna-misal	0 (0)	2 (1.3)	1 (1.56)	0 (0)	3 (0.96)
Bread (brown)	0 (0)	14 (8.48)	11 (15.94)	2 (8.7)	27(8.68)
Bread (white)	0 (0)	8 (4.94)	7 (11.11)	1 (5)	16(5.14)
Foods high in Sugar and Fat					
Gulabjamun	0 (0)	2 (1.29)	2 (2.86)	0 (0)	4 (1.29)
Kala jam	0 (0)	2 (1.31)	2 (2.94)	0 (0)	4 (1.29)
Bundi	0 (0)	1 (0.65)	2 (2.9)	0 (0)	3 (0.96)
Ladoo	0 (0)	7 (4.4)	2 (2.99)	0 (0)	9 (2.89)
Peda	0 (0)	3 (1.92)	2 (2.94)	0 (0)	5 (1.61)
Rasgulla	0 (0)	2 (1.29)	1 (1.49)	0 (0)	3 (0.96)

Rasmalai	0 (0)	2 (1.3)	1 (1.52)	0 (0)	3 (0.96)
Rabdi	0 (0)	2 (1.3)	1 (1.49)	0 (0)	3 (0.96)
Jalebi	0 (0)	2 (1.29)	2 (2.9)	0 (0)	4 (1.29)
Basundi	0 (0)	1 (0.65)	1 (1.52)	0 (0)	2 (0.64)
Ice cream	0 (0)	14 (8.86)	3 (4.23)	0 (0)	17(5.47)
Chocolates	1(6.67)	39(24.38)	15 (20)	3(13.64)	58(18.65)
Puddings	0 (0)	2 (1.29)	1 (1.49)	0 (0)	3 (0.96)
Bun	0 (0)	4 (2.58)	2 (3.03)	1 (4.76)	7 (2.25)
Cakes	0 (0)	3 (1.88)	4 (5.63)	0 (0)	7 (2.25)
Pastry	0 (0)	4 (2.53)	3 (4.41)	0 (0)	7 (2.25)
Biscuit (cream)	0 (0)	31(18.79)	12 (17.14)	1 (4.76)	44(14.15)
Foods high in Sugar					
Fruit drinks-Mazza/slice/minute made/tropicana/real	2(12.5)	11 (6.88)	6 (8.57)	0 (0)	19 (6.11)
Fruit crush/sherbets-Mapro/mala/rasna/tang	2(12.5)	12 (7.5)	5 (7.35)	0 (0)	19 (6.11)
Red bull	0 (0)	2 (1.3)	2 (3.03)	0 (0)	4 (1.29)
Ketchups	2(12.5)	29(18.13)	17 (24.64)	3(13.64)	51 (16.4)
Jam	1(6.25)	13 (8.28)	10 (14.29)	0 (0)	24 (7.72)
Breakfast cereals	2(12.5)	40(25.32)	23 (33.33)	4(16.67)	69(22.19)
Sweet pickle	1(6.25)	10 (6.58)	9 (13.64)	0 (0)	20 (6.43)
Sweet chutney	0 (0)	11 (7.05)	8 (12.31)	0 (0)	19 (6.11)
Regular carbonated beverages (e.g. Coke / Pepsi)	0 (0)	3 (1.94)	2 (3.08)	0 (0)	5 (1.61)
Foods high in Salt and Fat					
Noodles (e.g. maggi/yippee/chings)	2(12.5)	12 (7.45)	7 (10.29)	1 (4.76)	22 (7.07)
Mayonnaise	1(6.25)	7 (4.49)	5 (7.46)	2 (9.09)	15 (4.82)
Cheese spreads	1(6.25)	12 (7.55)	3 (4.69)	2 (9.09)	18 (5.79)

Frozen food (e.g. Mccain, frozen pizza, paratha)	0 (0)	6 (3.9)	3 (4.55)	0 (0)	9 (2.89)
Fries	0 (0)	4 (2.56)	2 (3.03)	0 (0)	6 (1.93)
Kurkure	1(6.25)	5 (3.21)	1 (1.54)	1 (4.76)	8 (2.57)
Khakhra	3(18.75)	41(25.63)	15 (22.39)	9(40.91)	68(21.86)
Soya sticks	1 (6.25)	10 (6.45)	2 (3.03)	2 (9.52)	15 (4.82)
Gathiya	1 (6.25)	8 (5.16)	5 (7.46)	2 (9.52)	16 (5.14)
Papdi	1 (6.25)	11 (7.19)	4 (5.88)	2 (9.52)	18 (5.79)
Chawanu	1 (6.25)	6 (3.92)	6 (8.96)	3(14.29)	16 (5.14)
Sev	2 (12.5)	17(11.11)	9 (13.04)	3(14.29)	31 (9.97)
Sev-mamra	2 (12.5)	29(18.59)	12 (17.39)	5(23.81)	48(15.43)
Burger (e.g. Mc Donalds, KFC, Burger king)	0 (0)	2 (1.3)	2 (2.99)	0 (0)	4 (1.29)
Pizza	0 (0)	6 (3.77)	4 (5.88)	0 (0)	10 (3.22)
Subway	0 (0)	3 (1.91)	2 (3.08)	0 (0)	5 (1.61)
Fafda	0 (0)	2 (1.31)	1 (1.52)	0 (0)	3 (0.96)
Khaman	0 (0)	2 (1.32)	1 (1.49)	0 (0)	3 (0.96)
Sour pickle	2 (12.5)	21(13.91)	5 (7.46)	2 (9.52)	30 (9.65)
Chinese food	0 (0)	2 (1.29)	3 (4.48)	0 (0)	5 (1.61)
Biscuits (salty)	1 (6.25)	34(20.48)	10 (14.71)	2 (9.09)	47(15.11)
Foods high in Salt					
Soups	1 (6.25)	14 (8.97)	10 (14.08)	2 (9.09)	27 (8.68)
Papad	1 (6.25)	31(19.25)	14 (21.54)	3(14.29)	49(15.76)
Oats	0 (0)	18(11.54)	11 (17.19)	1 (4.55)	30 (9.65)
Instant soup	1 (6.25)	6 (3.9)	3 (4.69)	0 (0)	10 (3.22)
Baked Chips / Wafers (e.g. Too Yumm, Ruffles baked chips)	2 (12.5)	7 (4.46)	4 (6.15)	0 (0)	13 (4.18)
Regular Chips/ Wafers (e.g. Lays, Uncle chips)	0 (0)	13 (8.18)	5 (7.46)	0 (0)	18 (5.79)

Diet food					
Diet carbonated beverages (e.g. Diet Coke / Diet Pepsi)	0 (0)	2 (1.28)	2 (3.03)	1 (5)	5 (1.61)

Figures in parentheses denote percentage

subjects were consuming (21.54%) papad, (17.19%) oats and (14.08%) soups on daily basis.

A study by Shete and Wagh (2018) found that almost 77.3% adolescent school children were consuming junk food more than once a week. Around 12% overweight subjects were consuming junk food frequently while 100% obese subjects were consuming junk food more than once in week. A study carried out by Joshi et al (2014) on adolescents of 10-19years age group have found that Subjects who were consuming fast food twice or more times in a week were overweight (1.9%) or at risk of being overweight (27.4%) in comparison to the subjects who consumed fast food once (1.5%) or rarely in a week (4.4%).

A study by Karki et al (2019) conducted among children of 6-13years group reported that children who consumed foods like processed meats, junk food like chips, candies, confectionaries and chocolates for more than twice a week were at high risk of becoming overweight and obese in comparison to the those who consume less than twice a week. According to a study by Patnaik et al (2011) conducted among children of 1st to 10th class it was reported that higher prevalence of overweight and obesity was found among children who consumed junk food regularly (42.86%).

Table 4.10 shows the consumption of HFSS food items according to age groups. Majority of the younger age groups subjects were consuming food high in fat like white bread (6.49%) followed by brown bread (6.38%) and egg items (5.52%) on frequent basis. Among food items high in sugar and fat younger children were consuming cream biscuits (18.75%) and chocolates (18.42%) more as compared to other food items. Around 26.2% younger subjects reported frequent consumption of breakfast cereal and 19.05% subjects were consuming ketchups frequently. Almost 26.06% younger subjects were consuming khakhra followed by 16.67% subjects consuming salty biscuits, 18.18% subjects consuming sev-mamra and 11.96% subjects were consuming sev frequently. Among older children 13.24% subjects were consuming brown bread and 12.06% subjects were consuming egg items. Chocolates were consumed by around 25.74% older subjects and 12.78%

TABLE 4. 10 FREQUENT (DAILY OR 4-5 TIMES PER WEEK) CONSUMTPION OF HFSS FOOD ITEMS ACCORDING TO AGE GROUP N (%)

Food items	Younger age group (10-14years) (N=196)	Older age group (15-18years) (N=178)	Total (N=374)
Foods high in Fat			
Puff	2 (1.06)	6 (4.35)	8 (2.14)
Samosa	3 (1.59)	3 (2.21)	6 (1.6)
Vada-pav	2 (1.06)	4 (3.03)	6 (1.6)
Frankie	1 (0.54)	3 (2.21)	4 (1.07)
Sandwich(cheese)	4 (2.14)	9 (6.38)	13 (3.48)
Sabudhana-vada	1 (0.54)	1 (0.77)	2 (0.53)
Pani-puri	4 (2.09)	6 (4.38)	10 (2.67)
Chaat	1 (0.54)	4 (3.03)	5 (1.34)
Sev-usal	1 (0.53)	4 (2.94)	5 (1.34)
Kachori	3 (1.61)	3 (2.29)	6 (1.6)
Dabeli	1 (0.53)	1 (0.77)	2 (0.53)
Pasta	3 (1.63)	6 (4.29)	9 (2.41)
Pav-bhaji	4 (2.12)	8 (5.97)	12 (3.21)
Egg-items	10 (5.52)	17 (12.06)	27 (7.22)
Bhajiyas	5 (2.7)	4 (3.01)	9 (2.41)
Bataka-vada	3 (1.64)	2 (1.6)	5 (1.34)
Puri	5 (2.66)	5 (3.88)	10 (2.67)
Puna-misal	1 (0.56)	2 (1.64)	3 (0.8)
Bread (brown)	12 (6.38)	18 (13.24)	30 (8.02)
Bread (white)	12 (6.49)	6 (4.76)	18 (4.81)
Foods high in Sugar and Fat			
Gulabjamun	2 (1.06)	2 (1.59)	4 (1.07)
Kala jam	1 (0.55)	3 (2.38)	4 (1.07)
Bundi	2 (1.06)	3 (2.44)	5 (1.34)
Ladoo	3 (1.61)	6 (4.72)	9 (2.41)

Peda	1 (0.54)	4 (3.17)	5 (1.34)
Rasgulla	1 (0.54)	2 (1.63)	3 (0.8)
Rasmalai	2 (1.08)	1 (0.83)	3 (0.8)
Rabdi	2 (1.07)	2 (1.67)	4 (1.07)
Jalebi	2 (1.06)	3 (2.42)	5 (1.34)
Basundi	1 (0.54)	1 (0.84)	2 (0.53)
Ice cream	9 (4.76)	9 (6.87)	18 (4.81)
Chocolates	35 (18.42)	35 (25.74)	70 (18.72)
Puddings	2 (1.08)	2 (1.61)	4 (1.07)
Bun	2 (1.12)	7 (5.51)	9 (2.41)
Cakes	1 (0.53)	7 (5.26)	8 (2.14)
Pastry	3 (1.63)	5 (3.82)	8 (2.14)
Biscuit (cream)	36 (18.75)	17 (12.78)	53(14.17)
Foods high in Sugar			
Fruit drinks Mazza/slice/minute made/tropicana/real	7 (3.74)	14 (10.61)	21 (5.61)
Fruit crush/sherbets-Mapro/mala/rasna/tang	8 (4.28)	13 (10.32)	21 (5.61)
Red bull	1 (0.55)	3 (2.46)	4 (1.07)
Ketchups	36 (19.05)	23 (17.56)	59 (15.78)
Jam	16 (8.6)	11 (8.66)	27 (7.22)
Breakfast cereals	49 (26.2)	36 (27.69)	85 (22.73)
Sweet pickle	12 (6.52)	12 (10.08)	24 (6.42)
Sweet chutney	13 (6.95)	10 (8.33)	23 (6.15)
Regular carbonated beverages (e.g. Coke / Pepsi)	9 (4.79)	2 (1.67)	6 (1.6)
Foods high in Salt and Fat			
Noodles (e.g. maggi/yippee/chings)	12 (6.38)	12 (9.23)	24 (6.42)
Mayonnaise	8 (4.35)	11 (8.66)	19 (5.08)
Cheese spreads	11 (5.88)	10 (8.06)	21 (5.61)

Frozen food (e.g. Mccain, frozen pizza, paratha)	4 (2.16)	7 (5.79)	11 (2.94)
Fries	2 (1.08)	6 (4.88)	8 (2.14)
Kurkure	6 (3.23)	6 (4.84)	12 (3.21)
Khakhra	49 (26.06)	30 (23.08)	79 (21.12)
Soya sticks	10 (5.35)	7 (5.83)	17 (4.55)
Gathiya	11 (5.85)	8 (6.61)	19 (5.08)
Papdi	10 (5.46)	9 (7.32)	19 (5.08)
Chawanu	11 (6.01)	7 (5.69)	18 (4.81)
Sev	22 (11.96)	14 (11.38)	36 (9.63)
Sev-mamra	34 (18.18)	22 (17.46)	56 (14.97)
Burger (e.g. Mc Donalds, KFC, Burger king)	2 (1.08)	3 (2.4)	5 (1.34)
Pizza	3 (1.62)	8 (6.2)	11 (2.94)
Subway	2 (1.08)	4 (3.2)	6 (1.6)
Fafda	0 (0)	3 (2.52)	3 (0.8)
Khaman	2 (1.08)	2 (1.68)	4 (1.07)
Sour pickle	15 (8.2)	18 (15.38)	33 (8.82)
Chinese food	2 (1.08)	4 (3.28)	6 (1.6)
Biscuits (salty)	32 (16.67)	19 (14.39)	51 (13.64)
Foods high in Salt			
Soups	14 (7.49)	18 (14.29)	32 (8.56)
Papad	33 (17.65)	24 (19.2)	57 (15.24)
Oats	19 (10.27)	15 (12.4)	34 (9.09)
Instant soup	7 (3.85)	4 (3.36)	11 (2.94)
Baked Chips / Wafers (e.g. Too Yumm, Ruffles baked chips)	8 (4.23)	8 (6.5)	16 (4.28)
Regular Chips/ Wafers (e.g. Lays, Uncle chips)	9 (4.79)	11 (8.59)	20 (5.35)
Diet food			

Diet carbonated beverages (e.g. Diet Coke / Diet Pepsi)	3 (1.61)	4 (3.33)	7 (1.87)

Figures in parentheses denote percentage

older subjects consumed cream biscuits on regular basis. Food items high in sugar like breakfast cereals was consumed by 27.69% subjects followed by 17.56% subjects consuming ketchups daily or 4-5times per week. Consumption of food items like khakhra was reported by 23.08% older children followed by 17.46% subjects consuming sev-mamra and 15.38% subjects consuming sour pickle. Around 19.2% older subjects were consuming papad on regular basis. Consumption of diet coke (3.33%) and baked chips (6.5%) was more among older children in comparison to younger children (1.6% and 4.23%).

CONSUMPTION OF HFSS FOOD ITEMS IN LAST 24 HOURS

Table 4.11 shows the consumption of HFSS food by the subject in last 24 hours of the survey according to nutritional status. Irrespective of the BMI majority of children reported consumption of HFSS food in last 24 hour. Around 70.6%, 81.7%, 71.9% and 83.33% of thin, normal, overweight and obese children reported HFSS food consumption in the last 24hours respectively. A study by Gupta et al (2018) found that 78% of children had consumed at least one junk food item in last 24 hours and 22% children had consumed 2 or more junk food items in the last 24 hours of the survey.

