Master of Science in Public Health


# Effect of Smartphone/Tablet Use on the Dietary Patterns of Adolescents in Secondary Schools of Gujranwala City

**By:**

**NISHWA SIDDIQUE**

**Al-Shifa School of Public Health, PIO,**

**Al-Shifa Trust Eye Hospital**
**Quaid-I-Azam University**

**Islamabad, Pakistan**

**(2023)**

# Effect of Smartphone/Tablet Use on the Dietary Patterns of Adolescents in Secondary Schools of Gujranwala City

NISHWA SIDDIQUE

**(362887-PIO/MSPH-2021)**

**Dissertation submitted in partial fulfilment of the requirement for the degree of:**

**MASTER OF SCIENCE IN PUBLIC HEALTH** (2023)

to

**Al-Shifa School of Public Health, PIO,**
**Al Shifa Trust Eye Hospital, Faculty of Medicine**
**Quaid-I-Azam University, Islamabad.**

| Word Count |
| --- |
| 11749 |

# DECLARATION

In submitting this dissertation, I certify that I have read and understood the rules and regulations of ASOPH and QAU regarding assessment procedures and offences and formally declare that all work contained within this document is my own apart from properly referenced quotations.

I understand that plagiarism is the use or presentation of any work by others, whether published or not, and can include the work of other candidates. I also understand that any quotation from the published or unpublished works of other persons, including other candidates, must be clearly identified as such by being placed inside quotation marks and a full reference to their source must be provided in proper form.

This dissertation is the result of an independent investigation. Where my work is indebted to others, I have made acknowledgments.

I declare that this work has not been accepted in substance for any other degree, nor is it currently being submitted in candidature for any other degree.

_____

**(Dr. Quratulain Waheed)**
Sr. Lecturer Public Health
Al-Shifa School of Public Health,
PIO, Al Shifa Trust Eye Hospital
Date: 01-09-2023

_____

**(Nishwa Siddique)**
(362887PIO/MSPH/2021)
Date: 01-09-2023

**Dedicated to the dearest Father Ch. Muhammad Siddique**

**and beloved Mother Ms. Mumtaz Sardar**

# ABSTARCT

**Background**: Smartphone/tablets use is increasing drastically especially among adolescents. It is causing many problems among adolescents and effect on their dietary patterns is one of them. Pakistan is one of the developing countries where undernutrition is already a burden and unhealthy dietary patterns due to many factors is increasing the risk of obesity. It is therefore necessary to assess the effect of smartphone/tablet on the dietary patterns of adolescents as it is one of the prevalent factors these days, so that strategies and policies can be developed and implemented accordingly.

**Objectives:** This study aimed to assess the dietary patterns of adolescents in secondary schools of Gujranwala city and to find the association of smart phone/tablet use and sociodemographic with dietary patterns among adolescents of secondary schools.

**Methodology:** A cross-sectional study was carried out in secondary schools of Gujranwala city, Pakistan. A total of 384 respondents (aged 11-19) who were in secondary schools were selected by non-probability consecutive sampling technique from the schools which were selected by simple random sampling for the purpose of the study. Chi-square test of association was applied to examine the association of outcome variable with smartphone/tablet use and socio-demographic factors.

**Results:** Out of 384 respondents (49.2%, n=189) were male. Most of the respondents were aged 14-16 years (39.8%). Out of total 384 respondents (84.1%, n=323) had unhealthy eating patterns. Chi-square test of association was run for demographic variables and smartphone/tablet use with computed grade for dietary patterns which showed significant association of mother's education level, physical activity, BMI,

smartphone usage time, purpose of smartphone/tablet use, frequency of eating in front of smartphone/tablet screen and consumption of type of food while using smartphone/tablet ($p = <0.05$).

**Conclusion:** This study demonstrates that there was a high prevalence of smartphone/tablet use that had negatively affected adolescents' dietary patterns and food choices. Most of them spend more than 2 hours screen on daily basis, which is above the recommended screen time limit for them. Majority of them were skipping breakfast and eating much more than planned due to high smartphone/tablet use which is affecting their dietary patterns. Mostly consumption of junk food, fast food, sweets, fried foods and snacks were the most selected food groups while using screen which were badly affecting their overall health of adolescents.

**Keywords:** Smartphone, Tablet, dietary patterns, adolescents, secondary schools, Gujranwala.

# ACKNOWLEDGEMENTS

***In the name of Allah, the most Merciful and Beneficent***

First of all, I am thankful to Allah Almighty, the most Merciful and Beneficent, for making the journey of my life till this point, including the completion of my thesis, which is a blessing indeed. I would like to mention one of the beautiful hadiths of our leader and beloved last Prophet Muhammad Mustafa Sallallahu Alaihi Wasallam. Abu Hurairah, may Allah be pleased with him, narrated that the **Messenger of Allah (ﷺ) said:** "When a person dies, his deeds are cut off except for three: Continuing charity, knowledge that others benefited from, and a righteous child who supplicates for him. — Jami` at-Tirmidhi 1376.

My utmost gratitude to my thesis supervisor Dr. Quratulain Waheed without your expertise and guidance this would not have been possible. In spite of her busiest and tiring routine she had provided me with her adroit guidance and worthy suggestions throughout this time. I would like to thank all my teachers who furthered my early and professional development during my education life.

I owe my supreme gratitude towards my mother for her unconditional love and support for me. My mother Ms. Mumtaz Sardar has always supported me in each and every phase of life. Whatever I am and wherever I am is just because of the altruistic love of my mother.

I would like to extend my thanks to **Maham Khaliq**, **Yumna Siddique** and all my friends who give time and support throughout my research work.

# TABLE OF CONTENT

# LIST OF TABLES

# LIST OF FIGURES

# LIST OF ABBREVIATIONS

| | |
|---|---|
| **BMI** | Body mass index |
| **ST** | Screen time |
| **MMT** | Media multitasking activities |
| **TV** | Television |
| **FFQ** | Food frequency questionnaire |
| **h** | hour |
| **SSB's** | Sugary sweetened beverages |
| **SPSS** | Statistical package for social sciences |
| **CDC** | Center of disease control |

# CHAPTER I: INTRODUCTION

Smartphone/tablet is an electronic device that performs many functions and have touch screen, internet accessibility and downloaded applications and games (LP et al., 2014). In 1997 the term 'Smartphone' was introduced (Waters, 2015). Smartphones are different from cell phones and are easily accessible to everyone now. Adolescents is defined as an age group in which important emotional, cognitive and behavioral changes takes place which are influenced by many individual, family, community and social factors (Viner et al., 2012). It is an important period of life for the development of healthy living habits for the rest of an individual's life. Dietary patterns mean all foods and beverages an individual usually drinks and eats which have effect on individual's health. It further indicated the health status and disease risk in an individual (Jacobs et al., 2014).

Smartphone/tablet is an electronic device with appeals every age group especially adolescents. It is an age where an individual wants to know and explore more and learn. This curious phase of life leads to spend more time on these gadgets. Although there are many beneficial effects of these devices but we cannot neglect the negative effects especially when it comes to effect health of an individual. We see around us most of the individuals especially adolescents always on smartphone/tablets ignoring everything around them which is a matter of concern. The advertisements on smartphone/tablet related to food which are mostly of junk and snacks have very important impact on the eating patterns and habits of adolescents which are available on the applications being used by them.

Adolescents is the age group which gets attracted very easily. Being on these gadgets more than the allowed time which is 2 hours per day for adolescents (CDC) leads towards sedentary lifestyle, bad food choices which ultimately effect dietary patterns of adolescents lead towards unhealthy adulthood of adolescents as we know that adolescents are the future of every country.

Dietary patterns are critical daily routine linked with adolescents (Hebebrand et al., 2014). Many studies have shown that certain type of foods can cause neurological changes that initiates addictive eating (Gordon et al., 2018). The consumption of highly processed food, high fat, salt and sugar containing foods for example sodas, pizza and snacks increase food cravings (Schulte et al.,2015). In opposition to this the consumption of diet rich in fiber, fruits and vegetables don't come in the category of food cravings (Steele et al., 2017). The investigation shows that the consumption of certain foods which mostly comes in the category of food cravings is associated with smartphone/tablet use timings (Kim et al., 2021).

The American Academy of Pediatrics as well as CDC suggests that children and adolescents ST should not be <2 h per day (Kang et.al., 2010). The time spent by watching TV, using smartphone/tablet, on computers is considered as screen time (ST). Due to this increased screen time in adolescents the eating speed and timing of eating along with eating choices are affected badly. The urge to eat unhealthy food increases due to increased ST. This will further lead to increased morbidity rates as well as mortality due to chronic diseases like obesity, hypertension, diabetes, depression in adulthood of these adults which is an issue to be addressed in time.

One of the most important public health issues in the present century that is affecting every country in the world is obesity in children. In the recent decades, obesity among school aged children and adolescents has increased more than ten times (Haththotuwa et al., 2020). Obesity and overweight are now considered as global pandemic. In Pakistan, both over nutrition and undernutrition co-exists simultaneously. This is adding more burden on already struggling heath care system of our country. There are many factors which contributes to this problem which is prevalent in Pakistan (Warraich et al., 2009). Increased ST due to the availability and accessibility of smartphones and tablets among adolescents is also one of the major contributors that cannot be ignored in present times.

The relationship between smartphone overuse and eating behaviors or patterns is very important to consider. It is further linked with many issues in adolescents with is the future of our country. A study reports that the rate of reduced physical activity, sleep disorders, meal skipping was high in those whose smartphone use time is more as compare to those whose smartphone usage time is less. (Martin et al., 2020).

Current evidence shows that the use of digital devices which increases ST of adolescents represents a risk factor of obesity among them. Previous investigations show that there is correlation between use of media devices, body mass index and adiposity level. Studies report that the food intake of people increases when they are playing video games and watching television. Recently studies claim same results for smartphone use (Kenney & Gortmaker et al, 2017). However, many studies conducted with other multimedia devices, research investigating the relationship between food intake and smartphone use is at an early stage.

The American Academy of Pediatrics (2016) says that the effects of television and video games will expands to smartphones/tablets and today it is evident we can see adolescents around us constantly on smartphones/tablets completely ignoring what is happening around them and this is alarming and has to be considered in time. More time spent on smartphone predicts sedentary lifestyle and further weight management is a question (Whitehead et al., 2010). As smartphone/tablet is a convenient device and require only one hand to use it, it is one of the most popular media devices which is being used even during meals.

Research reports that distraction can increase food intake and more researches are going on from few years now. Music, ambiance, social context affects the caloric ingestion while consuming meals among people (Higgs et al., 2015). Similarly, there are experimental reports which shows that there are many variables that can cause distraction from eating which includes story listening, music in the background while eating, computer games (Bellisle & Dalix, 2001). In current times smartphones/tablets are the distractions especially for the adolescents.

Distractions affect the amount of food ingestion in a person (Higgs & Woodward, 2009). Diversions during eating results in increased caloric intake. Studies report that these electronic devices such as watching television program while eating effects the amount of food intake (Ogden et al., 2017). According to (Higgs et all., 2009) the quantity of food consumed if a person is watching television is not accurate. Recently smartphone is easily accessible and portable distraction available as it can perform all the activities that different devices perform individually (Kenney & Gortmaker, 2017).

## 1.1. Rationale:

Adolescents' everyday eating habits and the use smartphones are related (Kim et al.,2021). Pakistan is already facing malnutrition crisis, so it is imperative that policymakers address the issue of unhealthy eating which is further linked with obesity an emerging epidemic in Pakistan especially in adolescents. In Pakistan, the incidence rate of obesity and overweight are quickly increasing among children and adolescents (Tanzil & Jamali, 2016). Obesity is a risk factor which indicates more mortality as compare to underweight and it is also preventable (Organization WHO, obesity and overweight, 2021). The unhealthy eating patterns in adolescence contributes to weight gain and obesity on adulthood which will increase the burden of CVD's and other health complications and will add more burden to already weak health care system of Pakistan. The future of any nation lies with its adolescents.

This study was conducted to find out the effect of smartphone/tablet use on the dietary patterns of adolescents so that strategies and policies can be developed and implemented accordingly to address this public health issue.

## 1.2. Objectives:

The objectives of the study were:

**1:** To assess dietary patterns of adolescents in secondary schools of Gujranwala city, Pakistan

**2:** To determine association of smartphone/tablet use among adolescents with dietary patterns of adolescents in secondary schools

**3:** To determine the association of sociodemographic characteristics with dietary patterns of adolescents

# Chapter II: LITERATURE REVIEW

## 2.1. Smartphone use among adolescents: An overview:

In past few years the use of smartphone has increased all over the world. Recently, more than 3 billion people have their own smartphone in the world which is expected to be several hundred million in next few years (O'Dea et al., 2020). Smartphone has become an important gadget for everyone in daily life, especially in adolescents, where one in four adolescents claim that he/she use it constantly (Kabali et al.,2015). Smartphone access in adolescents of United States is reported to increase from 40% in 2004 to 75% in 2013 (Rideout et al.,2018), 53% report to have their own smartphone from the age of 11 years with the increase of 80% to 14 years (Anderson et al., 2018).

In European figures, there is constant rise as 64% of young people have a smartphone at 15-16 years of age, 55% at 13-14 years of age, 40% at the age of 11-12 years and 20% at the age of 9-10 years (Mascheroni & Cuman, 2014). This access is alarming. As there are benefits of having this access to smartphones/tablets among adolescents, the harmful effects of this overuse cannot be ignored.

About 38% of adolescents claim to spend several hours on social media applications (Rideout et al., 2018). As adolescents own their own smartphone devices, reports show that there is an increase in media activities in daily routine such as in bed, bathroom, on streets and most importantly in mealtimes. This gradually increasing trends does not seem to decrease in coming years. These technological advancements have led to many improvements in the society such as improved and fast communication but also have negative points which includes social isolation, addictive behavior (Takao et al., 2009) and, recently, interfering with eating behaviors and ultimately on eating patterns.

In India, adolescents have been running smartphones market place. The smartphone usage percentage has been increased from 5% to 25% in adolescents of age 16-18 years of age in the year 2012 to 2014. In 2013 the percentage of smartphone users in urban India was increased to 90% (Davey & Davey, 2014).

## 2.2. Caloric ingestion during smartphone use:

A study was conducted among 62 universities in 2019 in which both genders from age 18-28 participated voluntarily to evaluate the total caloric ingestion and food choices while using smartphone during mealtimes. In the trail sessions, all the volunteers were given the snack task, they were given three different conditions. First condition was to eat in no distraction, second one was to eat while using smartphone and third one was to eat while reading. After each of these trail sessions, total caloric ingestion and nutritional content of food which was consumed were measured.

The results reported that eating in the presence of smartphone and reading, there is increased caloric intake by 15% with increased lipid consumption. The results reported that smartphone use during meals and reading text significantly affects the calories consumption (da Mata Gonçalves et al., 2019)

Furthermore, the external factors also influence eating behaviors of adolescents, recent observations show that distraction effects the calories consumption. A hypothesis was tested in 2019 by which children involved in media multitasking activities (MMT) in smartphone/tablet would be more due to environmental stimuli (Lopez et al., 2019). In this study they reported that there is a relationship between MMT activities in smartphones and obesity risk. The researchers used the sample of 179 adolescents aged

children of age 9-11 years and investigated the relationship between MMT activities and BMI, regardless of physical activity, it suggests that the use of ST technologies affects the food consumption which is mostly due to external stimuli. As the previous findings report, the individuals due to reduced cognitive control about the food consumption as a result eat more (Ogden et al.,2017).

Researches related to psychology examined in detail the importance of concentration while eating meals. Experiments has proved that not eating with concentration increases food intake and amount of food consumed at different meals (Ogden et al., 2013).
When you eat in the presence of distractors which may include MMDs, background music etc. affect the formation of memory while eating such as proper awareness of food ingestion which further interferes with food intake and satiety and hunger signals. Satiety is an important component which controls appetite and gives a feeling of fullness to a person and stops a person to eat more (Morris et al., 2020).

Recent eating behavior of cognitive models shows that satiety is cognitively formed and depends on memory (Higgs et al., 2017). These eating behavior models are validated by certain evidence that reducing memory for food intake by interfering with concentration at time of eating increases food intake (Robinson et al., 2013).

## 2.3. Previous studies similar to this topic:

A cross-sectional study was conducted in Korea among adolescents of age 12-18 by doing nationwide survey which was self-reported on food consumption and smartphone use. Nine food groups including fruits, vegetables, milk, sodas, energy drinks, sweetened beverages, fast food, instant noodles and snacks were included in the food

consumption list. The smartphone use duration was also self-reported. About 66.5% participants used smartphone over 2 hours per day. The more consumption of fruits ($p<0.001$), vegetables ($p<0.001$) and milk ($p<0.001$) have significant association with lower smartphone use. Whereas, more consumption of sodas ($p<0.001$), fast food ($p<0.001$), instant noodles ($p<0.001$) and snacks ($p<0.001$) were significantly associated with higher smartphone use (Kim et al., 2021).

A study conducted among 150 students of different schools, colleges and universities to determine their eating habits and screen time in Lahore, Pakistan. Non-probability convenient sampling technique was used to select participants. A self-constructed questionnaire was used for data collection. Those students of selected age group who have no screen time were excluded from the study. Data was analyzed by using SPSS version 25.0. About 8% of the respondents were obese and 26% were overweight. About 23% were spending 3-5 hours on screen and 32% were spending more than 7 hours. About 54% mostly skipped breakfast, 45% delay meals, 57% ate more than requirement. 56% prefer to consumed fried food and 44% consumed sweets while using electronic devices (Ahmed et al., 2022).

A study was conducted among six kindergartens pre-school aged children and participants were their caregivers regarding ST and dietary patterns of that specific age group in Hunan, China. A questionnaire included FFQ and questions regarding children's daily ST. Total participants were 1567 kindergarten caregivers. The results showed that the mean ST of preschoolers was 1.36±1.26 h, and 54.3% children spent more than 1 h on screens. Those children who have longer screen time have less consumption of fruits and vegetables and high consumption of snacks and SSBs. After

adjusting confounders, the association between ST and vegetables and ST with SSBs was significant (Huo et al., 2022).

A study was conducted to find out the association between ST and nutrients intake in children of age group 6-15 was done in Shika, Japan. Total 1414 students were included in the study. In boys, longer TV viewing time was found associated with lower protein, potassium, calcium, iron, vitamin K, vitamin B-12, and total dietary fiber intake. In girls, long TV watching time was found associated with lower protein, salt, calcium, vitamin D, and vitamin B-2 consumption and higher fatty acids intake. The aim of this study was to assess the dietary patterns of adolescents and its association with ST. (Tsujiguchi et al., 2018). When people consume meals in front of a screen which includes mostly smartphones these days, they mostly binge and physical activity is not performed by them. This leads to weight gain results in being overweight and then in the category of obesity causing other health-related problems.

A cross-sectional study was conducted to find association between diet, physical activity and screen time among adolescents in Manipur, India. Data was collected by questionnaire method from 929 adolescents from class 7 and 8. Data analysis was done by using SPSS version 21. Results showed that 7 out of 10 students were physically inactive. 56.9% students have their own smartphone along with social media accounts. The percentage of those who were eating healthy was 5.8% only. Girls and non-hostilities were more physically inactive. (Lyngdoh et al., 2019).

## 2.4. Conceptual framework:

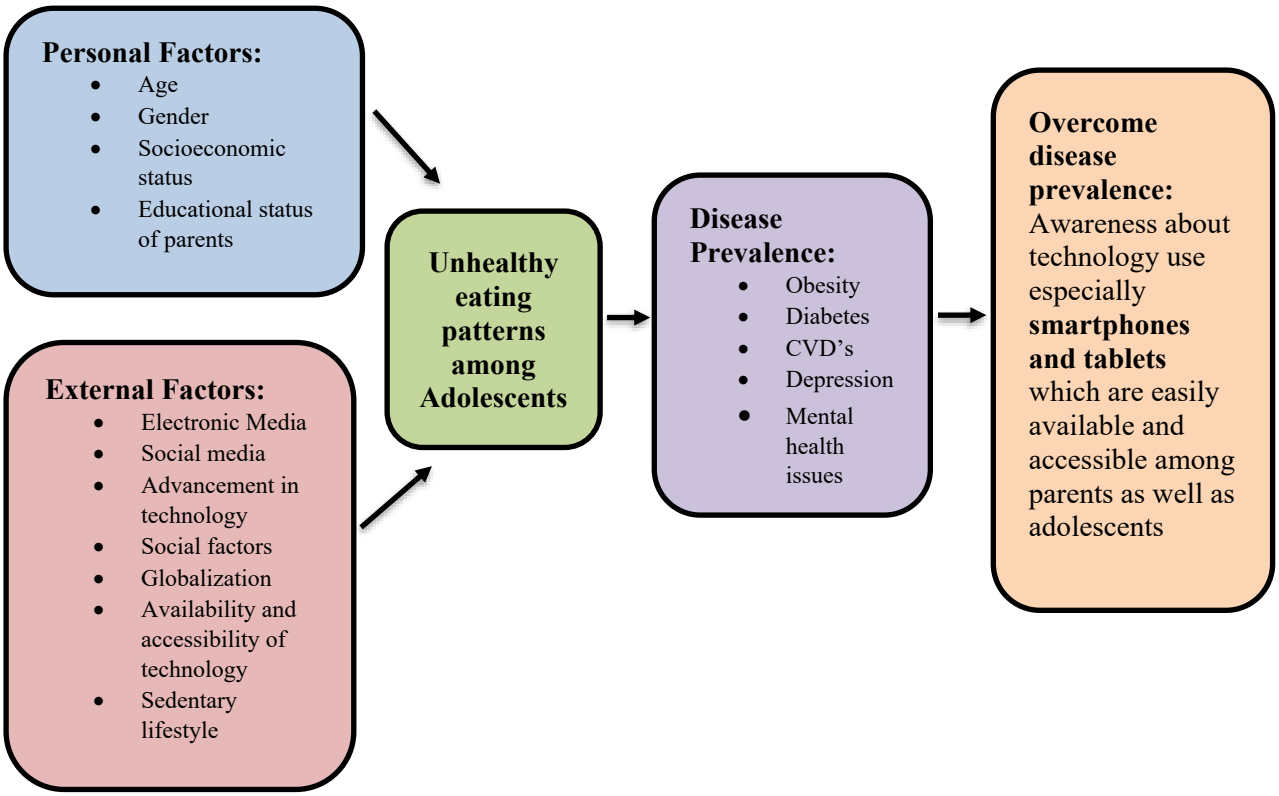



**Figure 1: Conceptual framework**

## 2.5. Operational Definitions:

### 2.5.1. Dietary patterns:

Dietary patterns are defined as the proportions and variety or combination of different foods, drinks, and nutrients in diets, and the frequency with which they are habitually consumed. (Dietary guidelines for Americans)

### 2.5.2. Smartphone:

A mobile phone that performs many of the functions of a computer, typically having a touchscreen interface, internet access, and an operating system capable of running downloaded apps. (Tech target)

### 2.5.3. Tablet:

A device which is a wireless, portable personal computer with a touchscreen interface is called as tablet. It is smaller in size than a notebook large in size than a smartphone. The idea of tablet computing is generally credited to Alan Kay of Xerox, who sketched out the idea in 1971. (Tech target)

### 2.5.4. Adolescents:

Adolescence is a transitional stage of physical and psychological development, generally occurs during the period from puberty to adulthood. Adolescence is usually associated with the teenage years 10-19 years. (World health organization)

# Chapter III: METHODOLOGY

## 3.1. Study Design:

A quantitative research approach using cross-sectional study design was carried out to assess the effect of smartphone/tablet use on the dietary patterns of adolescents in secondary schools of Gujranwala, city.