A study by Agrawal et al (2019) conducted among school going children reported that around 54.5% subjects consumed 2 or more junk food products in last 24 hours while 30% subjects consumed single junk food item in last 24 hours. Another study by Kotecha et al (2013) reported that almost 56.3% subjects consumed food products like chocolate/pastries/sweet, 52.4% subjects consumed papad and pickles, 50.4% subjects consumed biscuits and bakery products, 39.2% subjects consumed cold drinks/soft drinks and 38.4% subjects consumed deep fried snacks in last 24 hours. Another study by Goel et al (2013) reported significant and positive correlation between frequent consumption of fried foods, chinese food and BMI of overweight adolescent girls. Around 30% girls were consuming junk food three times in a week.

Table 4.12 shows the type of HFSS foods consumed by the children in the last 24hours. Almost 55.1% subjects reported consumption of food items high in salt and fat in last 24 hours followed by 45.6% subjects reported consumption

TABLE 4.11 CONSUMPTION OF HFSS FOOD ITEMS BY SUBJECTS IN LAST 24 HOURS ACCORDING TO NUTRITIONAL STATUS N (%)

Have you consumed HFSS food items in last 24 hours?	Thin (N=17)	Normal (N=186)	Overweight (N=82)	Obese (N=24)	Total (N=309)
Yes	12 (70.6)	152 (81.7)	59 (71.9)	20(83.33)	243(78.64)
No	5(29.4)	34(18.3)	23(28.1)	4 (16.67)	66 (21.35)

Figures in parentheses denote percentage

TABLE 4.12 CONSUMPTION OF HFSS FOOD ITEMS ACCORDING TO HFSS CATEGORY IN LAST 24 HOURS

	Food high in fat	Food high in sugar and fat	Food high in sugar	Food high in salt and fat	Food high in salt	No. of Food items consumed in last 24 hours
Yes	131 (45.6)	58 (20.2)	58 (20.2)	158 (55.1)	27 (9.4)	Min 1 item Max 12 items
No	156 (54.4)	229 (79.8)	229 (79.8)	129 (44.9)	260 (90.6)	

Figures in parentheses denote percentage

of food high in fat, while 20.2% subjects had consumed food high in sugar as well as food high in sugar and fat. Minimum number of food items consumed by the subjects was 1 while the maximum number of food items consumed by the subjects were 12. Around 44.5% subjects had consumed at least one HFSS food product followed by 24% subjects consumed 2 HFSS food product, 15.7% had 3 products, 8% subjects had 4 products, 4.7% subjects had 5 products and 1.5% subjects had consumed 6 HFSS food products in last 24 hours.

A study by Bohara et al (2021) conducted on adolescents of 11th and 12th standard reported that 58.7% subjects consumed salty HFSS snacks while 57.5% subjects consumed sweet HFSS snacks frequently than other types of HFSS snacks. According to a study by Meena and Varma (2015) conducted among adolescent school girls it was reported that 93.1% subjects consumed food high in sugar and fat (biscuits) daily followed by food high in salt and fat (namkeen) 71.6%, and food high in fat (kachori/samosa) 28.7%.

SOURCES OF INFORMATION ABOUT HFSS FOOD

Table 4.13 shows different sources of information about HFSS food among subjects. Around 66.8% children reported that they get information about HFSS food from television advertisements followed by 43.9% subjects get information from friends, 43.3% subjects through internet and 36.3% children get information from social media. A study by Joseph et al (2015) reported that majority of the subjects get introduced to new HFSS food products through television advertisements (64.3%) followed by friends (53.7%) and parents (21.2%). Another study by Purushothaman et al (2015) reported that majority of the children get influenced by television advertisements (100%) for the choice of junk food. Latrey et al (2020) reported around 19.9% school students agreed that television advertisements were one of the most common source of information about junk food. Figure 4.4 shows the sources of information about HFSS food among children.

DESIRE TO TRY OUT THE NEW FOOD PRODUCTS

When asked to subjects whether they like to try out the new food product shown in television advertisements (Table 4.14), 59.3% subjects replied in the

TABLE 4.13 SOURCES OF INFORMATION ABOUT HFSS FOOD N (%)

Sources of information about HFSS food recently launched in the market (N=358)	
Television advertisements	239 (66.8)
Parents	72 (20.1)
Friends	157 (43.9)
Social Media	130 (36.3)
Flyers/newspaper	66 (18.4)
Internet	155 (43.3)
Others	8 (2.2)

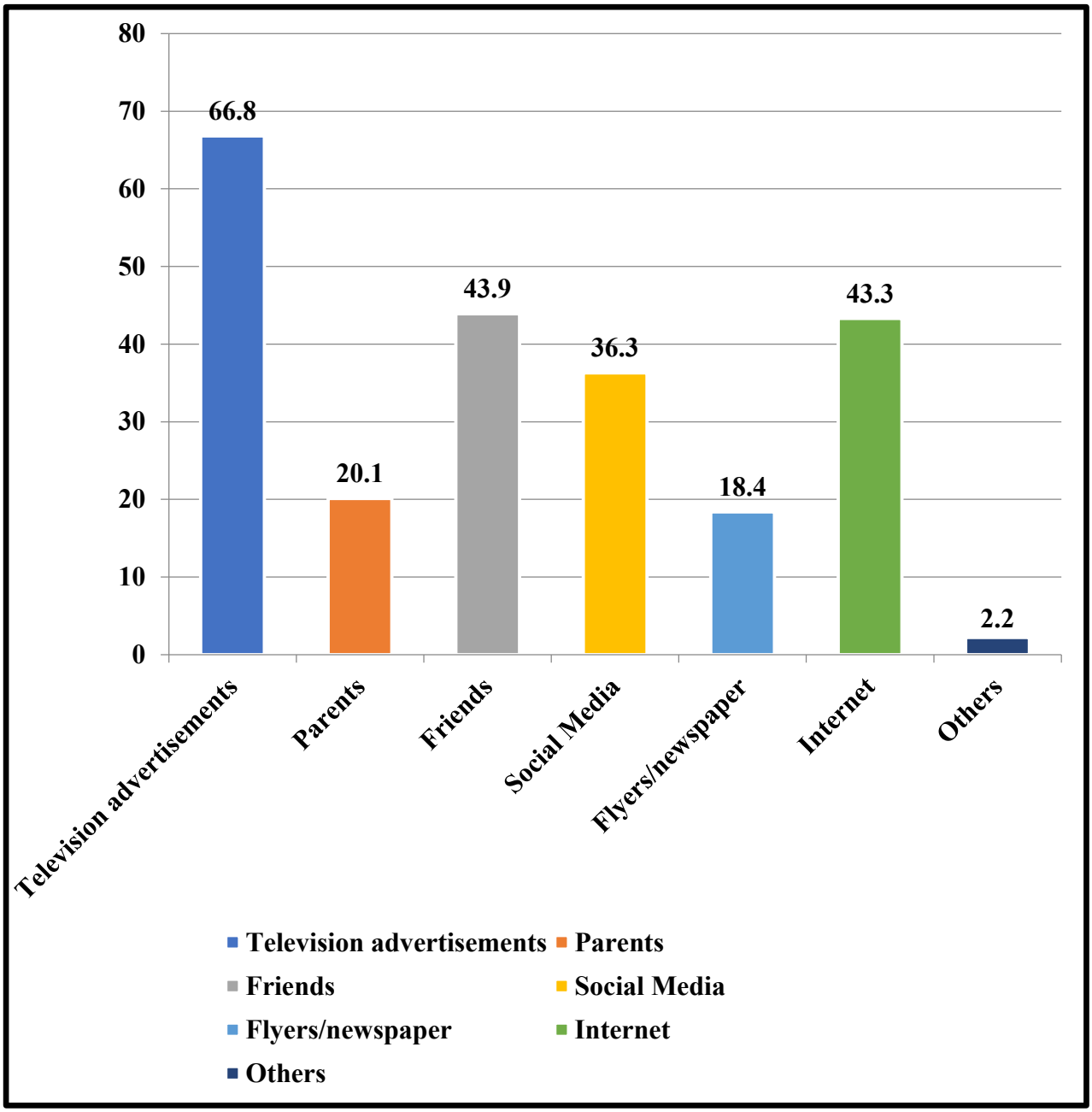
Figures in parentheses denote percentage

TABLE 4.14 DESIRE TO TRY OUT THE NEW FOOD PRODUCTS SHOWN IN THE TELEVISION ADVERTISEMENTS N (%)

Do you like trying the new food products shown in the television advertisements? (N=364)	
Yes	216 (59.3)
No	148 (40.7)

Figures in parentheses denote percentage

FIGURE 4.4 SOURCES OF INFORMATION ABOUT HFSS FOOD



affirmative. A study by Saghaiana and Mohammadi (2018) reported that factors like income, spouse occupation, awareness about composition of fast food, availability of fast food and advertising of various fast food were affecting the frequency of consumption of fast food among various households. Another study Dowarah et al (2020) conducted among college students reported that taste and advertisements have an effect on fast food consumption behavior of students.

Table 4.15 shows the duration within which subjects try out the new food products shown in television advertisements. Around 11.9% subjects reported that they try out the new food products within 15 days and 35.9% subjects reported they try out the new food product within one month.

A study by Kotwal et al (2017) reported that television advertisements plays an important role for influencing the viewer to try out the new product. In the study majority of the adolescent girls wanted to try out the new products shown in television advertisements. According to a study by Dixon et al (2007) it was found that excessive commercial viewing on television was positively associated with higher consumption of junk food among children of 5th and 6th class.

REASONS CITED FOR CONSUMPTION OF HFSS FOODS

Table 4.16 gives reasons cited for consumption of HFSS foods. Almost 91.1% subjects reported that they liked to consume HFSS food because they are tasty while 14.4% liked to consume HFSS foods as they were easily accessible and 8.6% subjects liked to consume HFSS food as it saves time. A study conducted by Joseph et al (2015) reported that 50% subjects consumed fast food due to curiosity to try the product, 25% like to consume it as a leisure time activity, 23.4% consume it under influence of friends and 7.8% consume it due to easy availability.

According to a study by Sapkota and Neupane (2017) carried out on secondary class students in Nepal around 90.1% subjects liked to consume junk food due to their taste followed by 44.4% subjects consumed it because they are faster to cook, 31.7% subjects were influenced by friends and 29.6% subjects consumed it because no other food item was available (Sapkota and

TABLE 4.15 DURATION WITHIN WHICH SUBJECTS TRY OUT THE NEW FOOD PRODUCTS SHOWN IN TELEVISION ADVERTISEMENTS N (%)

Duration (N=353)	
Same day	1 (0.3)
Within 1 week	14 (4)
Within 15 days	42 (11.9)
Within 1 month	127 (35.9)
Within 6 months or beyond	169 (47.9)

Figures in parentheses denote percentage

TABLE 4.16 REASONS CITED FOR CONSUMPTION OF HFSS FOODS N (%)

Reasons (N=360)	
They do not cost much	6 (1.7)
Saves time as they are easy to eat	31 (8.6)
They are tasty	331 (91.9)
They are easily accessible	52 (14.4)
My friends also eat such foods	18 (5)
Others	15 (4.2)

Figures in parentheses denote percentage

Neupane, 2017). Another study by Purushothaman et al (2015) reported that various factors influencing choice of children for junk food are taste and varieties of junk food (100%), cost (88.3%) and time (49. 6%).A study by Vaida (2013) reported that 41.66% adolescent subjects were attracted towards junk food due to the taste of food followed by 33.34% to variety of food products available and 8.34% to presentation of food products. According to a study by Shahanjariniteka (2009) it was reported that taste was the most important factor influencing children of 12-15 years age group for consumption of junk food followed by easy access to junk foods, friends pressure, media advertisements, and low price of unhealthy snacks.

Table 4.17 shows various television advertisement properties attracting children's attention towards television advertisements. Majority of the subjects reported that they are attracted towards the humor effect (40.9%) of the advertisements, followed by animation (40.1%), visual effects (36.5%) and jingles (30.1%). According to a study by Teka (2019) conducted among teenagers have reported music as the most important property to attract them towards the beverage advertisement shown in television followed by humor. Another study by Chan et al (2013) have reported that adolescent aged 13-19years were able to recall advertisements with celebrity endorsement who were attractive, funny and expressive. According to a study by Chan (2011) subjects were more attracted towards humours advertisements and they were more effective in gaining attention of the viewers. A study by Khanum et al (2015) have reported that animated commercial attracts viewers towards their products as both adults and children are able to recall animated commercial more than other types of commercial.

Table 4.18 shows the information related to the pocket money received and its expenditure by the subjects. Almost 15.6% subjects were receiving at least 500rupees or more as pocket money. Majority of subjects (29.4%) were spending it on food.

TABLE 4.17 TELEVISION ADVERTISEMENT PROPERTIES USED FOR ATTRACTING CHILDREN'S ATTENTION N (%)

Properties (N=342)	
Humor	140 (40.9)
Animation	137 (40.1)
Endorsement by celebrities or sports persons	43 (12.6)
Premium offers like free gifts, discounts etc.	65 (19)
Visuals and special effects	125 (36.5)
Music / Advertisement jingles	103 (30.1)
Others	16 (4.7)

Figures in parentheses denote percentage

TABLE 4.18 INFORMATION RELATED TO POCKET MONEY RECEIVED BY CHILDREN N (%)

	N=378
Pocket money received by children	
No pocket money	240 (63.5)
<500 rupees	60 (15.9)
>=500 rupees	59 (15.6)
Not responded	19 (5)
Spending of pocket money	
	N=119
Food	35 (29.4)
Video games	1 (0.84)
Music/Movies (CD/DVD)	4 (3.36)
Movies at a theatre	5 (4.2)
Books/Magazine	23 (19.32)
Others	8 (6.72)

Figures in parentheses denote percentage

Table 4.19 shows information related to use of Food Delivery Application. Around 60.8% subjects were using Food Delivery Application. And the major source of information about Food Delivery Application were received by the subjects from sources like television advertisements (56.1%) and social media (20.43%). Almost 57.39% subjects were using Food Delivery Application at least once in a month. Around 77.82% subjects were using discount coupons of Food Delivery Application and majority of them got those discount coupons through mobile SMS/WhatsApp (16.95%).

According to a study by Mukhtar and Javaid (2019) around 3% subjects were receiving more than 500 hundred rupees as pocket money, 10% subjects received 300-500 rupees as pocket money and 49.8% subjects received 100-200 rupees per day as pocket money and almost 16.8% subjects were spending their pocket money on fast food. Another study by Meena and Verma (2015) reported around 39.31% subjects received 500 or less as pocket money per month. Almost 40.68% spend less than or equal to 200 rupees and 22.75% subjects spend 200-500 rupees on food/snacks per month. A study by Devichandana et al (2020) reported that 88.5% subjects were using food delivery application and around 33.9% subjects were regular users of online application. Another study by Tribhuvan (2020) reported that 31.5% youth get attracted towards food delivery application due to offers on food applications, 14.7% subjects get influenced by social media post to various application and 45% subjects get information of food application from family and friends.

KNOWLEDGE REALTED TO HFSS FOOD AND TRANS-FAT

Table 4.20 shows the information about the knowledge of the subjects related to HFSS food and trans-fat. Around 44.03% subjects don't know about HFSS food. But 55.9% subjects knew that they are harmful for health. Almost 53.35% subjects have not heard about trans-fat. Majority of them knew that they are harmful for health (72.57%). Only 34.95% subjects were aware about the sources of trans-fast. These results are in conjunction with the findings of the study by Antony and Bhatti (2013) they have found that 46.15% teenagers have average knowledge about the ill effects of HFSS food, 11.54% subjects were

TABLE 4.19 INFORMATION RELATED TO USE OF FOOD DELIVERY APPLICATION BY THE SUBJECTS N (%)

Usage of Food Delivery Applications	
	N=378
Yes	230 (60.8)
No	134 (35.5)
Not responded	14 (3.7)
Sources of information about the Food Delivery Applications	
	N=230
Television Advertisements	129 (56.1)
Newspaper / Newspaper flyers	13 (5.65)
Friends / Classmates	19 (8.26)
Social media and internet	47 (20.43)
Relatives / Neighbors	19 (8.26)
Others	6 (2.6)
Frequency of using Food Delivery Applications	
	N=230
Daily	0 (0)
4-5 times per week	0 (0)
2-3 times per week	4 (1.7)
Once in a week	8 (3.47)
Once in 15 days	33 (14.34)
Once in a month	132 (57.39)
Once in 6 months or beyond	53 (23.04)
Usage of discount coupons / vouchers / codes of fast food establishments like Mc Donald's, Pizza hut, Domino's, KFC, etc.	
	N=230
Yes	179 (77.82)

No	51 (22.17)
Sources of receiving discount coupons / vouchers / codes.	
	N=230
Social media websites like Facebook, Instagram	30 (13.04)
Newspaper flyers	24 (10.43)
Mobile SMS / WhatsApp	39 (16.95)
Other	11 (4.78)

Figures in parentheses denote percentage

TABLE 4.2019 KNOWLEDGE RELATED TO HFSS FOOD AND TRANS-FAT AMONG SUBJECTS N (%)

Have you heard about HFSS (High Fat Salt Sugar) foods?	
	N=352
Yes	155 (44.03)
No	197 (55.9)
Do you think HFSS foods are harmful for health?	
	N=254
Yes	201 (79.13)
No	53 (20.86)
Have you heard about trans-fat?	
	N=343
Yes	160 (46.64)
No	183 (53.35)
Do you think trans-fat are harmful for health?	
	N=237
Yes	172 (72.57)
No	65 (27.42)
Do you know what the sources of trans-fat are?	
	N=309
Yes	108 (34.95)
No	201 (65.04)

Figures in parentheses denote percentage

having poor knowledge and 7.21% teenagers were having very good knowledge in Pune, Maharashtra

A study by Bohara et al (2021) shows that 33.5% children were having adequate knowledge about the harmful effects of junk food consumption and 66.5% children were having inadequate knowledge about the harmful effects of junk food in Pokhara Valley, Nepal. Another study by Sharma (2013) shows that 81.67% children were having average knowledge and 18.33% children were having below average knowledge related to harmful effects of junk food before the implementation of a teaching program regarding harmful effects of junk food consumption in Jalandhar, Punjab. Khongrangjem et al concluded in their study that around 31.87% children have inadequate knowledge related to harmful effects of junk food consumption, 41.88% have moderate knowledge while only 26.25% children have adequate knowledge related to the harmful effects of junk food consumption in Udupi, Karnataka. Another study by Ramchandran et al (2013) reported that majority of the adolescents (69.56%) have average knowledge while 24.35% were having good knowledge and 6.08% were having poor knowledge related to health hazards of junk food in Karad.

Table 4.21 shows the various harmful effects of HFSS foods stated by children. Around 35.24% subjects reported that obesity is caused due to HFSS food, 28.68% subjects reported different effects like lethargy, tooth problems, various diseases and inadequate growth, 17.21% subjects reported that consumption of HFSS foods leads to heart diseases and 13.11% subjects said that it causes diabetes.

Table 4.22 shows the various harmful effects stated by children due to consumption of trans-fat. Around 37.75% subjects reported that trans-fat increases the level of cholesterol in body, 28.57% subjects said that it causes heart diseases and 19.38% subjects said that it causes obesity.

TABLE 4.21 HARMFUL EFFECTS OF HFSS FOOD CONSUMPTION AS REPORTED BY THE SUBJECTS N (%)

Health Effects	N=122 (%)
Obesity/Become fat/Weight gain	43 (35.24)
Increases cholesterol/High bad cholesterol/Low good cholesterol	7 (5.73)
Heart diseases/Heart attack	21 (17.21)
Diabetes	16 (13.11)
Others (Decreases immunity, lethargy, problems of tooth, affects health, inadequate growth)	35 (28.68)

Figures in parentheses denote percentage

TABLE 4.22 HARMFUL EFFECTS OF TRANS-FAT CONTAINING FOOD AS REPORTED BY THE SUBJECTS N (%)

Health Effects	N=98 (%)
Obesity/Become fat/Weight gain	19 (19.38)
Increases cholesterol/Increase in bad cholesterol	37 (37.75)
Heart diseases/Heart attack	28 (28.57)
Others (Many diseases, anxiety, inflammation, fatty liver, constipation, stomach pain)	14 (14.28)

Figures in parentheses denote percentage

SEDENTARY ACTIVITY

In developed and developing countries sedentary lifestyle is an issue of great concern because of its deleterious health implications among individuals. Sedentary lifestyle is related with long sitting hours at work, in cars, communities, schools, homes, public places and limited physical activity which minimize human movement and muscular activities. Various health conditions like obesity, hypertension, cardiac disorders, vitamin deficiency, cancer are result of reduced physical activity (Inyang et al, 2015).

Table 4.23 shows the duration spent by the subjects performing specific sedentary activities on typical school day. Irrespective of the BMI the subjects spent almost similar amount of time in different sedentary activities. All the children were attending online classes for maximum time on a school day. Around 14.25 hours were spent by obese subjects in sedentary activities followed by 14.23 hours by thin, 14.2 hours by overweight and 13.9 hours by normal subjects. On a school day maximum time by the children was spent doing school related video calls. Thin subjects spent almost 4.9 hours, normal 4.8 hours, overweight 4.9 hours and obese subjects 4.5 hours. After school related video calls children spent on an average 2 hours in doing school related homework and 1.3 hours in watching television on a school day. Thin Boys were spending almost 5.4 hours in school related video calls followed by 2.3 hours in doing school related homework and 1.4 hours in video calls. Thin girls were spending around 4.4 hours for doing school related video calls followed by 1.9 hours in sitting and hanging out or talking with family and 1.7 hours video calls. After school related activities majority of the subjects spent time in watching television or videos thin (1.2 hours), normal (1.4 hours), overweight (1.3 hours) and obese (1.4 hours) followed by sitting while hanging out or talking with friends or family in person thin (1.3 hours), normal (1.2 hours), overweight (1hour) and obese (1.1 hours) on a school day respectively. A significant difference was found in time spent riding in car on a school day between normal and overweight boys ($p<0.05$). Normal boys were spending around 8.6 minutes riding in a car while overweight boys spent around 19.6 minutes.

TABLE 4.23 THE DURATION (in minutes) OF SPECIFIC SEDENTARY ACTIVITIES PERFORMED BY CHILDREN ON A TYPICAL SCHOOL DAY.												
ACTIVITIES	**TOTAL (Mean ± SD)**				**BOYS (Mean ± SD)**				**GIRLS (Mean ± SD)**			
	Thin (N=16)	**Normal (N=154)**	**Over-weight (N=68)**	**Obese (N=20)**	**Thin (N=9)**	**Normal (N=55)**	**Over-weight (N=39)**	**Obese (N=16)**	**Thin (N=7)**	**Normal (N=99)**	**Over-weight (N=29)**	**Obese (N=4)**
Playing (computer or video) games	43.1 ± 49.3	29.5 ± 43.8	31.2 ± 37.0	55.8 ± 61.7	40 ± 37.5	53.7 ± 55.2	36.1 ± 33.4	60.3 ± 63.9	47.1 ± 64.5	15.9 ± 28.2	24.5 ± 41.1	37.5 ± 55.5
Using the internet, emailing or other electronic media for leisure	50.7 ± 52	83.7 ± 97.1	78.6 ± 91.6	110.8 ± 122.7	36.7 ± 35.6	97.1 ± 82	69.9 ± 86.3	85.9 ± 83.9	71.7 ± 68.2	93 ± 103.9	91.8 ± 99.7	210 ± 209.3
Doing school-related video calls	299.4 ± 80.8	268.5 ± 119.3	298.7 ± 95.3	271.5 ± 82.3	325.6± 93.8	258.9 ± 109.2	291.21± 86.2	256.9 ± 79	265.7± 47.2	274 ± 124.9	309.1 ± 107.1	330 ± 77.5

Doing video calls	92.3 ± 112.3	50.1 ± 85.3	61.5 ± 112	38.8 ± 56.9	85 ± 115	41 ± 76.9	55.4 ± 88.9	19.7 ± 18.6	103.3± 118.1	54.9 ± 89.5	70 ± 139.3	115 ± 95.4
Doing school related work	131.3 ± 51.2	120.9 ± 70.5	126 ± 73.6	118.5 ± 57.1	136.7± 50	117.1 ± 80.9	118.1 ± 64.9	114.4 ± 55	124.3± 55.9	123.1 ± 64.2	137.1 ± 84.1	135 ± 71.4
Sitting while listening to music; (on radio, CD, tape, MP3, iPod, etc.)	18.8 ± 20.9	31.6 ± 41.1	32.3 ± 52.1	34.3 ± 51.5	13.3 ± 15.8	19.7 ± 28	22.6 ± 34.9	25.9 ± 41.8	25.7 ± 25.7	38.3 ± 45.7	45.9 ± 67.9	67.5 ± 78.9
Sitting while hanging out or talking with friends or family in person.	79.7 ± 59.7	69.4 ± 101.8	60.9 ± 49.4	63.5 ± 48.8	51.7 ± 37.6	83.7 ± 153.4	61.8 ± 46.8	65± 51	115.7± 65.8	61.2 ± 52.9	59.6 ± 53.7	57.5 ± 45
Reading a book or magazines NOT for school	27.5 ± 25.5	31.8 ± 34.7	36.6 ± 50	22.9 ± 23.9	20.6 ± 25.5	19.3 ± 22.4	36.8 ± 46.4	22.7 ± 24.3	36.4 ± 24.3	38.9 ± 38.4	36.3 ± 55.5	23.8 ± 25.6
Doing inactive hobbies; (music,	23.3 ± 25	49.1 ± 52.4	48.6 ± 55.2	47.6 ± 42.9	13.3 ± 21.8	39.3 ± 43.6	42.1 ± 48.4	44.4 ± 42.7	38.3 ± 23.2	54.6 ± 56.2	57 ± 62.8	65 ± 48.2

art, crafts, clubs, going to movies, etc.)												
Riding in a car	18.8 ± 20.2	14.6 ± 29.3	17.7± 21	22.1 ± 32.4	18.3 ± 25.7	8.6 ± 14.2 *	19.6 ± 19.9	18.1 ± 23.7	19.3 ± 11.7	18 ± 34.7	15.2 ± 22.5	43.3 ± 66.6
Watching television, videos or DVDs or movies.	73.8 ± 35.9	84 ± 56	79.8 ± 79	85.8 ± 35.6	75 ± 36.7	81.6 ± 61.8	65.7 ± 45.6	84.6 ± 30.9	75 ± 41.4	85.1 ± 55.1	97.9 ± 108.9	90 ± 54.8
Sitting while talking on the telephone or texting	26.5 ± 14.5	32.2 ± 35.7	28.1 ± 29.3	29.7 ± 26.4	20 ± 13.8	28.9 ± 31.5	25.4 ± 24.4	25.7 ± 28.8	27.5 ± 6.1	35.3 ± 39.4	31.2 ± 35.8	40 ± 14.1
Total for all the activities	855.9 ± 206.4	835.1 ± 334.3	853.2 ± 343.5	885 ± 331.7	804.4± 188.4	796 ± 314.4	821.2 ± 284.2	808.4 ± 198.6	905 ± 227.2	847.4 ± 345.4	920.9 ± 385.1	1187.5± 590.1
Significantly different from overweight at * $p < 0.05$												

According to study by Panchal et al (2019) the prevalence of overweight and obesity was seen to be more among students who spent greater than 2 hours daily in front of television and computer. A study by Govindan et al reported that watching TV for more than 2 hours per day was remarkably associated with obesity (Govindan et al, 2013). Another study by Tammelin et al (2007) reported that almost 48% boys and 44% girls are spending more than two hours daily for watching television and almost 24% boys and only 3% girls were using computers and playing video games for more than two hours per day.

Table 4.24 shows the duration of specific sedentary behavior performed by children on a holiday. On a holiday the time spent by subjects according to their nutritional status in different sedentary activities were 14.8 hours by obese subjects, 14.2 hours by overweight subjects, 13.8 hours by normal subjects and 12.3 hours by thin subjects. A lot of time was spent by subjects in watching television, around 2.6 hours by obese subjects, 2.3 hours by overweight subjects, 2.3 hours by normal subjects and 2.2 hours by thin subjects. On a holiday subjects were spending more than two hours in watching television followed by using internet for emailing or leisure (obese=2 hours, overweight=1.4 hours, normal=1.7 hours and thin=1.2 hours). Girls were spending a lot of time using internet for emailing or leisure. Thin girls spent around 1.7 hours, normal girls 1.8 hours, overweight 1.6 hours and 3.2 hours by obese girls. Children were spending more amount of time in watching television on a holiday (2.4 hours) as compared to a school day (1.3 hours).

A significant difference was found in time spent in playing computer or video games between normal and obese subjects ($p<0.001$). Normal subjects were spending around 56 minutes in playing computer or video games while obese subjects spent around 111 minutes.