## 3.2. Study Duration:

Study period for the current research was 6 months (March 2023 – August 2023)

## 3.3. Study Setting:

The study was carried out at public and private secondary schools of Gujranwala city.

## 3.4. Research Participants:

Study participants were adolescents who were secondary school students. Sample was selected on the basis of inclusion and exclusion criteria.

### 3.4.1. Inclusion Criteria:

1. Secondary school students of age 11-19 years
2. Both male and female were included in the study
3. Those students who use smartphone/tablet

### 3.4.2. Exclusion Criteria:

1. Students who were not willing to participate in the study
2. Students who were absent

4. Those students with no smartphone/tablet use

## 3.5. Sample Size Calculation:

Sample size was calculated using proportion formula for sample size calculation in 'OpenEpi menu', Version 3 software. Sample size of 384 was calculated by adding prevalence 51% with 95% confidence interval (C.I) and 5% margin of error (Ahmed et al., 2022).

## 3.6. Sampling Strategy:

Desired sample was collected using non-probability consecutive sampling strategy. Secondary schools were selected by using simple random sampling technique. Total 10 secondary schools were selected by simple random sampling from two lists of private and public schools separately, 5 were public and 5 were private secondary schools.

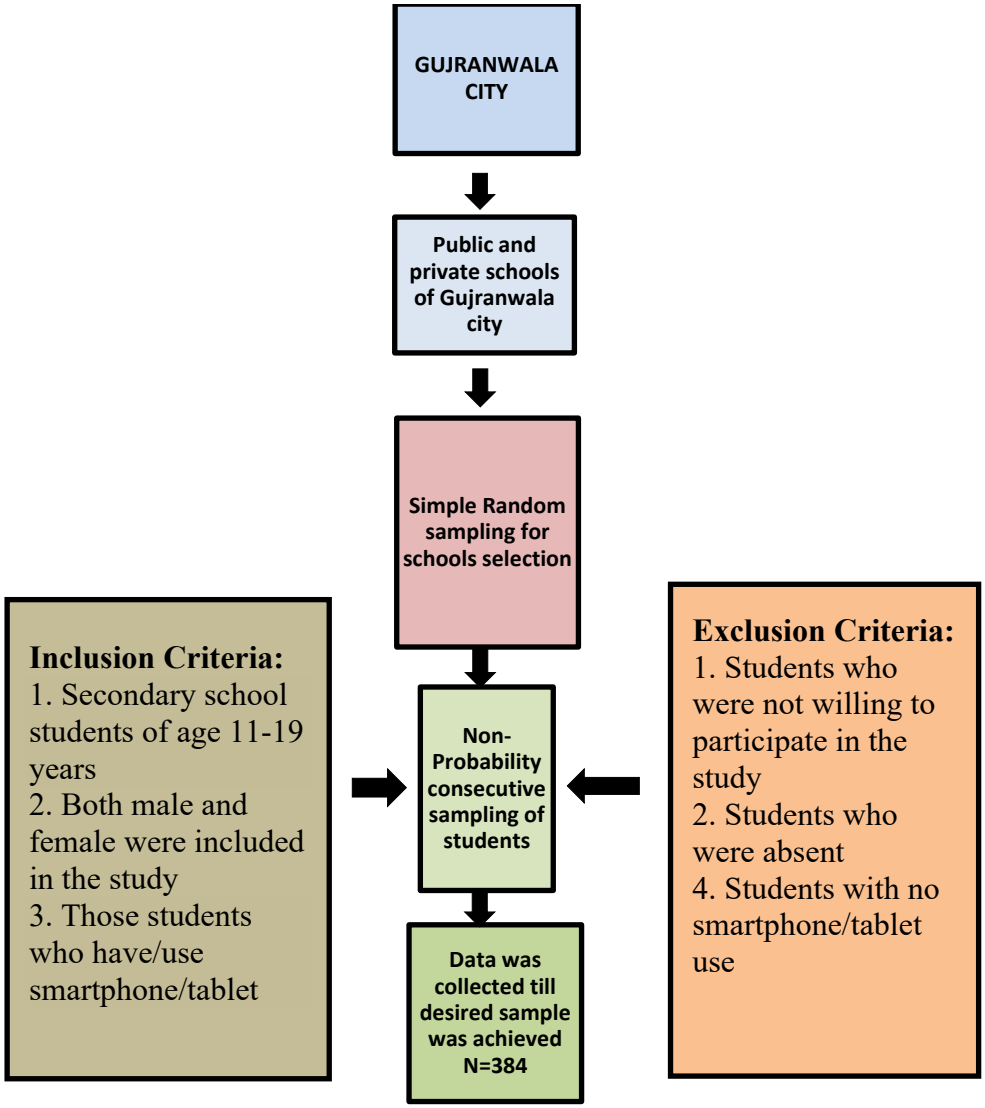



**Figure 2: Sampling technique strategy**

## 3.7. Data Collection Instrument:

### 3.7.1. Questionnaire Design:

Data was collected using an interview-based questionnaire in which the researcher asked the questions from the respondents and recorded their responses accordingly. Questionnaire was devised after going through different research papers. A Performa was developed to collect data regarding socio-demographic characters of the respondents, questions regarding smartphone use were adapted from previous studies (Ahmed et al., 2022) and FFQ for the determination of dietary patterns of respondents

(Tsujiguchi et al., 2018). FFQ is a validated tool for the assessment of dietary patterns. Validity of questionnaire was checked through public health specialist and public health care providers. Pilot study was carried out and structured questionnaires were filled from 10% of total sample size and tool was devised in pilot testing. After finalization of research questionnaire, data was collected. Questionnaire is attached as Annexure-A.

### 3.7.2. Content of the Questionnaire:

The questionnaire contained three major sections:

**1**. First part included questions related to socio-demographic characteristics.

**2**. Second part included questions related to smartphone/tablet use (Ahmed et al., 2022).

**3**. Third part included questions on dietary patterns of students (Tsujiguchi et al., 2018)

## 3.8. Study Variables:

### 3.8.1. Outcome variable:

The major construct of the questionnaire was to find the effect of smartphone/tablet use on the dietary patterns of adolescents. The outcome variable was dietary patterns of adolescents which were measured using questionnaire (FFQ) adapted from previous studies. It is a validated tool to assess the dietary patterns. This scale consists of twelve items which are graded on four-point Likert scale from 0= never, 1= 1-3 times/week, 2= 4-6 times/week. 3= daily one or more than 3 times/day.

### 3.8.2. Independent Variable:

Data on independent variables was collected through a structured Performa that is constructed after international and national literature review. The Performa included socio-demographic variables such as gender, age, education level of father and mother/guardian, profession of father and mother/guardian etc. in addition to these it also included some variables such as weight, height, BMI were also measured and interpreted by using CDC growth charts. BMI greater than equal to $95^{th}$ percentile interpreted as obese, BMI $85^{th}$ to $95^{th}$ percentile was interpreted as overweight, BMI greater than the $5^{th}$ percentile and less than $85^{th}$ percentile was interpreted as healthy weight and BMI less than $5^{th}$ percentile was interpreted as underweight. Growth charts are attached as Annexure-D.

## 3.9. Data Collection Process:

### 3.9.1. Pilot Testing:

Pilot testing was performed before starting the formal data collection procedure by including 10% of the actual sample size. Reliability was checked after entering data into SPSS. No major changes were done after pilot testing. The value of Cronbach's alpha for section C (dietary patterns of adolescents by using FFQ) was 0.67. Data from pilot testing was included in final analysis.

### 3.9.2. Data Collection:

Data was collected by the researcher herself and no data collectors were hired. All the students of secondary schools met inclusion criteria were approached. Assent was taken from students by attaching it to the diary of all the students' day before data collection and only those students were selected whose parents/guardians agreed/allowed them to

take part in the research process verified by checking the signs of parents/guardians on attached assent. Schools were selected by simple random sampling from the list of all schools present in Gujranwala city. After taking the assent, the students were interviewed and their responses were recorded by the researcher. Data collection was completed in approximately two and half months. All filled questionnaires were kept protected in plastic files and no one had access to it other than the researcher.

## 3.10. Data Management:

Data was entered and recorded into statistical package for social sciences (SPSS) version 29.0. Code book was generated for all the variables in the questionnaire. Data was rechecked for any error, discrepancies or completeness by spot checking method. Data was stored in a separate storage device to avoid any loss in future.

## 3.11. Data Analysis Procedure:

Code book was developed and data was entered in Statistical Package for Social Sciences (SPSS) version 29. After careful data entry, data was checked for any error before proceeding to the further analysis. After data cleaning, data transformation was carried out for certain variables. Data analysis was done in two phases; descriptive analysis and inferential analysis.

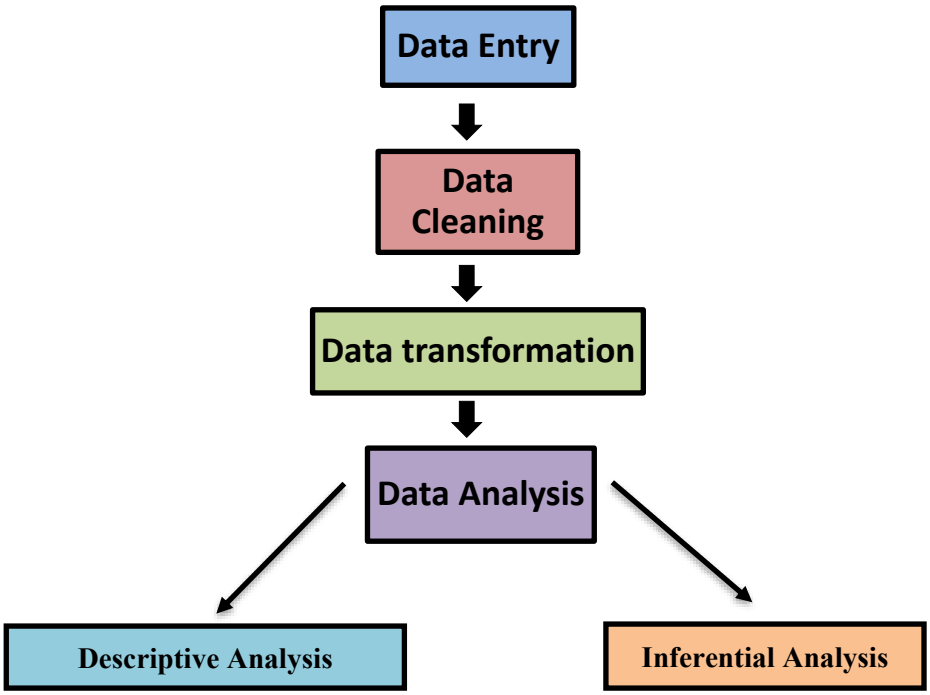



**Figure 3: Data analysis plan**

## 3.12. Data transformation:

Dietary patterns were assessed by using FFQ including 12 items of different foods. For open ended questions which was age, variable was transformed into three categories with coding 1, 2 and 3.