According to a study by Micklesfield et al (2014) it was reported that adolescents spent majority of time in sedentary activity with an average up to 2-3 hours per day. Around 68% of time was spent in screen time, followed by 26% doing homework and 6% listening to radio. Another study by Yang et al

TABLE 4.24 THE DURATION (in minutes) OF SPECIFIC SEDENTARY ACTIVITIES PERFORMED BY CHILDREN ON A HOLIDAY.												
ACTIVITIES	**TOTAL (Mean ± SD)**				**BOYS (Mean ± SD)**				**GIRLS (Mean ± SD)**			
	Thin (N=16)	**Normal (N=154)**	**Over-weight (N=68)**	**Obese (N=20)**	**Thin (N=9)**	**Normal (N=55)**	**Over-weight (N=39)**	**Obese (N=16)**	**Thin (N=7)**	**Normal (N=99)**	**Over-weight (N=29)**	**Obese (N=4)**
Playing (computer or video) games	60.9 ± 60.1	56 ± 85.8**	63.6 ± 66.7	111 ± 105	75 ± 73.5	97.4 ± 114.4	76.7 ± 57.7	117.2± 98.3	42.9± 34	33.2 ± 53.1	45.9 ± 74.5	86.3 ± 143
Using the internet, emailing or other electronic media for leisure	73.1 ± 65.5	104.1 ± 99.6	81.3 ± 67.8	122.5± 140.1	52.2± 33.8	93.9 ± 114.9	71.8 ± 71.5	104.4± 89.7	100 ± 87.7	109.8 ± 90.2	94.9 ± 61	195 ± 274.4
Doing school-related video calls	46.9 ± 66.6	56.9 ± 80	66.7 ± 99.3	50 ± 63.6	43.3± 65.6	54.3± 74	66.7 ± 110.1	35 ± 55.1	51.4± 72.9	58.3 ± 83.4	66.8 ± 84.4	110 ± 66.3
Doing video calls	37.5 ± 60.5	32.7 ± 50.6	35 ± 51.2	26.3 ± 32.5	40 ± 58.1	22.5 ± 35.1	28.8 ± 39.4	22.7 ± 25.8	34.3± 68	38.1 ± 56.6	43.3 ± 63.6	40 ± 54.2
Doing school related work	97.5 ± 50.8	123.3 ± 83.5	122.1± 105.8	105.8± 67.3	103.3± 58.3	117.3 ± 87.9	115.1± 91.1	94.7 ± 65.2	90 ± 42.4	12.6 ± 81.2	131.8± 124.5	150 ± 64.8

Sitting while listening to music; (on radio, CD, tape, MP3, iPod, etc.)	45.3 ± 49.6	48.5 ± 60.0	58.3 ± 106.6	42.6 ± 64.1	27.5 ± 25.5	33.4 ± 43.5	45.2 ± 61.3	32 ± 47	65.7± 63.7	57.2 ± 66.5	76.3 ± 147.5	82.5 ± 107.8
Sitting while hanging out or talking with friends or family in person.	120 ± 79.4	105.3 ± 89.8	101.8± 83.8	125.5± 103.8	93.3 ± 46.1	106.6 ± 107.3	100.4± 85.6	132.5± 107.4	160 ± 105.1	104.5 ± 79	103.8± 82.7	97.5 ± 96
Reading a book or magazines NOT for school	40.3 ± 53.6	52.2 ± 61.4	51.3 ± 58.4	39.5 ± 54.7	25 ± 37.5	29.8 ± 38.2	51.3 ± 69.7	41.9 ± 58.3	60 ± 67.1	65 ± 68.4	51.3 ± 38.6	30 ± 42.4
Doing inactive hobbies; (music, art, crafts, clubs, going to movies, etc.)	59 ± 44.8	84.3 ± 88.1	87.4 ± 85.4	74.7 ± 76.4	38.3 ± 40.5	61.6 ± 53.8	72.6 ± 66.8	69.1 ± 70.4	90 ± 32.9	97.4 ± 100.8	106.4± 102.7	105 ± 117.2
Riding in a car	27.5 ± 27.3	31.6 ± 39.6	41.1 ± 46.5	30 ± 42.8	21.12± 32.7	29.3 ± 38.9	49.9 ± 51.8	24.7 ± 24.2	35.7± 17.2	32.8 ± 40.1	29.7 ± 36.3	50 ± 87.2

Watching television, videos or DVDs or movies	136.2± 76.1	140.3 ± 64.2	140.6± 96.3	155.8± 65.3	140 ± 105.1	141.5 ± 65.9	129.6± 86.1	154.3± 65.4	135 ± 52.8	138 ± 64.2	156.5± 110.2	161.3± 74.9
Sitting while talking on the telephone or texting.	41.9 ± 24.2	43.4 ± 42.3	41.8 ± 40.7	34.7 ± 20.1	35.8 ± 33.2	39 ± 37.8	39.9 ± 34.3	27.5 ± 15.2	45 ± 13.4	48.2 ± 46.2	45 ± 49.3	50 ± 24.5
Total for all the activities	738.8± 319.9	828.8 ± 400.4	850.7± 429.2	890.75± 466.3	633.3± 217.2	776.2 ± 346.9	812.6± 417	828.1± 285.4	848.6± 388.2	842 ± 428.2	896.8± 452	1131.2± 933.7
Significantly different from obese at ** $p < 0.01$												

(2019) reported that prevalence of watching television or videos for two hours per day or more increased from 2001 to 2016 among children from 62% to 67% and adolescents from 59% to 65%, while the use of computer outside school or work for one hour per day or more by children increased from 43% to 56% and among adolescents it increased from 53% to 57%. Musaiger (2014) et al reported that majority of boys (82.3%) were spending greater than two hours per day on screen time in comparison to girls (64.1%).

Table 4.25 shows the comparison of different sedentary activities performed on school day and holiday by boys and girls. Majority of the time was spent by girls on school day doing school related video calls (4.6 hours) followed by doing school related work (2.1 hours), using internet for emailing and leisure (1.5 hours) and watching television and videos (1.5 hours) while boys spent most of the time doing school related video calls (4.5 hours) followed by school related work (1.9 hour), sitting while hanging out or talking with friends or family in person (1.9 hour) and watching television and videos (1.3 hour). Girls were spending more time in activities like using internet for leisure (1.5 hour), doing video calls (1 hour) as compared to boys (1.1 hour and 45.5 minutes respectively) on a school day. Almost similar amount of time was spent by both boys and girls in doing video calls related to school.

On holiday girls were spending most of the time watching television or videos (2.4 hours) followed by doing school related work (2.1 hours), using internet for leisure (1.8 hours) and sitting while hanging out or talking with friends or family in person (1.7 hours). Similarly, boys were also spending majority of time in watching television or videos (2.3 hours), doing school related work (1.9 hours), sitting while hanging out or talking with friends or family in person (1.7 hours) and using internet for leisure (1.6 hours). On a holiday, boys (1.5 hour) were spending significantly more time in playing computer or video games than girls (37.1 minutes). On a holiday, girls (59.1 minutes) were spending significantly more time in reading magazines or books and (1.5 hour) in doing inactive hobbies than boys (38.1 minutes and 1 hour).

TABLE 4.25 COMPARISON OF SPECIFIC SEDENTARY ACTIVITIES PERFORMED ON SCHOOL DAY AND HOLIDAY BETWEEN BOYS AND GIRLS										
ACTIVITIES	**SCHOOL DAY**					**HOLIDAY**				
	GIRLS (N=139)	**BOYS (N=119)**	**TOTAL (N=258)**	**t VALUE**	**p VALUE**	**GIRLS (N=139)**	**BOYS (N=119)**	**TOTAL (N=258)**	**t VALUE**	**p VALUE**
Playing (computer or video) games	19.4 ± 34.71	47.7 ± 49.51	33.6 ± 9.21	5.19	0.000*** (##)	37.1 ± 60.76	89.9 ± 93.65	63.5 ± 23.26	5.27	0.000*** ($$$)
Using the internet, emailing or other electronic media for leisure	91.8 ± 106.03	67.6 ± 80.93	79.7 ± 27.14	2.07	0.03*	105 ± 94.71	82.9 ± 94.83	93.9 ± 0.08	1.86	0.06
Doing school-related video calls	274.3 ± 125.41	271.7 ± 101.24	273.0 ± 103.49	0.18	0.85 (###)	59.5 ± 81.88	53.5 ± 84.12	56.4 ± 1.59	0.57	0.56 ($$$)
Doing video calls	60.9 ± (102.1	45.5 ± 79.83	53.2 ± 40.09	1.36	0.17 (#)	38.2 ± 57.67	24.9 ± 37.18	31.5 ± 14.49	2.22	0.02* ($)
Doing school related work	123.6 ± 69.8	118.5 ± 70.25	121.1 ± 34.45	0.58	0.55	122.8 ± 90.98	111.5 ± 84.15	117.1 ± 4.83	1.11	0.26
Sitting while listening to music; (on radio,	38.5 ± 50.66	20.6 ± 31.47	29.6 ± 21.2	3.46	0.0006*** (#)	58.8 ± 88.05	35.1 ± 48.85	46.9 ± 27.72	2.71	0.007** ($$)

CD, tape, MP3, iPod, etc.)										
Sitting while hanging out or talking with friends or family in person.	61.7 ± 54.62	71.1 ± 109.81	66.4 ± 11.63	0.83	0.4 (###)	102.1 ± 82.4	104.4 ± 96.84	103.2 ± 10.21	-0.21	0.83 ($)
Reading a book or magazines NOT for school	37.2 ± 41.3	25.4 ± 33.24	31.3 ± 11.24	2.5	0.01* (###)	59.1 ± 62.53	38.1 ± 53.51	48.6 ± 6.38	2.9	0.003** ($)
Doing inactive hobbies; (music, art, crafts, clubs, going to movies, etc.)	51.1 ± 55.94	36.9 ± 43.74	43.9 ± 13.47	2.28	0.02* (###)	92.1 ± 98.4	61.6 ± 59.89	76.8 ± 27.23	3.04	0.002** ($$$)
Riding in a car	16.4 ± 31.33	13.3 ± 18.81	14.8 ± 12.76	0.98	0.32 (##)	30 ± 39.38	31 ± 41.47	30.5 ± 1.48	0.19	0.84 ($$$)
Watching television, videos or DVDs or movies	87.6 ± 69.77	76 ± 51.74	81.8 ± 4.43	1.39	0.16 (###)	142.9 ± 76.35	138.9 ± 75.28	140.9 ± 0.76	0.37	0.70 ($$$)

Sitting while talking on the telephone or texting.	34.1 ± 36.81	26.9 ± 27.78	30.5 ± 7.01	1.64	0.1 (#)	47.3 ± 44.93	37.5 ± 33.87	42.4 ± 7.83	1.82	0.06 ($)
Significantly different between girls and boys on school day or holiday at * p< 0.05, ** p< 0.01, *** p< 0.001 Significantly different between school day and holiday for girls at # p < 0.05, ## p < 0.01, ### p < 0.001 Significantly different between school day and holiday for boys at $ p < 0.05, $$ p < 0.01, $$$ p < 0.001										

On holidays major amount of time was spent by both girls (2.4 hours) and boys (2.3 hours) while watching television, videos or DVDs or movies on both school days and holidays girls were watching more television, videos or DVDs or movies (1.5 and 2.4 hours) as compared to boys (1.3 and 2.3 hours) respectively.

On a school day girls and boys were spending significantly more amount of time doing different sedentary activities playing computer or video games and listening to music ($p<0.001$), reading a book or magazine, doing inactive hobbies and using internet for leisure ($p<0.05$) as compared to holiday. Girls on a school day were spending significantly more amount of time in activities like doing school related video calls ($p<0.01$) as compared to holiday while on a holiday significantly more amount of time was spent doing different sedentary activities like sitting while hanging out with family and friends, reading a book, doing inactive hobbies and watching television or videos ($p<0.001$), playing computer or video games and riding in a car ($p<0.01$), doing video call, sitting while listening to music, sitting while talking on the telephone or texting ($p<0.05$) in comparison to school day. Boys on a school day were spending significantly more amount of time doing school related video calls ($p<0.001$) while on a holiday significantly more amount of time was spent in playing computer or video games, doing school related video calls, riding in a car, doing inactive hobbies and watching television or videos ($p<0.001$), sitting while listening to music ($p<0.01$), doing video call, sitting while hanging out with family and friends, reading books or magazine not for school and sitting while talking on the telephone or texting ($p<0.05$) in comparison to school day.

A study by Nascente et al (2016) reported 66.8% prevalence of sedentary lifestyle among adolescents. Majority of females (78%) were sedentary as compared to males (54.3%). Another study by Hallal et al (2006) have found that 58.2% subjects were living a sedentary lifestyle and females were positively associated with sedentary lifestyle. A study by Bibiloni et al (2012) reported 37.1% prevalence of sedentary lifestyle among children. Sedentary behavior among girls was directly related to age, time spent on screen usage and homework. A study by Mielgo et al (2017) reported that the use of television was higher during weekends among children (25.1%) than in adolescents (16.9%). The use of internet, computer and video games was seen to be higher

during weekends than weekdays. Adolescents were more indulged in computer games and use of internet for non-study reasons than children during weekdays and weekends. Another study by Ciampo et al (2019) reported 49.7% boys and 44% girls spend more time in sedentary activities i.e., more than the 5 hours of school. Girls of 15 to 19 age groups were spending more time sitting during the week, while girls of 10 to 14 age groups were more sedentary during weekends. A study by Dubey et al (2018) reported that 68% subjects were having more than 2hours of screen time. Television was viewed by the subjects for 2.9 hours during vacation and 2.3 hours during school days.

Table 4.26 shows comparison of specific sedentary activities performed on school day and holiday between younger and older age group. On school day younger children were spending around 4.5 hours in school related video calls followed by 1.9 hours by school related work and 1.4 hour watching television or videos. Older children were spending almost 4.6 hours in school related video calls, 2.1 hours doing school related work and 1.4 hours using internet, emailing or other electronic media for leisure.

On school day both younger and older age group subjects were spending major amount of time in doing school related video calls (4.5 hours) and school related work (2 hours). On a holiday younger subjects spent almost 2.2 hours in watching television or videos, 1.7 hours sitting while hanging out or talking with friends or family in person and 1.7 hour doing school related work while older children spent around 2.5 hours 2.2 hours and 1.7 hour.

Older children spent more amount of time (1.9 hours) using internet, emailing or other electronic media for leisure and doing video calls (44.2 minutes) as compared to younger children (1.3 hour and 22.7 minutes) on a holiday. On school day younger and older subjects were spending significantly more amount of time in playing computer or video games and sitting while listening to music ($p<0.05$) as compared to holiday.

TABLE 4.26 COMPARISON OF SPECIFIC SEDENTARY ACTIVITIES PERFORMED ON SCHOOL DAY AND HOLIDAY BETWEEN YOUNGER AGE GROUP (10-14years) AND OLDER AGE GROUP (15-18years) SUBJECTS										
ACTIVITIES	**SCHOOL DAY**					**HOLIDAY**				
	YOUNGER GROUP (N=145)	**OLDER GROUP (N=113)**	**TOTAL (N=258)**	**t VALUE**	**p VALUE**	**YOUNGER GROUP (N=145)**	**OLDER GROUP (N=113)**	**TOTAL (N=258)**	**t VALUE**	**p VALUE**
Playing (computer or video) games	36.9 ± 49.31	26.7 ± 36.43	32.5 ± 44.4	2	0.04*	67.9 ± 91.36	53.2 ± 67.3	61.5 ± 81.88	1.49	0.13
Using the internet, emailing or other electronic media for leisure	79.3 ± 98.45	82.4 ± 92.72	80.6 ± 95.83	0.19	0.84	80.2 ± 92.79	113.6 ± 95.39	94.8 ± 95.22	2.83	0.004**
Doing school-related video calls	270.9 ± 102.12	276 ± 129.45	273.2 ± 114.68	0.34	0.73	32.2 ± 51.39	88.1 ± 102.81	56.7 ± 82.81	5.2	0.000***
Doing video calls	58.5 ± 102.97	47.8 ± 77.61	53.8 ± 92.7	0.94	0.34	22.7 ± 41.68	44.2 ± 56.21	32.1 ± 49.65	3.4	0.0008***

Doing school related work	117.9 ± 64.78	125.6 ± 76.08	121.3 ± 69.92	0.85	0.39	104.1 ± 79.9)	134.9 ± 94.72	117.6 ± 87.91	2.7	0.007**
Sitting while listening to music; (on radio, CD, tape, MP3, iPod, etc.)	25.2 ± 39.23	36.9 ± 48.29	30.3 ± 43.73	2.09	0.03*	44.2 ± 76.49	52.6 ± 69.45	47.8 ± 73.47	0.92	0.35
Sitting while hanging out or talking with friends or family in person.	63.1 ± 63.09	69.9 ± 106.23	66.1 ± 84.62	0.60	0.54	100.6 ± 89.24	106.3 ± 89.41	103.1 ± 89.18	0.49	0.61
Reading a book or magazines NOT for school	31.8 ± 38.14	31.6 ± 38.41	31.7 ± 38.18	0.03	0.96	47.2 ± 52.59	52.3 ± 67.21	49.4 ± 59.37	0.65	0.51
Doing inactive hobbies; (music, art, crafts, clubs,	45.4 ± 47.24	43.5 ± 55.82	44.5 ± 51.08	0.30	0.76	77 ± 72.25	79.3 ± 97.6	78 ± 84.13	0.2	0.83

going to movies, etc.)										
Riding in a car	15.6 ± 24.61	14.1 ± 28.43	14.9 ± 26.31	0.44	0.65	33.9 ± 41.48	26 ± 38.42	30.4 ± 40.28	1.56	0.11
Watching television, videos or DVDs or movies	81.6 ± 71.14	81.6 ± 47.75	81.5 ± 62.46	0.0004	0.99	134.4 ± 72.41	149.7 ± 80.71	140.7 ± 76.12	1.44	0.14
Sitting while talking on the telephone or texting.	29.7 ± 31.92	30.9 ± 34.81	30.2 ± 33.07	0.26	0.78	41.3 ± 37.4	42.9 ± 44.06	41.9 ± 40.18	0.28	0.77
Significantly different between older and younger subjects on school day or holiday at * p< 0.05, ** p< 0.01, *** p< 0.001										

Table 4.27 shows the number of children spent ≥5hour per day on screen time. It includes the usage of all screen type like playing computer or video games, using internet, emailing or other electronic media, doing school related video calls, doing video calls and watching television, videos or DVDS or movies. On school day almost 100% thin subjects, 87% normal subjects, 92.6% overweight subjects and 100% obese children were spending ≥5hour per day on screen time while on holiday around 56.3% thin subjects, 56.5% normal subjects, 57.4% overweight subjects and 80% obese subjects spent ≥5hour per day on screen time. On school day majority of the subjects (90.3%) were spending ≥5hour per day on screen time due to online classes as compared to holiday (58.5%). According to a study by Mark and Janseen (2008) subjects who spent ≥5hour per day on screen time have 3.07 times more chance of getting Metabolic Syndrome in comparison to children who spent ≤1hour per day on screen time

BREAKFAST CONSUMPTION PATTERN

Breakfast consumption is very important to attain nutritional adequacy among children and adolescents (Arora et al, 2012). Two commonly used measures for dietary quality are dietary diversity and amount of animal source foods consumed by an individual. Balanced diet of vitamins and nutrients are essential for healthy growth and development of an individual. Nutrients and vitamins from different food groups like vegetables, fruits, grains, and animal source foods should be consumed adequately (Belachew et al., 2004). Skipping breakfast is one of the reason leading to negative energy balance and intake of higher energy later in a day do not compensate for the energy loss occurred during breakfast (Kral et al. 2011; Levitsky and Pacanowski 2013).

FOOD GROUPS CONSUMED IN BREAKFAST BY THE SUBJECTS

Table 4.28 shows different food groups consumed by children for three consecutive days. Majority of the subjects (67.17%) consumed grains in breakfast followed by milk and milk products (62.38%), HFSS food products (36.93%) and other vegetables

TABLE 4.27 PERCENT CHILDREN SPENDING ≥300 MINUTES ON SCREEN TIME N (%)

	SCHOOL DAY			HOLIDAY		
	GIRLS (N=139)	**BOYS (N=119)**	**TOTAL (N=258)**	**GIRLS (N=139)**	**BOYS (N=119)**	**TOTAL (N=258)**
THIN (N=16)	7 (43.7)	9 (56.3)	16 (100)	4 (25)	5 (31.3)	9 (56.3)
NORMAL (N=154)	84 (54.5)	50 (32.5)	134 (87)	54 (35.1)	33 (21.4)	87 (56.5)
OVERWEIGHT (N=68)	27 (39.7)	36 (52.9)	63 (92.6)	18 (26.5)	21 (30.9)	39 (57.4)
OBESE (N=20)	4 (20)	16 (80)	20 (100)	3 (15)	13 (65)	16 (80)
TOTAL (N=258)	122(47.3)	111 (43)	233(90.3)	79 (30.6)	72 (27.9)	151(58.5)

Figures in parentheses denote percentage

TABLE 4.28 FOOD GROUPS CONSUMED IN BREAKFAST BY THE SUBJECTS N (%)

Food Groups	**Day-1**	**Day-2**	**Day-3**	**3-Day Average N=334**
Grains	236 (70.65)	218(65.26)	219(65.56)	224 (67.17)
Pulses	32 (9.58)	41(12.27)	46(13.77)	40 (11.88)
Nuts and oilseeds	63(18.86)	43 (12.87)	36 (10.77)	47 (14.17)
Milk and milk products	219(65.56)	208(62.27)	198(59.28)	208 (62.38)
Meat, poultry, fish	0 (0)	0 (0)	0 (0)	0 (0)
Eggs	11 (3.29)	8 (2.39)	12 (3.59)	10 (3.09)
Dark green leafy vegetables	5 (1.49)	5 (1.49)	7 (2.09)	6 (1.7)
Other vitamin A rich fruits and vegetables	13 (3.89)	17 (5.08)	18 (5.38)	16 (4.79)
Other vegetables	92 (27.54)	88 (26.34)	91 (27.24)	90 (27.05)
Other fruits	24 (7.18)	25 (7.48)	23 (6.88)	24 (7.19)
HFSS food	122(36.52))	120(35.92)	128(38.32)	123 (36.93)

Figures in parentheses denote percentage

(27.05%). Around 3.59% subjects reported skipping breakfast for 3 days, 0.6% subjects for 2 days and 2.99% subjects for one day. Consumption of food groups like pulses (11.88%), nuts and oilseeds (14.17%), eggs (3.09%), green leafy vegetables (1.7%), vitamin A rich fruits and vegetables (4.79%) and other fruits (7.19%) was less in comparison to other food groups.

According to a study by Vakili et al (2013) it was reported that 73.2% adolescents were consuming milk and milk products while 22.13% subjects were consuming eggs followed by 19.98% subjects consuming fruits and vegetables rich in vitamin A and 16% subjects consuming fish. Fast food consumption was recorded by 20.2% subjects. Another study by Christina (2012) reported that cereals and grains were the most frequently consumed food group. Low consumption of fruits was reported by the adolescents of 14-18years age group. According to a study by Endalifer et al (2021) it was reported that around 50% subjects consumed food groups like cereals, other vegetables and fruits and legumes while 22.9% consumed flesh, 10% ate eggs and 7.8% consumed milk and milk products.

NUMBER OF FOOD GROUPS CONSUMED AT BREAKFAST BY THE SUBJECTS

Table 4.29 shows the number of food groups consumed by children. The mean number of food groups consumed by the children was 2 ± 0.8. Around 93.8% subjects consumed less than or equal to three food groups while only 6.2% subjects had consumed more than 3 food groups in breakfast. About 100% thin and obese subjects were consuming less than or equal to three food groups followed by 92.9% overweight subjects and 91.6% normal subjects respectively. More than three food groups were consumed by 8.4% normal subjects and 7.04% overweight subjects. Almost 2.69% normal subjects and 0.89% overweight subjects did not consumed breakfast for three consecutive days. According to a study by Worku et al (2017) 20% adolescents girls consumed less than or equal to three food groups, 53.2% subjects consumed 3-4 food groups and 26.8% subjects consumed greater than or equal to 6 food groups. A study by Omage and Omuemu (2018) reported that 49% subjects had consumed more than or equal to 6 food groups followed by 26.5% who had consumed less than or equal to 3 food groups and 24.5% had consumed 4-5 food groups.

TABLE 4.29 NUMBER OF FOOD GROUPS CONSUMED AT BREAKFAST BY THE CHILDREN

Average number of food groups consumed	Thin (N=29)	Normal (N=179)	Overweight (N=71)	Obese (N=43)	Total (N=322)
≤ 3 food groups	29 (100)	164 (91.6)	66 (92.9)	43 (100)	302(93.8)
More than 3 food groups	0 (0)	15 (8.4)	5 (7.04)	0 (0)	20 (6.2)
Mean number of food groups consumed	2.08 ± 0.64	1.99 ± 0.83	1.96 ± 0.8	1.97 ± 0.53	2 ± 0.8

Figures in parentheses denote percentage

According to a study by Endalifer et al (2021) it was reported that the mean dietary diversity score among adolescents were 4.73. Around 40.4% subjects consumed 4 food groups and 30.4% subjects consumed 5 food groups.

FOOD GROUPS CONSUMED ACCORDING TO NUTRITIONAL STATUS

Table 4.30 shows the food groups consumed by subjects according to their nutritional status. Irrespective of the BMI a large percentage of the subjects reported consumption of HFSS foods in breakfast. Around 33.33%, 36.7%, 38.74% and 34.62% of thin, normal, overweight and obese subjects reported consumption of HFSS foods in breakfast respectively. Majority of the subjects consumed cereals in breakfast thin (71.26%), normal (67.02%), overweight (64.86%) and obese (66.67%) followed by milk and milk products thin (65.52%), overweight (64.86%), normal (60.11%) and obese (58.97%).Consumption of eggs was reported only by 4.6% thin subjects, 4.26% normal subjects and 0.9% overweight subjects respectively and consumption of green leafy vegetables was reported by 3.45% thin subjects, 1.42% normal subjects and 2.25% obese subjects. None of the obese subjects had consumed eggs, green leafy vegetables and meat, poultry and fish in breakfast.

According to a study by Worku et al (2017) 73.3% normal subjects and 78.7% underweight subjects consumed less than 6 food groups. Another study by Mohajeri et al (2020) reported higher dietary diversity score among obese individual in comparison to normal subjects. They had proved that obese people have more diverse diet compared to other but with less consumption of fruits and vegetables.

FOOD GROUPS CONSUMED ACCORDING TO AGE GROUP

Table 4.31 shows the food groups consumed according to age groups Majority of younger children (71.31%) were consuming grains followed by milk and milk products (62.03%), HFSS food (36.71%) and other vegetables (27.43%). Among older children around 62.89% subjects consumed milk and milk products followed by 56.7% subjects consuming grains, 37.11% subjects consuming HFSS foods and 25.77% subjects consuming other vegetables. Grains were consumed more by younger children (71.31%) as compared to older children (56.7%) while consumption of vitamin A rich fruits and vegetables was seen more among older children (8.25%) as compared to younger children (3.38%). Breakfast was not consumed by 1.49% younger children and 2.09% older children for all the three days. According to a study by Isabirye et al (2020)

TABLE 4.30 FOOD GROUPS CONSUMED BY THE SUBJECTS ACCORDING TO NUTRITIONAL STATUS N (%)

Food Groups	Thin (N=29)	Normal (N=188)	Overweight (N=74)	Obese (N=26)	Total (N=317)
Grains	21(71.26)	126(67.02)	48 (64.86)	17(66.67)	212(66.87)
Pulses	4 (14.94)	21 (11.17)	8 (11.26)	4 (15.38)	37 (11.67)
Nuts and oilseeds	4 (13.79)	27 (14.18)	12 (16.22)	4 (15.38)	47 (14.82)
Milk and milk products	19(65.52)	113 (60.11)	48 (64.86)	15 (58.97)	195(61.51)
Meat, poultry, fish	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eggs	1 (4.6)	8 (4.26)	1 (0.9)	0 (0)	10 (3.15)
Dark green leafy vegetables	1 (3.45)	3 (1.42)	2 (2.25)	0 (0)	6 (1.89)
Other vitamin A rich fruits and vegetables	2 (5.75)	9 (4.96)	3 (4.5)	1 (5.13)	15 (4.73)
Other vegetables	7 (25.29)	54 (28.55)	19 (25.68)	7 (28.21)	87 (27.44)
Other fruits	1 (3.45)	15 (7.98)	4 (5.86)	2 (8.97)	22 (6.94)
HFSS food	10(33.33)	69 (36.7)	29 (38.74)	9 (34.62)	117(36.90)

Figures in parentheses denote percentage

TABLE 4.31 FOOD GROUPS CONSUMED BY THE CHILDREN ACCORDING TO AGE GROUP N (%)

Food Groups	Younger Group (10-14years) (N=237)	Older Group (15-18years) (N=97)	Total (N=334)
Grains	169 (71.31)	55 (56.7)	224 (67.06)
Pulses	32 (13.5)	8 (8.25)	40 (11.97)
Nuts and oilseeds	34 (14.35)	14 (14.43)	48 (14.37)
Milk and milk products	147 (62.03)	61 (62.89)	208 (62.27)
Meat, poultry, fish	0 (0)	0 (0)	0 (0)
Eggs	7 (2.95)	4 (4.12)	11 (3.29)
Dark green leafy vegetables	4 (1.69)	2 (2.06)	6 (1.79)
Other vitamin A rich fruits and vegetables	8 (3.38)	8 (8.25)	16 (4.79)
Other vegetables	65 (27.43)	25 (25.77)	90 (26.94)
Other fruits	17 (7.17)	7 (7.22)	24 (7.18)
HFSS food	87 (36.71)	36 (37.11)	123 (36.82)

Figures in parentheses denote percentage

it was reported that 99.7% subjects were consuming grains while 42.3% subjects consumed green leafy vegetables, 33.1% subjects consumed meat/poultry/fish, 32.9% subjects consumed dairy products. Least consumption of eggs (11.2%) and fruits (8.2%) was reported by the subjects.

Table 4.32 shows the average number of food groups consumed according to age group of subjects. Food groups less than or equal to three was consumed by 92.4% younger children and 85.56% older children. While more than 3 food groups were consumed by only 5.48% younger children and 7.21% older children. Around 1.49% younger children and 2.09% older children did not consumed breakfast for all the three consecutive days.

PHYSICAL ACTIVITY

As there are changes in the working styles of people and development of unhealthy life habits among population the importance of physical activity has decreased which is considered as the most important public health problem by the experts (Heywood, 2010). With increase in sedentary lifestyle among people they are increasing their risk towards various conditions and diseases affecting their health. Medical experts have shown a straight relation between lack of physical activity and overweight, obesity and metabolism-related syndromes (Hollander and Mechanick, 2008)

Table 4.33 shows the 3-day energy expenditure of the subjects. Irrespective of the BMI majority of the children were performing less physical activity. Around 1891 kilocalories energy expenditure was reported by thin subjects, 2031 kilocalories by normal, 2338 kilocalories by overweight and 2589 kilocalories by obese subjects. Among sleeping hours of the subjects no major difference was found. Thin subjects reported 9hours of sleep followed by 8.6 hours of sleep by normal subjects, 8.5 hours by overweight and 8.1 hours by obese subjects. According to a study by Bandini et al (1990) total energy expenditure of obese adolescents was significantly greater than adolescents who were not obese. Another study by Zalilah et al (2006) reported energy expenditure of Malaysian adolescents. The energy expenditure of under-weight girls was 1581kcal/day, normal weight girls 1778 kcal/day and 2189 kcal/day by overweight

TABLE 4.32 NUMBER OF FOOD GROUPS CONSUMED BY THE CHILDREN ACCORDING TO AGE GROUP N (%)

Number of food groups consumed	Younger Group (10-14years) (N=237)	Older Group (15-18years) (N=97)	Total (N=334)
≤3 food groups	219 (92.4)	83 (85.56)	302 (90.41)
More than 3 food groups	13 (5.48)	7 (7.21)	20 (5.98)
Mean number of food groups consumed	2.0 ± 0.7	1.9 ± 0.9	2.0 ± 0.78

Figures in parentheses denote percentage

TABLE 4.33 ENERGY EXPENDITURE OF THE SUBJECTS ACCORDING TO NUTRITIONAL STATUS (Mean ± SD)

	BOYS (N=101)	GIRLS (N=136)	TOTAL (N=237)
THIN	2041± 271	1641 ±243	1891 ±322
NORMAL	2230 ±309	1925 ± 250	2031 ± 308
OVERWEIGHT	2480 ± 421	2208 ± 380	2338 ± 419
OBESE	2543 ± 488	2716 ± 607	2589 ± 505
TOTAL	2320 ± 392	2004 ± 350	2139 ± 399
TOTAL SLEEPING HOURS (Mean ± SD)			
THIN	9 ± 1.1	9 ± 0.8	9 ± 1
NORMAL	8.7 ± 1.2	8.6 ± 1.2	8.6 ± 1.2
OVERWEIGHT	8.5 ± 2	8.5 ± 1.1	8.5 ± 1.5
OBESE	8.2 ± 0.9	8 ± 0.7	8.1 ± 0.8
TOTAL	8.6 ± 1.4	8.6 ±1.1	8.6 ± 1.2

girls while energy expenditure of under-weight boys was 1917 kcal/day, normal weight boys 2195 kcal/day and 2871 kcal/day by overweight boys.