### 3.12.1. Descriptive Analysis:

Descriptive statistics were generated for socio-demographic characteristics and smartphone use related questions and outcome variable. For categorical variables, data was summarized in the form of frequencies and percentages and presented in table form, Bar chart and Pie chart. Frequencies and percentages were also reported.

Grades were assigned as per used in the tool. Lowest grade was given 0 and 3 was the highest grade. Question number 30, 31, 32, 33, 34, 35 were reverse graded. By adding up the grades, respondents were divided in 2 groups using median as a cutoff point which was 18.

Respondent with grade greater than 18 were considered as having healthy dietary patterns and respondents with grade less than 18 were considered as having unhealthy dietary patterns.

Data analysis was divided into **3 stages:**

**1**.Descriptive was run for socio-demographic variables that were age, gender, education status of mother and father/guardian, employment status of father and mother/guardian, monthly income of parents or guardian, weight, height and BMI of respondents.

**2**. Descriptive analysis was run for outcome variable

### 3.12.2. Inferential Analysis:

**3**. In third step chi-square test of association was run to find the association of dietary patterns with socio-demographic variables in section A and independent variables of section B. A significant value of $p \leq 0.05$ was used for all statistical analysis.

## 3.13. Ethical Considerations:

Before starting formal data collection, approval from Institutional Review Board (IRB) of Al-Shifa School of Public Health Rawalpindi, Pakistan has been taken. Permission letter from the Head of Department of Al-Shifa School of Public Health was obtained regarding access to Secondary schools. Permission was taken from the secondary

schools of Gujranwala city for conducting research. Parents were explained the purpose of the research in a written assent which was taken from each participant. Participants were assured for the confidentiality of their data. Data collected from the respondents was kept anonymous and was not shared with anyone. Data was entered in SPSS anonymously. After data entry, hard copies of collected were kept at a safe place.

# CHAPTER IV: RESULTS

For the current study, data of 384 students from secondary schools was collected. A summary of descriptive and inferential analysis is given below.

## 4.1. Sociodemographic Characteristics:

A total of 384 respondents were included in this study. Out of 384 respondents (n=184, 49.2%) were male and (n=195, 50.8%) were female. Majority of the respondent's father occupation was own business (n=202, 52.6%) and (n=182, 47.4%) were employed. Majority of the respondent's mothers were housewives (n=345, 89.8%) and (n=39, 10.2%) were working women. 4.7% respondents' fathers' education status (n=18) was less than matric, 38% respondent (n=146) were matric, 31.5% respondents' fathers (n=121) had higher secondary level of education, 15.6% respondents' fathers (n=60) had bachelors' level of education and 10.2% (n=39) had masters level of education. 22.9% respondents' mothers' education status (n=88) was less than matric, 24.0% respondent (n=92) were matric, 20.8% respondents' mothers (n=80) had higher secondary level of education, 19.0% respondents' mothers (n=73) had bachelors' level of education and 13.3%(n=51) had masters level of education. 13.8% respondents (n=53) were underweight, 24.5% respondents (n=94) had healthy weight and 39.6% respondent (n=152) were overweight and 22.1% respondent (n=85) were obese. 48.4% respondent were physical activity (n=186), 51.6% respondents had no physical activity (n=198).

Details of demographic characteristics are listed in table 1.

**Table 1: Descriptive summary of Sociodemographic variables**

| Variables | Frequency (n) | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Male | 189 | 49.2 |
| Female | 195 | 50.8 |
| **Monthly income** | | |
| Less than 50,000 | 106 | 27.6 |
| 50,000-1 lac | 209 | 54.4 |
| More than lac | 69 | 18 |
| **Father's occupation** | | |
| Employed | 182 | 47.4 |
| Business | 202 | 52.6 |
| **Mother's occupation** | | |
| Housewife | 345 | 89.8 |
| Working women | 39 | 10.2 |
| **Father's education** | | |
| Less than matric | 18 | 4.7 |
| Matric | 146 | 38 |
| Higher secondary | 121 | 31.5 |
| Bachelors | 60 | 15.6 |
| Masters | 39 | 10.2 |
| | | |

| | | |
|---|---|---|
| **Mother's education** | | |
| Less than matric | 88 | 22.9 |
| Matric | 92 | 24.0 |
| Higher secondary | 80 | 20.8 |
| Bachelors | 73 | 19.0 |
| Masters | 51 | 13.3 |
| **Physical activity** | | |
| Yes | 186 | 48.4 |
| No | 198 | 51.6 |

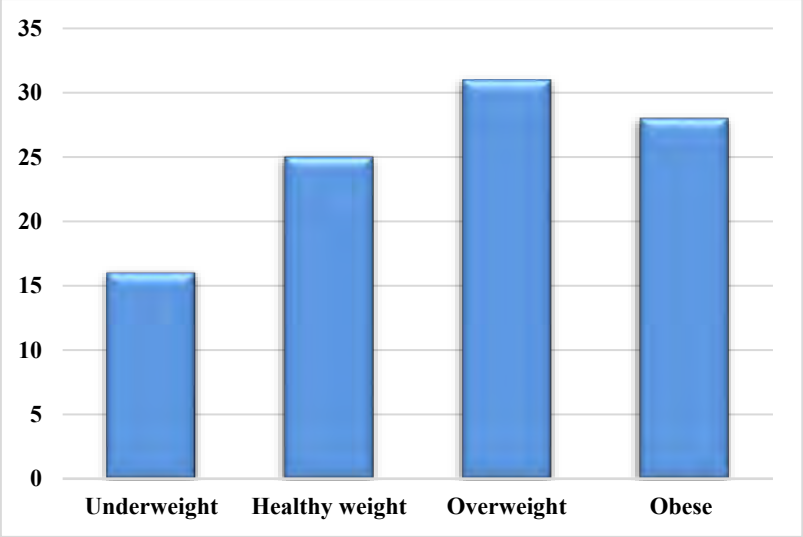



**Figure 4: Percentage of BMI**

Among 384 respondents, 16.1% respondents (n=62) were under-weight, 24.5% respondents (n=94) had healthy weight and 31.0% respondent (n=119) were overweight and 28.4% respondent (n=109) were obese.

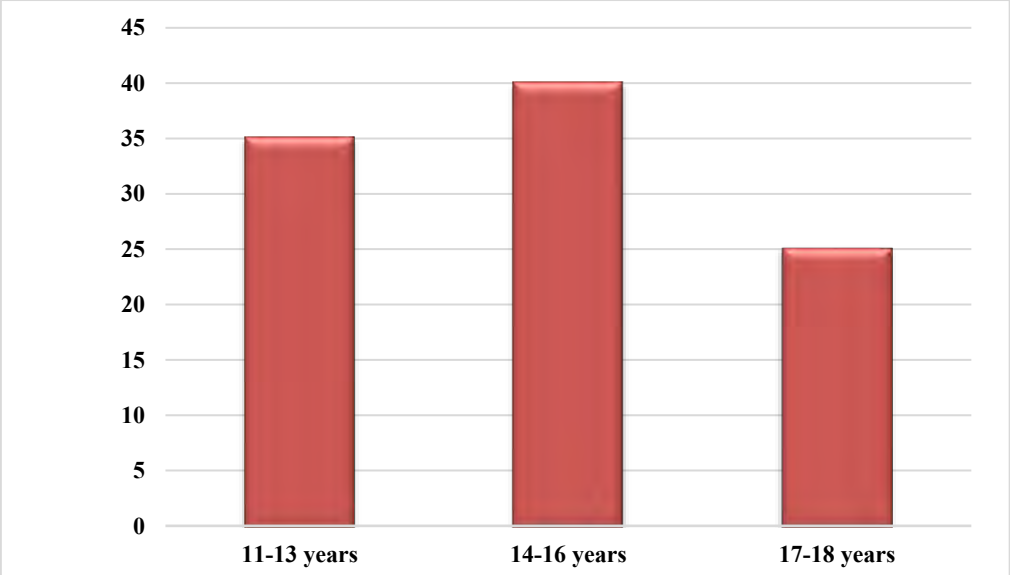



**Figure 5: Percentage of adolescents age**

Out of 384 respondents, most of the respondents were 14-16 years of age group (n=153, 39.8%).

## 4.2. Descriptive summary of smartphone/tablet use:

Total 384 respondents completed the questionnaire about the effect of smartphone/tablet use on the dietary patterns of adolescents in the secondary schools. Questionnaire was interview based. Questionnaire about smartphone/tablet use was adapted from previous studies. Out of total 384 respondents (57.3%, n=220) have their own smartphone/tablets and (42.7%, n=164) don't have their own smartphone/tablets. Most of the respondents (68.2%, n=262) spend more than 2 hours on smartphone/tablet per day and (31.8%, n=122) spend up to 2 hours on smartphone/tablet per day. Out of total 384 respondents (34.4%, n=132) mostly eat junk food while using smartphone/tablet, (20.3%, n=78) mostly eat regular food while using smartphone/tablet and (18.5%, n=71) mostly eat desserts while using smartphone/tablet.

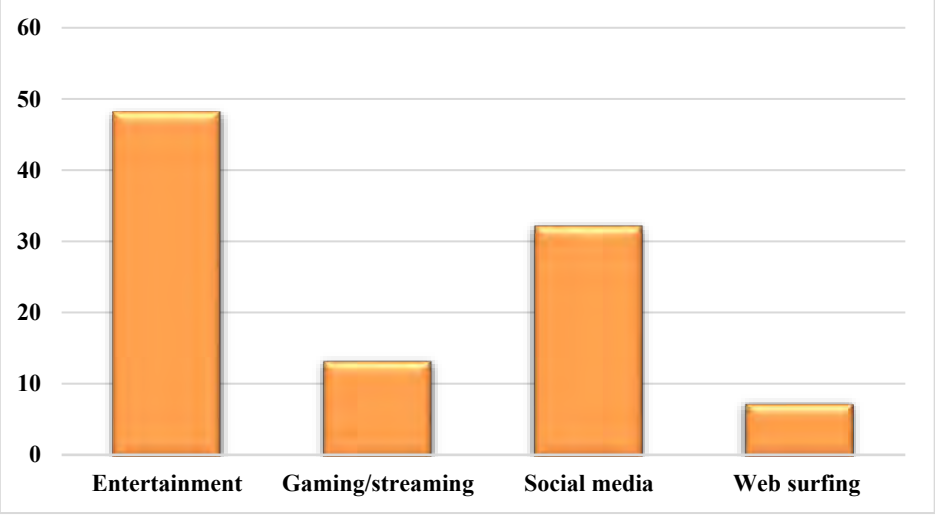



**Figure 6: Percentage of smartphone/tablet usage purpose**

Among 384 respondents, (47.9%, n=184) were using smartphone/tablets for entertainment, (31.8%, n=122) were using smartphone/tablet for social media apps, (13.3%, n=51) were using smartphone/tablet for gaming/streaming and (7.0%, n=27)

were using smartphone/tablet for web surfing.

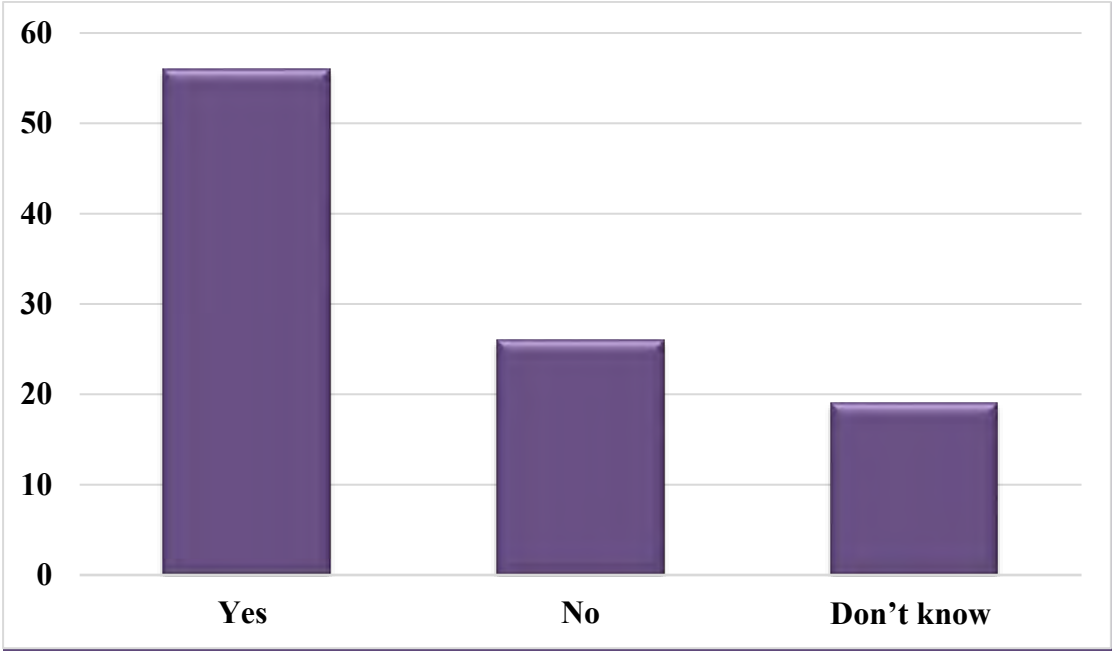



**Figure 7: Percentage of eating more in front of smartphone/tablet screen**

Among 384 respondents, (55.5%, n=213) said they start eating more in front of smartphone/tablet screen, (25.8%, n=99) said no they don’t start eating more in front of smartphone/tablet screen and (18.8%, n=72) said they don’t know.

Details of smartphone/tablet use among adolescents is given in table 2.

**Table 1: Descriptive summary of smartphone/tablet use**

| Content | Frequency (n) | Percentage (%) |
|---|---|---|
| **Do you have your own smartphone/tablet?** | | |
| Yes | 220 | 57.3 |
| No | 164 | 42.7 |
| **Smartphone/tablet usage time?** | | |
| Up to 2 hours | 122 | 31.8 |
| More than 2 hours | 262 | 68.2 |
| **Do you skip meals due to smartphone/tablet use?** | | |
| Yes | 72 | 18.8 |
| No | 312 | 81.3 |
| **Which type of food do you mostly consume while using smartphone\tablet?** | | |
| Regular meal | 78 | 20.3 |
| Junk food | 132 | 34.4 |
| Beverages | 57 | 14.8 |
| Fresh fruits and vegetables | 24 | 6.3 |
| Desserts | 71 | 18.5 |
| Nothing | 22 | 5.7 |
| **Do you like to consume fried food while using smartphone/tablet?** | | |
| Yes | 315 | 82.0 |
| No | 69 | 18.0 |

| | | |
|---|---|---|
| **Do you like to consume sweets, chocolates, candies while using smartphone/tablet?** | | |
| Yes | 270 | 70.3 |
| No | 114 | 29.7 |
| **Do you miss your breakfast due to the use of smartphone/tablet overnight?** | 243 | 63.3 |
| Yes | 141 | 36.7 |
| No | | |
| **You eat in front of your smartphone/tablet screen?** | | |
| Never | 45 | 11.7 |
| Off and on | 92 | 24.0 |
| Once a day | 73 | 19.0 |
| Two times or more a day | 174 | 45.3 |
| **Do you think your dietary patterns are affected due to smartphone/tablet use?** | | |
| Yes | 177 | 46.1 |
| No | 108 | 28.1 |
| Don't know | 99 | 25.8 |

### 4.3.3 Descriptive summary of Dietary Patterns (outcome variable):

Total 384 respondent completed the questionnaire about dietary patterns. Questionnaire was interview based. Dietary patterns were assessed using questionnaire adapted from previous studies. Total grade was computed for each type of food item. Out of total 384 respondents (84.1%, n =323) had unhealthy dietary patterns and (15.9%, n=61) had healthy dietary patterns.

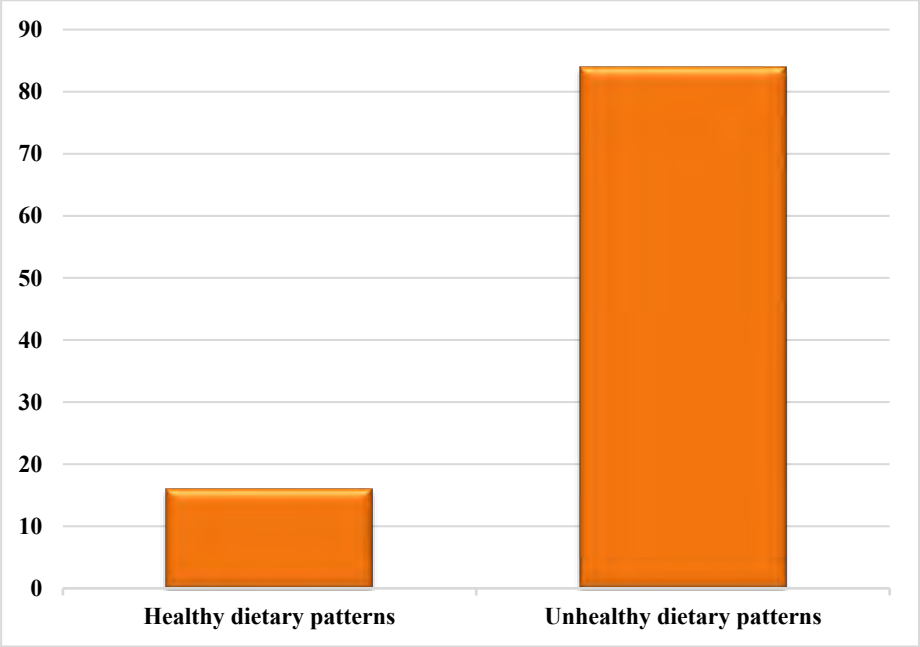



**Figure 8: Percentage of dietary patterns of adolescents**

Out of total 384 respondents, (23.2%, n=89) never had milk and milk products per week, (33.65, n=129) had milk and milk products 1-3 times per week, (27.9%, n=107) had milk and milk products 4-6 times per week and (15.4%, n=59) were used to drink milk and milk products daily. Out of total 384 respondents, (34.4%, n=132) never had caffeinated beverages per week, (17.4%, n=67) had caffeinated beverages 1-3 times per week, (19.0%, n=73) had caffeinated beverages 4-6 times per week and (29.2%, n=112)

were used to have caffeinated beverages daily.

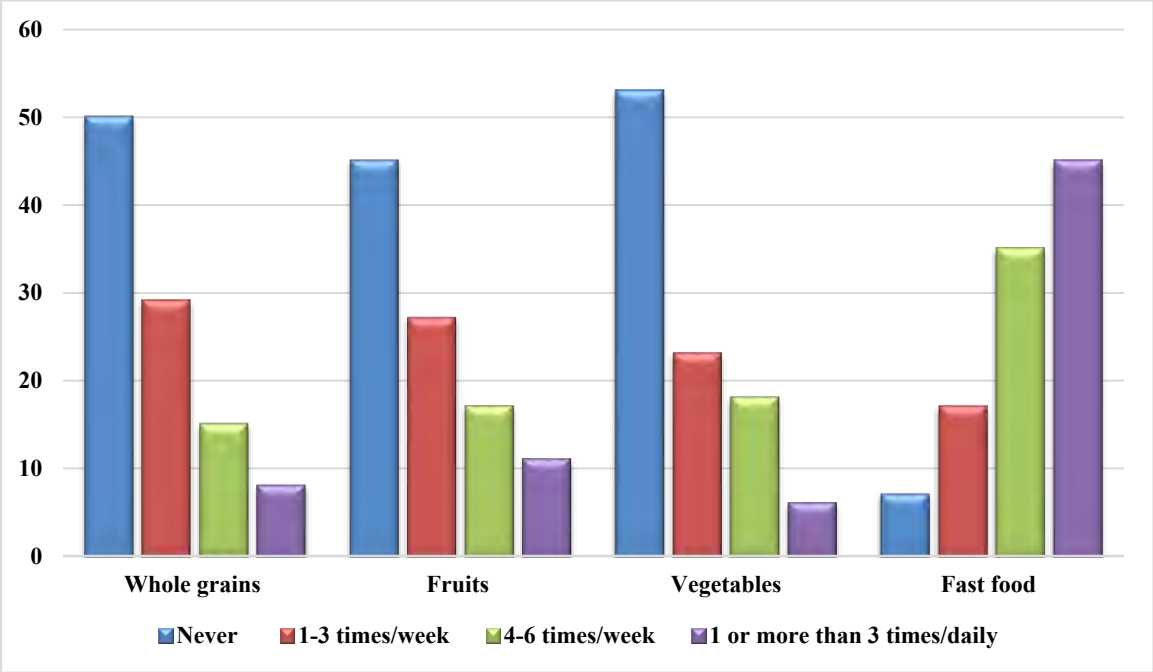



**Figure 9: Percentage of whole grain, fruits, vegetables and fast-food intake per week**

Out of total 384 respondents, (47.9%, n=184) never had whole grains per week, (29.2%, n=112) had whole grains 1-3 times per week, (15.4%, n=59) had whole grains 4-6 times per week and (7.6%, n=29) were used to eat whole grains daily. Out of total 384 respondents, (45.1%, n=173) never had fruits per week, (26.6%, n=102) had fruits 1-3 times per week, (16.9%, n=65) had fruits 4-6 times per week and (11.5%, n=44) were used to eat fruits daily. Among total 384 respondents, (53.1%, n=204) never had vegetables per week, (22.9%, n=88) had vegetables 1-3 times per week, (18.2%, n=70) had vegetables 4-6 times per week and (5.7%, n=22) were used to have vegetables daily. Among total 384 respondents, (2.6%, n=10) never had fast food per week, (17.2%, n=66) had fast food 1-3 times per week, (35.2%, n=135) had fast food 4-6 times per week and (45.1%, n=173) were used to have fast food daily.