Table 4.34 shows the physical activity level of subjects according to their nutritional status. A large proportion of the obese subjects (40%) were leaving a sedentary lifestyle followed by normal subjects (32.86%), overweight subjects (30.15%) and thin subjects (25%). Around 50% thin subjects. 39.86% normal subjects, 42.85% overweight subjects and 40% obese subjects were physically less active. Only 2.79% normal subjects, 3.17% overweight subjects and 6.6% obese subjects were leaving a physically active lifestyle. A study by Coelho et al (2012) shows that around 22.20% children with excess body fat and 77.80% subjects without excess body fat were involved in low physically active lifestyle.

Table 4.35 shows the physical activity level of male and female subjects. Around 32.06% subjects were leading sedentary lifestyle, 41.35% subjects led low physically active lifestyle, 5.9% subjects were having a limited physically active life-style, 17.7% subjects were having moderate physical activity while only 2.95% subjects were physically active. Around 44.85% girls had a low physically active lifestyle followed by 23.52% girls with sedentary lifestyle and 20.58% girls with moderate physically active life-style. Among boys 43.56% subjects were having a sedentary lifestyle followed by 36.63% boys with low physical activity and 13.86% boys with moderate physical activity. More number of boys (43.56%) were leading a sedentary lifestyle in comparison to girls (23.52%). Around 4.41% girls were physically active while only 0.99% boys were physically active. According to a study by Dan et al (2011) only 3% subjects were involved in high physical activity and 33.5% subjects were involved in low physical activity. According to a study by Tammelin et al (2007) 23% boys and 10% girls reported 60min of physical activity per day while 11% of boys and 9% of girls were classified as inactive as they were not performing any physical activity. Increase in the time of watching television and using computer was associated with low physical activity. Another study by Cheng et al (2009) around 9.8% boys and 21.1% girls were involved in low physical activity and 13.3% boys and 18.9% girls were involved in moderate physical activity.

TABLE 4.34 PHYSICAL ACTIVITY LEVEL (PAL) OF SUBJECTS ACCORDING TO NUTRITIONAL STATUS N (%)

Type of life-style	Thin (N=16)	Normal (N=143)	Overweight (N=63)	Obese (N=15)	Total (N=237)
Sedentary life-style (PAL<1.4)	4 (25)	47 (32.86)	19 (30.15)	6 (40)	76 (32.06)
Low physically active life-style (PAL: 1.4-1.54)	8 (50)	57 (39.86)	27 (42.85)	6 (40)	98 (41.35)
Limited physically active life-style (PAL: 1.55-1.60)	0 (0)	10 (6.99)	3 (4.76)	1 (6.66)	14 (5.9)
Moderate physically active life-style (PAL: 1.6-1.74)	4 (25)	25 (17.48)	12 (19.04)	1 (6.66)	42 (17.72)
Physically active life-style (PAL: 1.75 and above)	0 (0)	4 (2.79)	2 (3.17)	1 (6.6)	7 (2.95)

Figures in parentheses denote percentage

TABLE 4.35 PHYSICAL ACTIVITY LEVEL (PAL) OF GIRLS AND BOYS N (%)

Type of life-style	Girls (N=136)	Boys (N=101)	Total (N=237)
Sedentary life-style (PAL<1.4)	32 (23.52)	44 (43.56)	76 (32.06)
Low physically active life-style (PAL: 1.4-1.54)	61 (44.85)	37 (36.63)	98 (41.35)
Limited physically active life-style (PAL: 1.55-1.60)	9 (6.61)	5 (4.95)	14 (5.9)
Moderate physically active life-style (PAL: 1.6-1.74)	28 (20.58)	14 (13.86)	42 (17.7)
Physically active life-style (PAL: 1.75 and above)	6 (4.41)	1 (0.99)	7 (2.95)

Figures in parentheses denote percentage

Table 4.36 shows the physical activity level of subjects according to age groups. Among younger children 48.92% subjects were less active physically followed by 21.5% subjects with moderate physical activity and 18.7% subjects with sedentary lifestyle. In older age group around 51.02% subjects were leading a sedentary lifestyle, 30.61% subjects were less active physically and 12.24% subjects were involved in moderate physical activity. Majority of the older children (51.02%) were leaving a sedentary lifestyle as compared to younger children (18.7%). Almost 21.5% younger subjects were involved in moderate physical activity in comparison to 12.24% older children. A study by Dave et al (2017) reported that 69.3% subjects of 10-19 years age group reported low physical activity. According to a study by Ciampo et al (2019) it was reported that adolescents of 15 to 19 years age groups were more sedentary during the week, while girls of 10 to 14 age group were more sedentary during weekends.

Table 4.37 shows the mean PAL values of the subjects according to their nutritional status. The mean PAL value of thin subjects was 1.48 $\pm$ 0.14, normal subjects was 1.46 $\pm$ 0.15, overweight subjects was 1.47 $\pm$ 0.18 and obese subjects was 1.44 $\pm$ 0.16. No significant difference was found in PAL values with respect to nutritional status. According to a study by Dan et al (2011) the distribution of different activity levels like low, moderate or high were similar among underweight, normal weight and at risk of overweight adolescents. Another study by Coelho et al (2012) reported no significant relation between nutritional status and physical inactivity among school age children.

Table 4.38 shows the comparison of physical activity level among girls and boys. The mean PAL value of girls was 1.49 $\pm$ 0.15 and boys was 1.43 $\pm$ 0.15. Girls were significantly more active in comparison to boys ($p<0.001$).

Table 4.39 shows the comparison of physical activity level among younger and older age group children. The mean PAL value of younger children was 1.5 $\pm$ 0.13 and older children was 1.41 $\pm$ 0.17. Younger children were significantly more active than older children. According to a study by Coelho et al (2012) significant different was found among children (6-9years) and adolescents (10-14years) in physical activity ($p<0.03$). According to a study by Olivares et al (2004) girls of younger age group were significantly more active than girls of older age group.

TABLE 4.36 PHYSICAL ACTIVITY LEVEL (PAL) OF SUBJECTS ACCORDING TO AGE GROUP N (%)

Type of life-style	Younger Group (10-14years) (N=139)	Older Group (15-18years) (N=98)	Total (N=237)
Sedentary life-style (PAL<1.4)	26 (18.7)	50 (51.02)	76 (32.06)
Low physically active life-style (PAL: 1.4-1.54)	68 (48.92)	30 (30.61)	98 (41.35)
Limited physically active life-style (PAL: 1.55-1.60)	10 (7.19)	4 (4.08)	14 (5.9)
Moderate physically active life-style (PAL: 1.6-1.74)	30 (21.5)	12 (12.24)	42 (17.72)
Physically active life-style (PAL: 1.75 and above)	5 (3.59)	2 (2.04)	7 (2.95)

Figures in parentheses denote percentage

TABLE 4.37 PHYSICAL ACTIVITY LEVEL OF SUBJECTS ACCORDING TO NUTRITIONAL STATUS (Mean $\pm$ SD)

Nutritional Status	PAL	F-value
Thin (N=16)	1.48 $\pm$ 0.14	0.19
Normal (N=143)	1.46 $\pm$ 0.15	
Overweight (N=63)	1.47 $\pm$ 0.18	
Obese (N=15)	1.44 $\pm$ 0.14	
Total (N=237)	1.46 $\pm$ 0.16	

TABLE 4.38 COMPARISION OF PHYSICAL ACTIVITY LEVEL (PAL) BETWEEN GIRLS AND BOYS (Mean ± SD)

Sex	PAL	p-value
Girls(N=136)	1.49 ± 0.15	0.0009***
Boys (N=101)	1.43 ± 0.15	

Significantly different at *** $p < 0.001$

TABLE 4.39 COMPARISION OF PHYSICAL ACTIVITY LEVEL (PAL) BETWEEN YOUNGER GROUP AND OLDER GROUP CHILDREN (Mean ± SD)

Age Group	PAL	p-value
Younger Group (10-14years) (N=139)	1.5 ± 0.13	0.00002***
Older Group (15-18years) (N=98)	1.41 ± 0.17	

Significantly different at *** $p < 0.001$

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

World Health Organization has declared obesity as one of the most neglected diseases. Childhood obesity has become one of the leading international challenges. The dramatic changes in the lifestyle of people due to transition from rural to an urban area is also linked to increased level of obesity. At least 30% of obesity begins from childhood and 50-80% of obese children become obese adults later in life. Obesity and overweight have a close relationship with diabetes, heart diseases, malignancy, asthma, back pain and depression. There are many factors leading to obesity like lack of physical activity, lifestyle changes, prolonged television viewing, playing computer games and also nutritional factors such as consumption of fast food / junk food, consumption of calorie dense food and also the family history of obesity. The practice of regular consumption of food which is high in fat, salt, sugar and low in nutrient contents, e.g., noodles, chocolates, burgers, pizza, pastries, patties, popcorn, etc. may have adverse effect on the health of children. The factors contributing to childhood obesity are easy availability and access to unhealthy food in school canteens and its vicinity. Television food advertisements play an important role in influencing children decision to a major extent. Substantially scientific evidences have proven that there is a positive relation between unhealthy food advertisements and children's choices of consumption. The nutritious balanced diet is getting replaced by HFSS foods at the cost of health. This study aims to study the association between television food advertisements and consumption of high in fat, salt and sugar foods by school age children after initiation of the FSSAI Eat Right Movement. Thus, with this background the present study was planned with following objectives:

1. To analyze the type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels.
2. To study the association between television food advertisements and consumption of HFSS food by school age children.
3. To assess the physical activity pattern of school age children using 3-day physical activity recall.
4. To study sedentary behavior (watching TV, playing video games, using internet for leisure, sitting while talking on the telephone or texting etc.) in school age children.

The study was carried out in following two phases:

PHASE I – Analysis of type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels.

PHASE II – Association between television food advertisements and consumption of HFSS food by school age children.

Phase I – Analysis of type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels.

Five channels popular across genres and five popular kid's channels was selected for the study according to the TRP ratings and responses given by children during pretesting of the questionnaire. These five channels were viewed for three days in a week for two weeks for the duration of two hours in the afternoon from 2 p.m. – 4 p.m. and two hours in the evening from 8 p.m. – 10 p.m. On Sundays these channels were viewed in the morning from 10 a.m. – 12 p.m. and in evening from 8 p.m. – 10 p.m. The type and duration of advertisements shown on the channels were recorded and analysed. Five selected channels popular across genres were Star Plus, Colors, Sony, Sab, Star gold and five selected channels popular among kids were Disney Channel, Hungama, Cartoon Network, Pogo and Nick.

OBSERVATIONS

Results of type, frequency and duration of advertisements shown on channels popular across genres and popular kid's channels.

- From total food advertisements showed on Disney channel (12.2%), Hungama (12.4%), Cartoon Network (45.4%), Pogo (47.5%) and Nick (40.6%) majority of the food advertisements were of HFSS foods like pop rings, instant noodles, candies, breakfast cereals like chocos, biscuits, cookies, cake and ice-creams. Around 44.6% advertisements were related to HFSS products on Disney channel, 67.8% HFSS food advertisements on Hungama, 74.2% HFSS food advertisements on Cartoon Network, 76% HFSS advertisements on Pogo and 74.9% HFSS food advertisements on Nick channel.
- More number of HFSS food advertisements were telecasted on Sundays as compared to weekdays on channels like Hungama and Pogo.

- There were no advertisements related to fresh fruits and vegetables which are rich in vitamins and minerals on kid's channel.
- On general viewing channels like Star Plus, Colors, Sony, Sab and Star Gold 58.5%, 63.5%, 58.5%, 48.7% and 66.3% advertisements were related to HFSS food products from total food advertisements. Around 27% food advertisements were shown on Star Plus, 35.6% food advertisements on Colors, 35.1% advertisements on Sony, 28% advertisements on Sab and 28.1% on Star Gold. Other food items advertisements showed on general viewing channels were related to beverages like tea, coffee, health drinks like protein X, Horlicks, Yakut, boost and different types of oils.

Different types of food products shown on television advertisements

- Most of the advertisements telecasted on kid's channels were related to candies and chocolates (22.86%), followed by biscuits and cakes (20.98%), ready to eat food (19.7%) and 8.7% of food advertisements were related to chips, pop-rings, potato crackers.
- On general viewing channels majority of the food advertisements were related to healthy food products (15.07%) like wheat flour, gram flour, followed by candies and chocolates (15%), biscuit and cakes (12.66%), health drinks like protein powders (12.21%) and ready to eat food (9.7%) from total food advertisements shown.

Properties of advertisements used to attract attention of viewers

- Around 21.98% advertisements shown on kid's channel have humor effects to attract children towards the product followed by other special effects like celebrity endorsement (15.75%), free gifts like toys inside the products (13.81%) and jingles (13.14%).
- On general viewing channels almost 31.88% advertisements have celebrity endorsement to attract viewers toward their products, followed by humor (18.54%) and nutrient claims messages (18.24%).
- Animation (8.11%) and cartoon characters (8.78%) were used more in kid's channels than general viewing channels 2.11% and 0%. More advertisements with nutrient content claims were shown on general viewing channels (18.24%) in comparison to kid's channels (9.32%).

CONCLUSIONS

- Food television advertisements showed on kid's channels and general viewing channels were more related to HFSS food.
- Majority of the food advertisements were related to candies, biscuits, ready to eat food and chips.
- Humor, jingles, animation, free gifts and celebrity endorsement were used to attract children towards the products.

Phase II – Association between television food advertisements and consumption of HFSS food by school age children.

ENROLLMENT OF THE SUBJECTS

All the students studying in 6^{th} to 12^{th} standard who met the inclusion and exclusion criteria and whose parent gave their consent to participate in the study was enrolled in the study**.**

DATA COLLECTION

The data related to their background information, anthropometric measurements, 3-days physical activity recall, sedentary behaviour (watching TV, playing video games, using internet for leisure, sitting while talking on the telephone or texting etc.), HFSS food consumption and breakfast consumption pattern of last three days was collected. Physical activity recall of three consecutive days was collected. Sedentary behavior of the children was collected for different activities for a typical school day and a holiday. Total time spent by the students on such activities was collected. Frequency of consumption of HFSS food among children and three-day breakfast consumption pattern of the children was collected. The dish consumed by the subjects in breakfast along with the ingredients used in the dish was asked to fill by the children.

OBSERVATIONS

Background information of the subjects

- The mean age of the subjects was 14.4years. Almost 49.2% subjects belong to upper class family 2.9% belonged to upper middle-class family and 0.5% belongs to middle class family.
- Around 47.9 % fathers and 54.5% mothers of the subject had completed their graduation. Almost 37.3% father were having a private or government service and 54.8% mothers were housewife.

Anthropometric Screening

- From 319 total subjects 5.3% subjects belonged to thin category, 61.1 % subjects were normal, 26% were overweight and 7.5% subjects were obese.
- Prevalence of overweight and obesity was seen high among boys (28.8% and 11.6%) as compared to girls (23.7% and 4%).

HFSS food consumption among children

- Almost 27.04%, 18.13%, 8.6% and 7.89% subjects reported consumption of foods like breakfast cereal, ketchups, jam and sweet pickle on daily basis.
- Consumption of food rich in fat and sugar like chocolates and cream biscuits was consumed by 40.37% subjects and 29.4% subjects at least once in a week respectively.
- Around 38.68% subjects were consuming khakhra at least once in a week followed by 33.44% subjects consuming sev-mamra and 32.9% subjects consuming salty biscuits.
- Foods high in sugar and fat like cake (25.39%) and pastry (20.57%) were consumed once in 15 days or in a month by the subjects.
- Frequent consumption of cheese sandwich (6.94%), pasta (5.8%), egg items (5.71%) and pani-puri (5.48%) was observed among overweight subjects.
- Among obese subjects 13.64% reported frequent consumption of chocolates. Almost 40.91% obese subjects were consuming khakhra followed by sev-mamra (23.81%) and chavanu (14.29%) on daily basis.
- Overweight subjects were consuming (21.54%) papad, (17.19%) oats and (14.08%) soups on daily basis.
- Irrespective of the BMI majority of children reported consumption of HFSS food in last 24 hour.

- Around 70.6%, 81.7%, 71.9% and 83.33% of thin, normal, overweight and obese children reported HFSS food consumption in the last 24hours respectively.
- Around 44.5% subjects had consumed at least one HFSS food product followed by 24% subjects consumed 2 HFSS food product, 15.7% had consumed 3 products, 8% subjects had consumed 4 products, 4.7% subjects had consumed 5 products and 1.5% subjects had consumed 6 HFSS food products in last 24 hours.

Different sources of information about HFSS food among subjects

- Around 66.8% children reported that they get information about HFSS food from television advertisements.
- About 43.9% subjects get information from friends, 43.3% subjects through internet and 36.3% children get information from social media.
- About 59.3% subjects reported that they like to try out the new food products shown in television advertisements.
- Around 11.9% subjects reported that they try out the new food products within 15 days.
- Almost 91.1% subjects reported that they liked to consume HFSS food because they are tasty.
- Around 40.9% subjects reported that they are attracted toward humor effects shown by television advertisements followed by animation (40.1%), visual effects (36.5%) and jingles (30.1%).

Information related to the pocket money received by the subjects and usage of Food Delivery Application

- Almost 15.6% subjects were receiving at least 500rupees or more as pocket money. Majority of subjects (29.4%) were spending it on food.
- Around 60.8% subjects were using Food Delivery Application and about 57.39% subjects were using Food Delivery Application at least once in a month.

Knowledge of the subjects related to HFSS food and trans-fat

- Around 55.9% subjects don’t know about HFSS food. But 79.13% subjects knew that they are harmful for heath.

- Almost 53.35% subjects have not heard about trans-fat. About 72.57% subjects knew that they are harmful for health.
- Only 34.95% subjects were aware about the sources of trans-fast.

Sedentary Activity

Duration spent by the subjects performing specific sedentary activities on typical school day and holiday

- All the children were attending online classes for maximum time on a school day. Around 14.25 hours were spent by obese subjects in sedentary activities followed by 14.23 hours by thin, 14.2 hours by overweight and 13.9 hours by normal subjects.
- A significant difference was found in time spent riding in car on a school day between normal and overweight boys ($p<0.05$).
- On a holiday the time spent by subjects according to their nutritional status in different sedentary activities were 14.8 hours by obese subjects, 14.2 hours by overweight subjects, 13.8 hours by normal subjects and 12.3 hours by thin subjects.
- Children were spending more amount of time in watching television on a holiday (2.4 hours) as compared to a school day (1.3 hours).
- A significant difference was found in time spent in playing computer or video games between normal and obese subjects ($p<0.001$).

Comparison of different sedentary activities performed on school day and holiday by boys and girls

- On a school day girls and boys were spending significantly more amount of time doing different sedentary activities like playing computer or video games and listening to music ($p<0.001$), reading a book or magazine, doing inactive hobbies and using internet for leisure ($p<0.05$) as compared to holiday.
- Girls on a school day were spending significantly more amount of time in different sedentary activities like doing school related video calls ($p<0.001$) as compared to holiday while on holiday girls were spending significantly more amount of time on different sedentary activities like sitting while hanging out with family and friends, reading a book, doing inactive hobbies and watching

television or videos ($p<0.001$), playing computer or video games and riding in a car ($p<0.01$), doing video call, sitting while listening to music, sitting while talking on the telephone or texting ($p<0.05$) in comparison to school day.

- Boys on a school day were spending significantly more amount of time doing school related video calls ($p<0.001$) as compared to holiday while on holiday boys were spending significantly more amount of time in different sedentary activities like playing computer or video games, riding in a car, doing inactive hobbies and watching television or videos ($p<0.001$), sitting while listening to music ($p<0.01$), doing video call, sitting while hanging out with family and friends, reading books or magazine not for school and sitting while talking on the telephone or texting ($p<0.05$) in comparison to school.

Comparison of specific sedentary activities performed on school day and holiday between younger and older age group

- On school day younger and older subjects were spending significantly more amount of time in playing computer or video games and sitting while listening to music ($p<0.05$) as compared to holiday.

Children spending ≥5hour per day on screen time

- On school day almost 100% thin subjects, 87% normal subjects, 92.6% overweight subjects and 100% obese children were spending ≥5hour per day on screen time.
- On holiday around 56.3% thin subjects, 56.5% normal subjects, 57.4% overweight subjects and 80% obese subjects spent ≥5hour per day on screen time.

Breakfast Consumption Pattern

Food groups consumed by children for three consecutive days in breakfast

- Majority of the subjects (67.17%) consumed grains in breakfast followed by milk and milk products (62.38%), HFSS food products (36.93%) and other vegetables (27.05%).
- Around 3.59% subjects reported skipping breakfast for 3 days, 0.6% subjects for 2 days and 2.99% subjects for one day.

- Consumption of food groups like pulses (11.88%), nuts and oilseeds (14.17%), eggs (3.09%), green leafy vegetables (1.7%), vitamin A rich fruits and vegetables (4.79%) and other fruits (7.19%) was less in comparison to other food groups.
- The mean number of food groups consumed by the children was 2±0.8.
- Around 93.8% subjects consumed less than or equal to three food groups while only 6.2% subjects had consumed more than 3 food groups in breakfast.
- More than three food groups were consumed by only 8.4% normal subjects and 7.04% overweight subjects.
- Irrespective of the BMI a large percentage of the subjects reported consumption of HFSS foods in breakfast. Around 33.33%, 36.7%, 38.74% and 34.62% of thin, normal, overweight and obese subjects reported consumption of HFSS foods in breakfast respectively.
- Majority of the subjects consumed cereals in breakfast thin (71.26%), normal (67.02%), overweight (64.86%) and obese (66.67%) followed by milk and milk products thin (65.52%), overweight (64.86%), normal (60.11%) and obese (58.97%).
- A large number of younger children (71.31%) were consuming grains followed by milk and milk products (62.03%), HFSS food (36.71%) and other vegetables (27.43%) in breakfast.
- Among older children around 62.89% subjects consumed milk and milk products followed by 56.7% subjects consuming grains, 37.11% subjects consuming HFSS foods and 25.77% subjects consuming other vegetables.
- Breakfast was not consumed by 1.49% younger children and 2.09% older children for all the three days.
- Around 92.4% younger children and 85.56% older children consumed less than or equal to three food groups.
- More than 3 food groups were consumed by only 5.48% younger children and 7.21% older children.
- Around 1.49% younger children and 2.09% older children did not consumed breakfast for all the three consecutive days.

PHYSICAL ACTIVITY

3-day energy expenditure of the subjects

- Around 1891 kilocalories energy expenditure was reported by thin subjects, 2031 kilocalories by normal, 2338 kilo calories by overweight and 2589 kilo calories by obese subjects.
- Among sleeping hours of the subjects no major difference was found thin subjects reported 9hours of sleep followed by 8.6 hours of sleep by normal subjects, 8.5 hours by overweight and 8.1 hours by obese subjects.

Physical activity level of subjects

- Majority of the obese subjects (40%) were leaving a sedentary lifestyle followed by normal subjects (32.86%), overweight subjects (30.15%) and thin subjects (25%).
- Only 2.79% normal subjects, 3.17% overweight subjects and 6.6% obese subjects were leading a physically active lifestyle.
- No significant difference was found in PAL values with respect to nutritional status.
- Majority of the boys (43.56%) were leading a sedentary lifestyle in comparison to girls (23.52%).
- Around 4.41% girls led physically active lifestyle while only 0.99% boys were leading physically active lifestyle.
- Girls were significantly more active in comparison to boys ($p<0.001$).
- Among younger children group 48.92% subjects were less active physically followed by 21.5% subjects with moderate physical activity and 18.7% subjects with sedentary lifestyle.
- In older age group around 51.02% subjects were leading a sedentary lifestyle, 30.61% subjects were less active physically and 12.24% subjects were involved in moderate physical activity.
- Younger children were significantly more active than older children ($p<0.001$).

CONCLUSIONS

The consumption of HFSS food was found to be on higher side. Major source of information related to HFSS food was television advertisements. Majority of the

children agreed that they like to try out the new products showed in television advertisements. Children like to consume HFSS food because of the taste of the food and easy accessibility. Children are attracted towards advertisements due to different properties like humor, animation, visual effects and jingles. These effects are mostly used by the food advertisers to attract children. On average children watch television for at least 1.3 hours on a school day and 2.4 hours on a holiday and majority of HFSS related food advertisements were showed on holiday as compared to week day in some channels. Low physical activity was observed among children. Around 32.06% subjects were leading sedentary lifestyle, 41.35% subjects led physically less active lifestyle and 5.9% subjects were having a limited physical activity. No significant difference was found in PAL values with respect to nutritional status.

RECOMMENDATIONS

- Statutory interventions are needed to reduce the advertising of unhealthy foods, especially to children. There is a need for implementation and enforcement of existing laws to regulate advertising of different HFSS food products which can help in reducing the intake of HFSS food products by children. Also, there is a need to encourage more advertising of healthy foods.
- Overall, results from this study suggest that the children were less active physically and engaged in more sedentary behaviour. There is a need to take measures to promote home and neighbourhood based physical activity during children's leisure time.
- Children need to be sensitized about the ill effects of HFSS food consumption and encouraged to make healthy lifestyle choices.
- As stakeholders, parents and school authorities too need to be sensitized about the ill effects of HFSS food consumption and importance of physical activity so that they may help children make healthy lifestyle choices.

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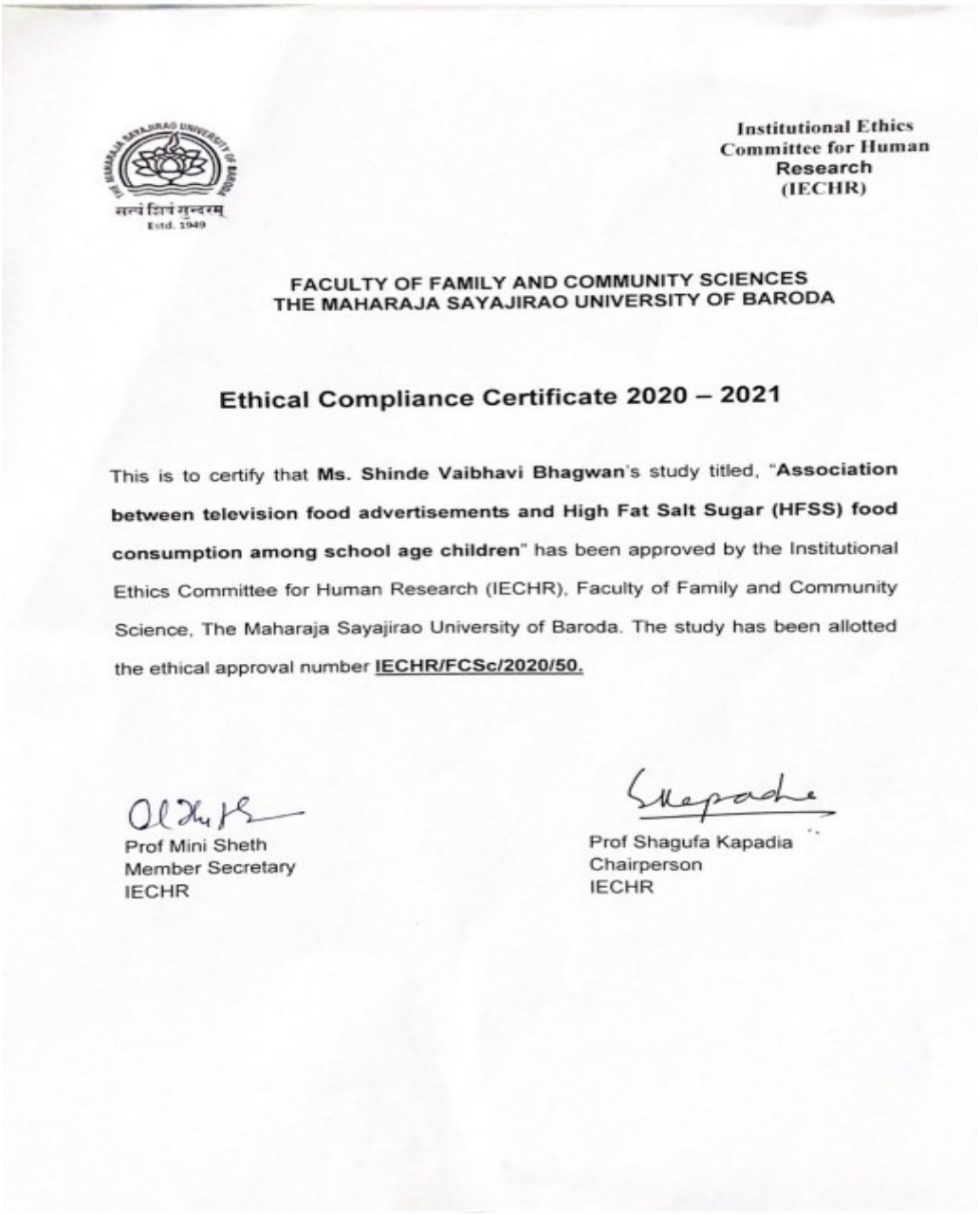
APPENDICES

APPENDIX I

ETHICAL CERTIFICATE



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Estd. 1949

Institutional Ethics
Committee for Human
Research
(IECHR)

FACULTY OF FAMILY AND COMMUNITY SCIENCES
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

Ethical Compliance Certificate 2020 – 2021

This is to certify that **Ms. Shinde Vaibhavi Bhagwan**'s study titled, "**Association between television food advertisements and High Fat Salt Sugar (HFSS) food consumption among school age children**" has been approved by the Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Science, The Maharaja Sayajirao University of Baroda. The study has been allotted the ethical approval number **IECHR/FCSc/2020/50.**

Prof Mini Sheth
Member Secretary
IECHR

Prof Shagufa Kapadia
Chairperson
IECHR

APPENDIX II

INFORMED CONSENT FORM FOR PARENTS

STUDY TITLE: ASSOCIATION BETWEEN TELEVISION FOOD ADVERTISEMENTS AND HIGH FAT SALT SUGAR (HFSS) FOOD CONSUMPTION AMONG SCHOOL AGE CHILDREN

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PURPOSE OF THE STUDY

There is an association between junk food consumption and the rising prevalence of childhood overweight and obesity. Junk foods are high in fat, salt and sugar with low nutritive value. Advertisements featuring products like snacks, toys, confectionaries, cookies and fast food are specifically targeted at children, in order to motivate them to try new brands and buy more. The FSSAI Eat Right Movement aims to create a new food culture by encouraging businesses and consumers to reduce the amount of fat, salt and sugar from foods. This study aims to study the association between television food advertisements and consumption of high in fat, salt and sugar foods by school age children after initiation of the FSSAI Eat Right Movement.

PROTOCOL FOR THE STUDY

If your child joins this study, they will be asked to complete online questionnaires which will collect information on anthropometric measurements (height, weight, waist circumference and hip circumference), background information, food consumption pattern, 3- day physical activity recall (2 school days and 1 holiday) and information

on time spent on activities like doing school related work, watching television etc. Your child can skip any question they don't want to answer.

COSTS

This study only requires your child's time and co-operation. All the costs incurred will be borne by the researcher and there is no financial compensation for your child's participation in this research.

POSSIBLE BENEFITS AND RISKS

The study will help to increase scientific knowledge about consumption patterns of high in fat, salt and sugar foods by school age children and their lifestyle behaviours which in turn could help in the development of effective strategies to reduce the burden of childhood overweight and obesity. We believe there are no risks associated with participation in this research study.