A summary of frequency and percentage of food groups is given bellow. Details of dietary patterns of adolescents is listed in table 3.

**Table 3: Descriptive summary of dietary patterns**

| Types of food groups | Frequency (n) | Percentage (%) |
|---|---|---|
| **Meat and meat products** | | |
| Never | 90 | 23.4 |
| 1-3 times/week | 141 | 36.7 |
| 4-6 times/week | 95 | 24.7 |
| 1 or more than 3 times/day | 58 | 15.1 |
| **Pulses** | | |
| Never | 167 | 43.5 |
| 1-3 times/week | 101 | 26.3 |
| 4-6 times/week | 64 | 16.7 |
| 1 or more than 3 times/day | 52 | 13.5 |
| **Milk and milk products** | | |
| Never | 89 | 23.2 |
| 1-3 times/week | 129 | 33.6 |
| 4-6 times/week | 107 | 27.9 |
| 1 or more than 3 times/day | 59 | 15.4 |
| **Sodas** | | |
| Never | 41 | 10.7 |

| | | |
|---|---|---|
| 1-3 times/week | 144 | 37.5 |
| 4-6 times/week | 93 | 24.2 |
| 1 or more than 3 times/day | 106 | 27.6 |
| **Caffeinated beverages** | | |
| Never | 132 | 34.4 |
| 1-3 times/week | 67 | 17.4 |
| 4-6 times/week | 73 | 19.0 |
| 1 or more than 3 times/day | 112 | 29.2 |
| **Energy drinks** | | |
| Never | 178 | 46.4 |
| 1-3 times/week | 60 | 15.6 |
| 4-6 times/week | 20 | 5.2 |
| 1 or more than 3 times/day | 126 | 32.8 |
| **Sweetened beverages** | | |
| Never | 52 | 13.5 |
| 1-3 times/week | 95 | 24.7 |
| 4-6 times/week | 117 | 30.5 |
| 1 or more than 3 times/day | 120 | 31.3 |
| **Snacks** | | |
| Never | 15 | 3.9 |
| 1-3 times/week | 98 | 25.5 |
| 4-6 times/week | 123 | 32.0 |
| 1 or more than 3 times/day | 148 | 38.5 |

## 5.1. Inferential Results:

### 5.1.1. Association of sociodemographic with the dietary patterns of adolescents:

Chi-square test of association was run for demographic variables with computed grade for dietary patterns. Result of Pearson's chi square showed significant association of mother's education level $X^2 = 10.597(4)$ p =0.03, BMI $X^2 = 10.597(3)$ p = 0.014 and physical activity $X^2 = 6.973(1)$ p = 0.008 with computed grade for dietary patterns. (Table 4)

**Table 4: Association of sociodemographic characteristics with dietary patterns**

| **Variables** | **Dietary patterns** | | **Chi-square (df)** | **P-value** |
|---|---|---|---|---|
| | **Healthy dietary patterns % (n)** | **Unhealthy dietary patterns % (n)** | | |
| **Gender** | | | | |
| Male | 8.3(32) | 40.9(157) | 0.305(1) | 0.581 |
| Female | 7.6(29) | 43.2(166) | | |
| **Age** | | | | |
| 11-13 | 6.3(24) | 28.6(110) | 0.972(2) | 0.615 |
| 14-16 | 5.5(21) | 34.4(132) | | |
| 17-19 | 4.2(16) | 21.1(81) | | |
| **Monthly income** | | | | |
| Less than 50,000 | 5.5(21) | 22.1(85) | 2.926(2) | 0.232 |
| 50,000- 1 lac | 8.6(33) | 45.8(176) | | |

| | | | | |
|---|---|---|---|---|
| More than 1 lac | 1.8(7) | 16.1(62) | | |
| **Fathers' education** | | | | |
| Less than matric | 1.0(4) | 3.6(14) | 4.965(4) | 0.291 |
| Matric | 7.6(29) | 30.5(117) | | |
| Higher secondary | 3.4(13) | 28.1(108) | | |
| Bachelors | 2.6(10) | 13.0(50) | | |
| Masters | 1.3(5) | 8.9(34) | | |
| **Mothers' education** | | | | |
| Less than matric | 1.8(7) | 21.1(81) | 10.597(4) | **0.03** |
| Matric | 5.7(22) | 18.2(70) | | |
| Higher secondary | 2.3(9) | 18.5(71) | | |
| Bachelors | 3.4(13) | 15.6(60) | | |
| Masters | 2.6(10) | 10.7(41) | | |
| **Fathers' occupation** | | | | |
| Job/employed | 7.3(28) | 40.1(154) | 0.065(1) | 0.799 |
| Business | 8.6(33) | 44.0(169) | | |
| **Mothers' occupation** | | | | |
| Housewife | 14.1(54) | 75.8(219) | 0.138(1) | 0.710 |
| Working women | 1.8(7) | 8.3(32) | | |
| **BMI** | | | | |
| Underweight | 1.0(4) | 15.1(58) | 10.597(3) | **0.014** |
| Healthy weight | 2.9(11) | 21.6(83) | | |
| Overweight | 7.3(28) | 23.7(91) | | |
| Obese | 4.7(18) | 23.7(91) | | |

**Physical activity**

| | | | | |
|---|---|---|---|---|
| Yes | 10.2(39) | 38.3(147) | 6.973(1) | **0.008** |
| No | 5.7(22) | 45.8(176) | | |

**5.1.2. Association of smartphone/tablet use with dietary patterns of adolescents:**

Chi-square test of association was run for smartphone/tablet use with computed grade for dietary patterns. Result of Pearson's chi square showed significant association of smartphone/tablet usage time $X^2 = 6.680(1)$ $p = 0.01$, purpose of smartphone/tablet use $X^2 = 13.309(3)$ $p = 0.004$, type of food mostly consumed while using smartphone/tablet $X^2 = 11.461(5)$ $p = 0.043$, consumption of fried food while using smartphone/tablet $X^2 = 4.822(1)$ $p = 0.02$, consumption of sweets, candies, chocolates while using smartphone/tablet $X^2 = 6.140(1)$ $p = 0.013$, missing of smartphone due to smartphone/tablet overuse at night $4.591(1)$ $p = 0.032$, eating in front of smartphone/tablet screen $X^2 = 17.564(3)$ $p = <0.001$, eating more than planned in front of smartphone/tablet screen $X^2 = 7.738(2)$ $p = 0.021$, affected on dietary patterns due to smartphone/tablet use $X^2 = 6.667(2)$ $p = 0.03$ with computed grade for dietary patterns. (Table 5)

**Table 5: Association of smartphone/tablet use with dietary patterns**

| Variables | Dietary patterns | | Chi-square (df) | P-value |
|---|---|---|---|---|
| | **Healthy dietary patterns % (n)** | **Unhealthy dietary patterns % (n)** | | |
| **Own smartphone/tablet** | | | | |
| Yes | 8.6(33) | 48.7(187) | 0,302(1) | 0.582 |
| No | 7.3(28) | 35.4(136) | | |
| **Smartphone/tablet usage time** | | | | |
| Up to 2 hours | 7.3(28) | 24.5(94) | 6.680(1) | **0.010** |
| More than 2 hours | 8.6(33) | 59.6(229) | | |
| **Purpose of smartphone/tablet use** | | | | |
| Entertainment | 4.4(17) | 43.5(67) | 13.309(3) | **0.004** |
| Gaming/streaming | 3.6(14) | 9.6(37) | | |
| Social media apps | 6.3(24) | 25.5(98) | | |
| Web surfing | 1.6(6) | 5.5(21) | | |
| **Meal skipping due to smartphone/tablet use** | | | | |
| Yes | 3.4(13) | 15.4(59) | 0.312(1) | 0.576 |
| No | 12.5(48) | 68.8(264) | | |
| **Type of food consumption due to smartphone/tablet use** | | | | |
| Regular food | 5.2(20) | 15.1(58) | 11.461(5) | **0.043** |
| Junk food | 4,9(19) | 29.4(113) | | |
| Sweetened Beverges | 2.1(8) | 86.0(49) | | |

| | | | | |
|---|---|---|---|---|
| Fresh fruits and vegetables | 1.6(6) | 4.7(18) | | |
| Desserts | 1.8(7) | 16.7(64) | | |
| Nothing | 0.3(1) | 5.5(21) | | |
| **Fried food consumption during smartphone/tablet use** | | | | |
| Yes | 11.5(44) | 70.6(271) | 4.822(1) | **0.028** |
| No | 4.4(17) | 13.5(52) | | |
| **Chocolates, candies, sweets consumption during smartphone tablet use** | | | | |
| Yes | 13.3(51) | 57.0(219) | 6.140(1) | **0.013** |
| No | 2.6(10) | 27.1(104) | | |
| **Missing breakfast due to smartphone/tablet use overnight** | | | | |
| Yes | 12.0(46) | 51.3(197) | 4.591(1) | **0.032** |
| No | 3.9(15) | 32.8(126) | | |
| **Eating in front of smartphone/tablet screen per day** | | | | |
| Never | 1.3(5) | 10.4(40) | 17.564(3) | **<0.001** |
| Off and on | 6.0(23) | 18.0(69) | | |
| Once a day | 4.7(18) | 14.3(55) | | |
| Two or more times a day | 3.9(15) | 41.4(159) | | |
| **End up eating more than planned in front of smartphone/tablet screen** | | | | |
| Yes | 7.8(30) | 47..7(183) | 7.738(2) | **0.021** |
| No | 6.3(24) | 19.5(75) | | |
| Don’t know | 1.8(7) | 16.9(65) | | |

| | | | | |
|---|---|---|---|---|
| **You think your dietary patterns are affected due to smartphone/tablet use** | | | | |
| Yes | 7.3(28) | 38.8(149) | 6.667(2) | **0.03** |
| No | 6.3(24) | 21.9(84) | | |
| Don’t know | 2.6(9) | 23.4(90) | | |

# CHAPTER V: DISCUSSION

In current study, effect of smartphone/tablet use on the dietary patterns of adolescents in secondary schools of Gujranwala, city was assessed. Questions related to smartphone/tablet use were adopted from previous studies. Dietary pattern was assessed by using a validated tool; food frequency questionnaire (FFQ). Pilot testing was performed before starting the formal data collection procedure by including 10% of the actual sample size (384).

The results showed that most of the adolescents have their own smartphone/tablet (57.3%, n=220). A cut off of smartphone/tablet usage time per day for adolescents is up to 2 hours per day (CDC recommendation). Most of the adolescents spent more than 2 hours on smartphone/tablets per day (68.2%, n=262). A previous study showed that about 66.5% adolescents used smartphone over 2 hours per day (Kim et al., 2021). It justifies that that the usage of smartphone/tablet in present times is relatively very high among adolescents.

Most of the adolescents eat in front of smartphone/tablet screen two times or more per day (45.3%, n=174). Most of the adolescents used smartphone/tablet for the purpose of entertainment (47.9%, n=184). Most of the adolescents were not skipping meals (81.3%, n=312) but prefer to eat with smartphone/tablet, and most of them consume junk food while using smartphone/tablet (34.4%, n=132) and a few preferred to have fresh fruits and vegetables (6.3%, n=24).