CONFIDENTIALITY

In the study your child's identity will be kept confidential. The results of the study may be published for scientific purposes but will not reveal your child's name or include any identifiable references to your child.

VOLUNTARY PARTICIPATION

Your decision to allow your child to join this study is voluntary. Your co-operation is important to the success of this study. Unless many parents like you allow your children to join; this study will not be possible. We hope you will permit your child to participate in the study because we need all the information we can get to draw correct conclusions.

RIGHT TO WITHDRAW

Participation is completely voluntary. If you agree to let your child participate now, you can always change your mind later. There are no negative consequences, whatever you decide.

AVAILABILITY OF RESULTS

At the end of the study, relevant information will be shared with you.

CONTACTS

If you have any questions about any part of the study, you can contact the investigators.

STATEMENT BY PARENT/GUARDIAN

I certify that I have read and understood the description of the study. I give permission for my child to participate in the study being carried out by Dr. Shonima Venugopal and her student, Ms. Vaibhavi Shinde on the association between television food advertisements and consumption of high in fat, salt and sugar foods by school age children.

I understand that the study requires my child to complete online questionnaires. I understand that I may ask questions about the study at any time. I am also aware of my right to remove my child from the study any time.

_____

Name of Child

_____

Name of Parent/Guardian

Date:

By clicking "I agree" below you are indicating that you have read this consent form and agree to let your child participate in this research study.

I Agree

I Do Not Agree

APPENDIX III

INFORMED ASSENT FORM FOR CHILDREN

STUDY TITLE: ASSOCIATION BETWEEN TELEVISION FOOD ADVERTISEMENTS AND HIGH FAT SALT SUGAR (HFSS) FOOD CONSUMPTION AMONG SCHOOL AGE CHILDREN

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PURPOSE OF THE STUDY

There is an association between junk food consumption and the rising prevalence of childhood overweight and obesity. Junk foods are high in fat, salt and sugar with low nutritive value. Advertisements featuring products like snacks, toys, confectionaries, cookies and fast food are specifically targeted at children, in order to motivate them to try new brands and buy more. The Food Safety and Standards Authority of India (FSSAI) Eat Right Movement aims to create a new food culture by encouraging businesses and consumers to reduce the amount of fat, salt and sugar from foods. This study aims to study the association between television food advertisements and consumption of high in fat, salt and sugar foods by school age children after initiation of the FSSAI Eat Right Movement. We think this research could help tell us that. So, we are getting information from school age children.

PROTOCOL FOR THE STUDY

If you decide to join this study, you will be asked to complete online questionnaires which will collect information on anthropometric measurements (height, weight, waist

circumference and hip circumference), background information, food consumption pattern, 3- day physical activity recall (2 school days and 1 holiday) and information on time spent on activities like doing school related work, watching television etc. If you do not wish to answer any of the questions included in the questionnaire, you may skip them and move on to the next question.

COSTS

This study requires only your time and co-operation. All the costs incurred will be borne by the researcher and there is no financial compensation for your participation in this research.

POSSIBLE BENEFITS AND RISKS

The study will help to increase scientific knowledge about consumption patterns of high in fat, salt and sugar foods by school age children and their lifestyle behaviours which in turn could help in the development of effective strategies to reduce the burden of childhood overweight and obesity. We believe there are no risks associated with participation in this research study.

CONFIDENTIALITY

In the study your identity will be kept confidential. The results of the study may be published for scientific purposes but will not reveal your name or include any identifiable references to you.

VOLUNTARY PARTICIPATION

You can choose whether or not you want to participate. We have informed your parents about this research. If you are going to participate in the research, your parent(s)/guardian also have to agree. But if you do not wish to take part in the research, you do not have to, even if your parents have agreed. If you decide not to be in the research, it is okay and no one will force you. Even if you say "yes" now, you can change your mind later and it will still be okay. Your co-operation is important to the success of this study. Unless many volunteers like you agree to join; this study will not be possible.

RIGHT TO WITHDRAW

Your decision to join this study is voluntary. You may quit at any time, for any reason, without notice. We hope you will take part for the entire study period because we need all the information to draw correct conclusions.

AVAILABILITY OF RESULTS

At the end of the study, relevant information will be shared with you.

CONTACTS

If you have any questions about any part of the study, you can contact the investigators. You may discuss anything in this form with your parents or teachers or anyone else you feel comfortable talking to.

CERTIFICATE OF ASSENT

I have read this information (or had the information read to me) and understood the description of the study. I agree to take part in the research being carried out by Dr. Shonima Venugopal and her student, Ms. Vaibhavi Shinde on the association between television food advertisements and consumption of high in fat, salt and sugar foods by school age children. I understand that the study requires the participants to complete online questionnaires. I understand that I may ask questions about the study at any time. I am also aware of my right to opt out of the study any time.

_____

Name of Child

_____

Name of Parent/Guardian

Date:

By clicking “I agree” below you are indicating that you have read this assent form and agree to participate in this research study.

I Agree

I Do Not Agree

QUESTIONNAIRE

CODE NO: _____ **DATE: _____**

1. BACKGROUND INFORMATION:

1. Full Name:
2. Age (years):
3. Date of Birth:
4. Sex: (a) Female

   (b) Male
5. In which standard are you studying? _____
6. In which section? _____
7. Contact Number:
8. Type of family:

   a) Nuclear

   b) Joint

   c) Extended
9. Number of family members:
10. Total family income (monthly):

2. EDUCATION AND OCCUPATION

11. Father's education: -
    a) Primary school
    b) Secondary school
    c) Higher secondary
    d) Graduate
    e) Master's degree
    f) Other (specify) _____
12. Father's occupation
    a) Business
    b) Self-Employed

c) Service (Private/Government)
d) Professional (MBBS/Engineer/LLB/MBA)
e) Retired
f) Other (specify)

13. Mother's education: -

a) Primary school education
b) Secondary school education
c) Higher secondary
d) Graduate
e) Master's degree
f) Other (specify) _____

14. Mother's occupation: -

a) Home-maker
b) Business
c) Self-Employed
d) Service (Private/Government)
e) Professional (MBBS/Engineer/LLB/MBA)
f) Retired
g) Other (specify)

3. ANTHROPOMETRY

15. Weight (Kg): _____

16. Height (cm): _____

17. Waist Circumference (cm): _____

18. Hip Circumference (cm): _____

4. PLEASE INDICATE HOW MUCH TIME (IN MINUTES) YOU SPEND PERFORMING THE FOLLOWING ON A TYPICAL SCHOOL DAY AND ON A WEEKEND:

Sr no		On a typical School Day	On a Holiday
1.	Watching television, videos or DVDs or movies		
2.	Playing (computer or video) games		
3.	Using the internet, emailing or other electronic media for leisure		
4.	Doing school-related video calls		
5.	Doing video calls		
6.	Doing school related work		
7.	Sitting while listening to music; (on radio, CD, tape, MP3, iPod, etc.)		
8.	Sitting while talking on the telephone or texting.		
9.	Sitting while hanging out or talking with friends or family in person.		
10.	Reading a book or magazines NOT for school		
11.	Doing inactive hobbies; (music, art, crafts, clubs, going to movies, etc.)		
12.	Riding in a car		

19. Which are the channels you watch most frequently on Television? (Please specify 5 channels) _____

20. Usually at what time do you wake up in the morning? _____

21. Usually at what time do you go to bed? _____

5. PLEASE WRITE DOWN THE ACTIVITY YOU WERE ENGAGED IN DURING THESE TIME SLOTS YESTERDAY:

Sr no	Time	Activity
1.	6-7a.m.	
2.	7-8a.m.	
3.	8-9a.m.	
4.	9-10a.m.	
5.	10-11a.m.	
6.	11-12p.m.	
7.	12-1p.m.	
8.	1-2p.m.	
9.	2-3p.m.	
10.	3-4p.m.	
11.	4-5p.m.	
12.	5-6p.m.	
13.	6-7p.m.	
14.	7-8p.m.	
15.	8-9p.m.	
16.	9-10p.m.	
17.	10-11p.m.	
18.	11-12p.m.	

6. FREQUENCY OF CONSUMPTION OF THE FOLLOWING FOOD ITEMS

Sr. no.	Food item	Daily	4-5 Times A week	2-3 times a week	Once A Week	Once In 10 Days	Once In 15 days	Once A Month	Occasi-onally	NEVER
1.	Puff									
2.	Samosa									
3.	Vada- pav									
4.	Frankie									
5.	Sandwich (cheese)									
6.	Sabudhana-vada									
7.	Pani-puri									
8.	Chaat									
9.	Sev-usal									
10.	Kachori									
11.	Dabeli									
12.	Pasta									
13.	Pav-bhaji									
14.	Egg-items									
15.	Bhajiyas									
16.	Bataka-vada									
17.	Puri									
18.	Puna-misal									
19.	Gulab-jamun									
20.	Kala-jamun									
21.	Bundi									
22.	Ladoo									
23.	Peda									
24.	Rasgulla									

25.	Ras-malai									
26.	Rabdi									
27.	Jaledi									
28.	Basundi									
29.	Ice-cream									
30.	Chocolates									
31.	Puddings									
32.	Bun									
33.	Cakes									
34.	Pastry									
35.	Fruit drinks-Mazza/slice/minute made									
36.	Fruit crush/sherbets-Mapro/mala/rasana									
37.	Red bull									
38.	Ketchups									
39.	Jam									
40.	Breakfast cereals									
41.	Sweet pickle									
42.	Sweet chutney									
43.	Noodles (e.g. Maggie/yippee/chings)									
44.	Mayonnaise									
45.	Cheese spreads									
46.	Frozen food (e.g. Mccain, frozen pizza, paratha)									
47.	Fries									
48.	Kurkure									
49.	Khakhra									

50.	Soya sticks									
51.	Gathiya									
52.	Papdi									
53.	Chawanu									
54.	Sev									
55.	Sev-mamra									
56.	Burger (e.g. Mc Donalds, KFC, Burger king)									
57.	Pizza									
58.	Subway									
59.	Fafda									
60.	Khaman									
61.	Sour pickles									
62.	Chinese food									
63.	Soups									
64.	Papad									
65.	Oats									
66.	Bread (brown)									
67.	Bread (white)									
68.	Instant soup									
69.	Baked chips / wafers (e.g. Too Yum									
70.	Regular chips / wafers (e.g. Lays, uncle chilps, Balaji)									
71.	Diet carbonated beverages (e.g. Diet coke, diet pepsi)									
72.	Regular carbonated									

	beverages (e.g. Fanta, Coke, Coca cola)									
73.	Biscuits (salty)									
74.	Biscuits (cream)									

22. Have you consumed any of the above-mentioned food items in the last 24 hours?

a) Yes
b) No

If yes, please specify what they were: _____

23. What is your source of information about foods like pizza, chips, chocolates, biscuits, burgers, soft drinks, cheese spreads, etc. which have been recently launched in the market?

a) Television advertisements
b) Parents
c) Friends
d) Social Media
e) Flyers/newspaper
f) Internet
g) Others

24. Do you like trying the new food products shown in the television advertisements?

a) Yes
b) No

25. How soon do you try out the new food products shown in television advertisements?

a) Same day
b) Within 1 week
c) Within 15 days
d) Within 1 month

e) Within 6 months or beyond

26. Why do you like consuming foods like pizza, chips, chocolates, biscuits, burgers, soft drinks, cheese spreads, etc.?

a) They do not cost much
b) Saves time as they are easy to eat
c) They are tasty
d) They are easily accessible
e) My friends also eat such foods
f) Others

27. Which of the following factors in television advertisements attract your attention?

a) Humor
b) Animation
c) Endorsement by celebrities or sports persons
d) Premium offers like free gifts, discounts etc.
e) Visuals and special effects
f) Music / Advertisement jingle
g) Others

28. On an average, how much pocket money do you receive every month?

a) No pocket money
b) <500 rupees
c) >=500 rupees

29. What do you spend your pocket money on?

a) Food
b) Video games
c) Music/Movies (CD/DVD)
d) Movies at a theatre
e) Books/Magazine
f) Others

30. Do you use Food Delivery Apps like Zomato, Swiggy, Uber Eats, etc.?

a) Yes
b) No

31. Where do you get to know about these Food Delivery Apps (Zomato, Swiggy) from?

a) Television Advertisements
b) Newspaper / Newspaper flyers
c) Friends / Classmates
d) Social media and internet
e) Relatives / Neighbours
f) Others

32. How frequently do you order food on these Food Delivery Apps?

a) Daily
b) 4-5 times per week
c) 2-3 times per week
d) Once in a week
e) Once in 15 days
f) Once in a month
g) Once in 6 months or beyond

33. Do you use discount coupons / vouchers / codes of fast food establishments like Mc Donald's, Pizza hut, Domino's, KFC, etc.?

a) Yes
b) No

34. Where do you get these discount coupons / vouchers / codes from?

a) Social media websites like Facebook, Instagram, etc.
b) Newspaper flyers
c) Mobile SMS / Whatsapp
d) Other

35. Have you heard about HFSS (High Fat Salt Sugar) foods?

a) Yes
b) No

36. If yes, then do you think they are harmful for health?

a) Yes
b) No

37. If yes, do you know what their harmful effects are? (please specify)

_____

38. Have you heard about trans-fat?

a) Yes
b) No

39. If yes, then do you think they are harmful for health?

a) Yes

b) No

40. If yes, do you know what their harmful effects are? (please specify)

_____

41. Do you know what the sources of trans fat are?

a) Yes

b) No

42. If yes, then please specify

_____

DAY-2 PHYSICAL ACTIVITY RECALL

1. Full name: -
2. Standard: -
3. Section: -

4. PLEASE WRITE DOWN THE ACTIVITY YOU WERE ENGAGED IN DURING THESE TIME SLOTS YESTERDAY:

Sr no	Time	Activity
1.	6-7a.m.	
2.	7-8a.m.	
3.	8-9a.m.	
4.	9-10a.m.	
5.	10-11a.m.	
6.	11-12p.m.	
7.	12-1p.m.	
8.	1-2p.m.	
9.	2-3p.m.	
10.	3-4p.m.	
11.	4-5p.m.	
12.	5-6p.m.	
13.	6-7p.m.	
14.	7-8p.m.	
15.	8-9p.m.	
16.	9-10p.m.	
17.	10-11p.m.	
18.	11-12p.m.	

DAY-3 PHYSICAL ACTIVITY RECALL

1. Full name: -
2. Standard: -
3. Section: -

4. PLEASE WRITE DOWN THE ACTIVITY YOU WERE ENGAGED IN DURING THESE TIME SLOTS YESTERDAY:

Sr no	Time	Activity
1.	6-7a.m.	
2.	7-8a.m.	
3.	8-9a.m.	
4.	9-10a.m.	
5.	10-11a.m.	
6.	11-12p.m.	
7.	12-1p.m.	
8.	1-2p.m.	
9.	2-3p.m.	
10.	3-4p.m.	
11.	4-5p.m.	
12.	5-6p.m.	
13.	6-7p.m.	
14.	7-8p.m.	
15.	8-9p.m.	
16.	9-10p.m.	
17.	10-11p.m.	
18.	11-12p.m.	

APPENDIX IV

BREAKFAST CONSUMPTION PATTERN QUESTIONNAIRE

1. Full Name: -
2. Standard: -
3. Section: -
4. Date of birth: -
5. Weight (kg): -
6. Height (cm): -

BREAKFAST CONSUMPTION PATTERN

Please write down what you have consumed for breakfast in last three days with the name of the dish and ingredients used in it. If you did not consume breakfast on a particular day then please write 'did not consume breakfast' or 'skipped breakfast'.

Day-1 Breakfast consumed
Name of the food item and ingredients used: -

Day-2 Breakfast consumed
Name of the food item and ingredients used: -

Day-3 Breakfast consumed
Name of the food item and ingredients used: -