Most of the adolescents liked to eat fried food while using smartphone/tablet (82%, n=315). The likeliness to consume sweets, chocolates and candies while using

smartphone and tablet was also high among adolescents (70.3%, n=270). Due to overnight use of smartphone/tablet most of the adolescents miss their breakfast (63.3%, n=243).

Most of the adolescents have unhealthy eating patterns (84%, n=323) and (15.9%, n=61) have healthy eating patterns. Very few adolescents were consuming whole grains daily one or more than 3 times (7.6%, n=29). The consumption of meat and meat products daily one or more than 3 times was (15%, n=58). Most of the adolescents have never consumed pulses (43.5%, n=167). Only few adolescents were consuming fruits daily one or more than 3 times (11.5%, n=44). The frequency of consumption of vegetables daily one or more than 3 times in adolescents was less than fruits (5.7%, n=22). Very few adolescents were consuming milk and milk products daily one or more than 3 times (15.4%, n=59). The consumption of sodas among adolescents was high as most of them have sodas 1-3 times per week (37.5%, n=144) and (27.6%, n=106) were consuming sodas daily one or more than 3 times.

Mostly adolescents were consuming caffeinated beverages daily one or more than 3 times (29.2%, n=112). About (32.8%, n=126) adolescents prefer to have energy drinks daily one or more than 3 times. The consumption of sweetened beverages daily one or more than 3 times was also high among adolescents (31.3%, n=120). Mostly adolescents were consuming fast food daily one or more than 3 times (45.1%, n=173). The consumption of snacks among adolescents daily one or more than 3 times was (38.5%, n=148) which shows that most of the adolescents liked to have snacks daily.

In this study, association was found between mothers' education, and physical activity (p=0.03), and (p=0.008) respectively. Most of the adolescents were overweight (31.0%,

n=119). About (28.4%, n=109) were obese, (24.5%, n=94) were in the category of heathy weight and (16.1%, n=62) were underweight. The association of mother's education and dietary patterns of adolescents is an important point to consider. Previous study showed a significant association between mother's education level and food practices among children of age 2.5-7 years ($p<0.003$). Children of mothers with low education had low fruits and vegetable intake and more soft drinks and sweets intake. It justifies that mother's education have influence on dietary patterns of children (Vereecken et al.,2004).

In this study association was found between BMI and physical inactivity with dietary patterns of adolescents ($p=0.01$). Many previous studies indicate that consumption of unhealthy food which leads towards obesity as well as physical inactivity is associated with each other. A previous study conducted in 16 schools of China showed that there was strong association between physical inactivity and BMI with unhealthy child eating behaviors of children of primary and middle schools ($p=<0.05$) (Jia et al.,2017).

In this study, there was no association found having a smartphone/tablet with dietary patterns ($p=0.582$) but significant association was found between smartphone usage time and dietary patterns ($p=0.01$). Those who spent more than 2 hours daily on smartphone/tablet, most of them have unhealthy eating patterns (59.6%, n=229) and few have healthy eating patterns (8.6%, n=33). A previous study showed significant association between smartphone usage time and dietary patterns. About 66.5% participants used smartphone over 2 hours per day. The more consumption of fruits ($p<0.001$), vegetables ($p<0.001$) and milk ($p<0.001$) have significant association with lower smartphone use. Whereas, more consumption of sodas ($p<0.001$), fast food

(p<0.001), instant noodles (p<0.001) and snacks (p<0.001) were significantly associated with higher smartphone use (Kim et al., 2021). It justifies that the more use of smartphone/tablet is associated with unhealthy dietary patterns.

Current study revealed that consumption in front of smartphone/tablet screen has significant association with dietary patterns (p<0.001). Those respondents who ate two times or more in front of smartphone/tablet screen mostly have unhealthy dietary patterns (41.4%, n=159) and only few have healthy eating patterns (3.9%, n=15). A previous study showed association between ST and dietary patterns among preschoolers. Those children who have longer screen time have less consumption of fruits and vegetables and high consumption of snacks and SSBs. After adjusting confounders, the association between ST and vegetables (p<0.001) and ST with SSBs was significant (p<0.001). (Huo et al., 2022). It justifies that screen time which is mostly spent on smartphones/tablets as they are continent and available all the time is associated with unhealthy eating patterns.

Current study showed significant association between purpose of smartphone/tablet use and dietary patterns (p=0.004). Those who use smartphone/tablet for entertainment purpose mostly have unhealthy dietary patterns (43.5%, n=167) and only (4.4%, n=17) have healthy dietary patterns. Previous study showed significant association of smartphone use with dietary intake. The results reported that eating in the presence of smartphone and reading, there is increased caloric intake by 15% with increased lipid consumption. The results reported that smartphone use during meals and reading text significantly affects the calories consumption (da Mata Gonçalves et al., 2019). As an individual get so involved in smartphone/tablet while eating this effects individual's

caloric intake.

Current study revealed that likeliness to eat fried food and sweets, chocolates and candies while using smartphone/tablet have significant association with dietary patterns (p=0.02) and (p=0.03) respectively. Those who like to consume fried food while using smartphone/tablet mostly have unhealthy dietary patterns (70.6%, n=271). Similarly, those who like to consume sweets, chocolates and candies while using smartphone/tablet mostly have unhealthy dietary patterns (57%, n=219). A previous study conducted among 150 students of different schools, colleges and universities to determine their eating habits and screen time in Lahore, Pakistan. 56% prefer to consumed fried food and 44% consumed sweets while using electronic devices. There was association between ST and dietary habits (p=0.004) (Ahmed et al., 2022). It shows that eating of unhealthy food which is also prevalent in current study is affecting the dietary patterns of adolescents.

Current study showed the results that there is significant association between missing breakfast due to smartphone/tablet use overnight with dietary patterns (p=0.03). Those who miss breakfast due to overnight smartphone/tablet use mostly have unhealthy dietary patterns (51.3%, n=197). A previous study showed the association between ST and dietary habits. About 54% mostly skipped breakfast, 45% delay meals, 57% ate more than requirement. 56% prefer to consumed fried food and 44% consumed sweets while using electronic devices. There was association between ST and dietary habits (p=0.004) (Ahmed et al., 2022). It justifies that missing of breakfast due to smartphone use which is also prevalent in current study is affecting the dietary patterns of adolescents.

Current study showed significant association between end up eating more in front of smartphone/tablet screen and dietary patterns (p=0.021). Those who end up eating more in front of smartphone/tablet screen mostly have unhealthy dietary patterns (47.7%, n=183). Previous study showed significant association of smartphone use with dietary intake. The results reported that eating in the presence of smartphone and reading, there is increased caloric intake by 15% with increased lipid consumption. The results reported that smartphone use during meals and reading text significantly affects the calories consumption (da Mata Gonçalves et al., 2019). As current study shows that those adolescents who end up eating more in front of smartphone/tablet screen have unhealthy eating patterns and previous study shows that there is more caloric intake especially of lipids among individuals who eat in the presence of distraction, it justifies that ST is associated with dietary patterns.

## 5.2: Strengths:

The strengths of this study include the wide range of socio-economic, educational sample and the use of standardized survey methods.

- The current study is somehow successful in assessing the effect of smartphone/tablet use on the dietary patterns of adolescents.
- In this study dietary assessment is done by validated and internationally accepted tool (FFQ). Current study is unique in this regard that dietary patterns effected by smartphone/tablet use were assessed among adolescents in secondary schools of Gujranwala, city as little similar studies were conducted in Pakistan on this aspect.
- The findings of the current study can be generalized to the adolescent population from other parts of Pakistan due to similar contextual factors.
- Promotion of healthy screen time along with screen time and healthy eating education

among adolescents and parents is the need of hour for better and disease free and healthy adulthood for our adolescents which is future of our country. It is anticipated that the results of this research might impact health.

## 5.3. Limitations:

Despite our sincere efforts few limitations needed to be mentioned.

- As the current study was cross-sectional study, which limits the establishment of causality
- This research study is time bond

## 5.4. Conclusion:

This study demonstrated that most of the respondents had unhealthy eating pattern which is associated to smartphone/tablet overuse, purpose of smartphone/tablet use, eating in front of smartphone/tablet screen. Most of them were spending more than 2 hours screen on daily basis, which is above the recommended screen time limit for them (CDC). Majority of them were skipping breakfast and eating much more than planned due to high smartphone/tablet use which is affecting their dietary patterns. Mostly consumption of junk food, fast food, sweets, fried foods and packaged snacks were the most selected food groups while using screen which were badly affecting their overall health of adolescents. It is necessary that policy makers should play major role in educating parents especially mothers as well as adolescents about heathy screen time and healthy eating. It is important for the future of our country to take immediate steps in time to save our future by providing healthy adulthood to our adolescents and decrease this burden of obesity which is further linked with other disease.

## 5.5. Recommendations:

Based on current findings following recommendations are put forward for policy maker to address this public health issue:

- Lifestyle changes play a major role in managing screen time among adolescents for a healthy adulthood.
- Government should encourage policies at local, national and international levels to educate the parents especially mothers as well as adolescents about healthy screen usage and healthy eating and its harmful effects on health especially on the health of adolescents as obesity is another burden along with undernutrition which cannot be neglected.
- Policies should be developed and implemented that focuses on influencing and supporting adolescents within their homes to follow healthy lifestyles with time limit of screen use.
- Education of adolescents in their institutes highlighting about the negative effects of smartphone/tablet over use especially on their dietary patterns.
- Education regarding control of screen time with the help of educational brochures, diet related articles in newspapers, social as well as digital media by adding advertisements related to healthy eating while using smartphone/tablet.

# REFERENCES


Ahmed, H., Rizwan, B., Fatima, A., Tariq, M., Zafar, R., Naeem, M., ... & Tahir, N. (2022). Association Between Screen-Time and Dietary Habits Among Students Of 11-25 Years: Screen-Time and Dietary Habits Among students. *Pakistan BioMedical Journal*, 240-245.

Anderson, M., & Jiang, J. (2018). Teens, social media & technology 2018. *Pew research center*, *31*(2018), 1673-1689.

Bellisle, F., & Dalix, A. M. (2001). Cognitive restraint can be offset by distraction, leading to increased meal intake in women. *The American journal of clinical nutrition*, *74*(2), 197-200.

da Mata Gonçalves, R. F., de Almeida Barreto, D., Monteiro, P. I., Zangeronimo, M. G., Castelo, P. M., van der Bilt, A., & Pereira, L. J. (2019). Smartphone use while eating increases caloric ingestion. *Physiology & behavior*, *204*, 93-99.

Davey, S., & Davey, A. (2014). Assessment of smartphone addiction in Indian adolescents: A mixed method study by systematic-review and meta-analysis approach. *International journal of preventive medicine*, *5*(12), 1500.

Gilhooly, C. H., Das, S. K., Golden, J. K., McCrory, M. A., Dallal, G. E., Saltzman, E., ... & Roberts, S. B. (2007). Food cravings and energy regulation: the characteristics of craved foods and their relationship with eating behaviors and weight change during 6 months of dietary energy restriction. *International journal of obesity*, *31*(12), 1849-1858.

Haththotuwa, R. N., Wijeyaratne, C. N., & Senarath, U. (2020). Worldwide epidemic of obesity. In *Obesity and obstetrics* (pp. 3-8). Elsevier.

Higgs, S. (2015). Manipulations of attention during eating and their effects on later snack intake. *Appetite*, *92*, 287-294.

Higgs, S., & Donohoe, J. E. (2011). Focusing on food during lunch enhances lunch memory and decreases later snack intake. *Appetite*, *57*(1), 202-206.

Higgs, S., & Woodward, M. (2009). Television watching during lunch increases afternoon snack intake of young women. *Appetite*, *52*(1), 39-43.

Huo, J., Kuang, X., Xi, Y., Xiang, C., Yong, C., Liang, J., ... & Lin, Q. (2022). Screen time and its association with vegetables, fruits, snacks and sugary sweetened beverages intake among Chinese preschool children in Changsha, hunan province: a cross-sectional study. *Nutrients*, *14*(19), 4086.

Jacobs Jr, D. R., & Orlich, M. J. (2014). Diet pattern and longevity: do simple rules suffice? A commentary. *The American journal of clinical nutrition*, *100*(suppl_1), 313S-319S.

Jia, P., Li, M., Xue, H., Lu, L., Xu, F., & Wang, Y. (2017). School environment and policies, child eating behavior and overweight/obesity in urban China: the childhood obesity study in China megacities. *International journal of obesity*, *41*(5), 813-819.

Kabali, H. K., Irigoyen, M. M., Nunez-Davis, R., Budacki, J. G., Mohanty, S. H., Leister, K. P., & Bonner Jr, R. L. (2015). Exposure and use of mobile media devices by young children. *Pediatrics*, *136*(6), 1044-1050.

Kang, H. T., Lee, H. R., Shim, J. Y., Shin, Y. H., Park, B. J., & Lee, Y. J. (2010). Association between screen time and metabolic syndrome in children and adolescents in Korea: the 2005 Korean National Health and

Kenney, E. L., & Gortmaker, S. L. (2017). United States adolescents' television, computer, videogame, smartphone, and tablet use: associations with sugary drinks, sleep, physical activity, and obesity. *The Journal of pediatrics*, *182*, 144-149.

Kim, K. M., Lee, I., Kim, J. W., & Choi, J. W. (2021). Dietary patterns and smartphone use in adolescents in Korea: a nationally representative cross-sectional study. *Asia Pacific Journal of Clinical Nutrition*, *30*(1), 163-173.

Lopez, R. B., Brand, J., & Gilbert-Diamond, D. (2019). Media multitasking is associated with higher body mass index in pre-adolescent children. *Frontiers in Psychology*, *10*, 2534.

LP, I. S. B. (2014). Before IPhone and Android Came Simon, the First Smartphone. *Bloomberg Businessweek.[Last updated on 2012 June*, *30*.

Lyngdoh, M., Akoijam, B. S., Agui, R. S., & Singh, K. S. (2019). Diet, physical activity, and screen time among school students in Manipur. *Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine*, *44*(2), 134.

Martin, I. S. M., Rojo, S. S., Cosano, L. G., de la Campa, R. C., Vilar, E. G., & Olivares, J. B. (2022). Impulsiveness in children with attention-deficit/hyperactivity disorder after an 8-week intervention with the Mediterranean diet and/or omega-3 fatty acids: a randomised clinical trial. *Neurología (English Edition)*, *37*(7), 513-523.

Mascheroni, G., & Cuman, A. (2014). Net Children Go Mobile: Final Report (with country fact sheets). Milano: Educatt. Recuperado de file. *D:/Documents/Downloads/NCGM_FinalReport_Country_DEF. pdf*.

Kang, H. T., Lee, H. R., Shim, J. Y., Shin, Y. H., Park, B. J., & Lee, Y. J. (2010). Association between screen time and metabolic syndrome in children and adolescents in Korea: the 2005 Korean National Health and Nutrition Examination Survey. *Diabetes research and clinical practice*, *89*(1), 72-78.

Ogden, J., Coop, N., Cousins, C., Crump, R., Field, L., Hughes, S., & Woodger, N. (2013). Distraction, the desire to eat and food intake. Towards an expanded model of mindless eating. *Appetite*, *62*, 119-126.

Ogden, J., Oikonomou, E., & Alemany, G. (2017). Distraction, restrained eating and disinhibition: an experimental study of food intake and the impact of 'eating on the go'. *Journal of health psychology*, *22*(1), 39-50.

Oldham-Cooper, R. E., Hardman, C. A., Nicoll, C. E., Rogers, P. J., & Brunstrom, J. M. (2011). Playing a computer game during lunch affects fullness, memory for lunch, and later snack intake. *The American journal of clinical nutrition*, *93*(2), 308-313.

Organization WH. Obesity and Overweight 2021 [30th1. August 2021]. Available from:http://www.who.int/newsroom/fact-sheets/detail/obesity-and-overweight.

Park, N., & Lee, H. (2012). Social implications of smartphone use: Korean college students' smartphone use and psychological well-being. *Cyberpsychology, Behavior, and Social Networking*, *15*(9), 491-497.

Rideout, V., & Robb, M. B. (2018). Social media, social life: teens reveal their experiences, 2018. *Common Sense Media: Age-Based Media Reviews for Families*.

Robinson, E., Aveyard, P., Daley, A., Jolly, K., Lewis, A., Lycett, D., & Higgs, S. (2013). Eating attentively: a systematic review and meta-analysis of the effect of food intake memory and awareness on eating. *The American journal of clinical nutrition*, *97*(4), 728-742.

Schulte, E. M., Avena, N. M., & Gearhardt, A. N. (2015). Which foods may be addictive? The roles of processing, fat content, and glycemic load. *PloS*

*one*, *10*(2), e0117959.

Steele, C. C., Pirkle, J. R., & Kirkpatrick, K. (2017). Diet-induced impulsivity: Effects of a high-fat and a high-sugar diet on impulsive choice in rats. *PLoS One*, *12*(6), e0180510.

Takao, M., Takahashi, S., & Kitamura, M. (2009). Addictive personality and problematic mobile phone use. *CyberPsychology & Behavior*, *12*(5), 501-507.

Tanveer, M., Hohmann, A., Roy, N., Zeba, A., Tanveer, U., & Siener, M. (2022). The current prevalence of underweight, overweight, and obesity associated with demographic factors among Pakistan school-aged children and adolescents—An empirical cross-sectional study. *International Journal of Environmental Research and Public Health*, *19*(18), 11619.

Tanzil, S., & Jamali, T. (2016). Obesity, an emerging epidemic in Pakistan-a review of evidence. *Journal of Ayub Medical College Abbottabad*, *28*(3), 597-600.

Tsujiguchi, H., Hori, D., Kambayashi, Y., Hamagishi, T., Asakura, H., Mitoma, J., ... & Nakamura, H. (2018). Relationship between screen time and nutrient intake in Japanese children and adolescents: a cross-sectional observational study. *Environmental health and preventive medicine*, *23*, 1-12.

Viner, R. M., Ozer, E. M., Denny, S., Marmot, M., Resnick, M., Fatusi, A., & Currie, C. (2012). Adolescence and the social determinants of health. *The lancet*, *379*(9826), 1641-1652.

Vereecken, C. A., Keukelier, E., & Maes, L. (2004). Influence of mother's educational level on food parenting practices and food habits of young children. *Appetite*, *43*(1), 93-103.

Warraich, H. J., Javed, F., Faraz-ul-Haq, M., Khawaja, F. B., & Saleem, S. (2009). Prevalence of obesity in school-going children of Karachi. *Plos one*, *4*(3),

e4816.

Waters, K. (2015). Smartphone Medical Applications: Technology Acceptance and Usage by edical Students ‘in Irish Universities

Whitehead, A., Johnston, H., Nixon, N., & Welch, J. (2010, July). Exergame effectiveness: what the numbers can tell us. In *Proceedings of the 5th ACM SIGGRAPH Symposium on Video Games* (pp. 55-62).

# ANNEXURE: A

## QUESTIONNAIRE

### Effect of smartphone/tablet use on the dietary patterns of adolescents in secondary schools of Gujranwala city

**Socio-demographic characteristics**
**Section A**

1. Gender

 Male

 Female

2. Age: _____

3. Monthly income:

 less than 50,000

 50,000-1 lac

 More than 1 lac

4. Father's occupation: _____

5. Mother's occupation: _____

6. Paternal educational level

 Less than matric

 Matric

 Higher secondary

 Bachelors

 Masters

7. Maternal educational level

- Less than matric
- Matric
- Higher secondary
- Bachelors
- Masters

8. Weight: _____
9. Height: _____
10. BMI: _____

11. Are you physically active?

- Yes
- No

## Section B

(Questions regarding smartphone/tablet use)

12. Do you have your own smartphone/tablet?

- Yes
- No

13. Smartphone/tablet usage time?

- Up to 2 hours
- More than 2 hours

14. What is the purpose of smartphone use?

- Entertainment
- Gaming/streaming
- Social media apps
- Web surfing

15. Do you have your smartphone/tablet with you all the time when you are home?

- Yes
- No

16. Do you skip meals due to smartphone/tablet use?

- Yes
- No

17. Which type of food do you mostly consume while using smartphone\tablet?

- Regular meal
- Junk food
- Beverages
- Fresh fruits and vegetables
- Desserts

18. Do you like to consume fried food while using smartphone/tablet?

- Yes
- No

19. Do you like to consume sweets, chocolates, candies while using smartphone/tablet?

- Yes
- No

20. Do you miss your breakfast due to the use of smartphone/tablet overnight?

- Yes
- No

21. You eat in front of your smartphone/tablet screen per day?

- Never
- Off and on
- Once a day
- two times or more a day

22. Do you think when you start eating certain foods in front of smartphone/tablet screen, you end up eating much more than planned?

- Yes
- No
- Don’t know

23. Do you think your dietary patterns are affected due to smartphone/tablet use?

- Yes
- No
- Don’t know

## SECTION C

(Questions about Dietary Patterns)

| How often do you eat? | Never | 1-3 times per week | 4-6 times per week | Daily one or more than 3 times |
|---|---|---|---|---|
| 24. Whole grains | | | | |
| 25. Meat and meat products | | | | |
| 26. Pulses | | | | |
| 27. Fruits | | | | |
| 28. Vegetables | | | | |
| 29. Milk and milk products | | | | |
| 30. Sodas | | | | |
| 31. Caffeinated drinks | | | | |
| 32. Energy drinks | | | | |
| 33. Sweetened beverages | | | | |
| 34. Fast food | | | | |
| 35. Snacks | | | | |

# ANNEXURE: B

## Assent Form

## Title of study:

**Effect of smartphone/tablet use on the dietary patterns of adolescents in secondary schools of Gujranwala city**

## Principal investigator:

Nishwa Siddique, student of MSPH- Final Semester, Al-Shifa School of Public Health, Al- Shifa Eye Hospital, Rawalpindi. I am doing research on the effect of smartphone/tablet use on the dietary patterns of adolescents in secondary schools of Gujranwala city.

**PURPOSE OF THE RESEARCH**

The purpose of this study is to assess the effect of smartphone/tablet use on the dietary patterns of adolescents in secondary schools of Gujranwala city.

**Participation:**

I have read and I understand the provided information and have allowed you to ask questions regarding this topic. I understand that my child's participation is voluntary and that he/she is free to withdraw at any time, without giving a reason and without cost. I voluntarily agree and allow my child to take part in this study.

**Signature of Participant's Parents/guardian: _____**

**Date:** _____ (DD/MM/YY)

***A copy of this assent Form has been attached to student's dairy.***

# Informed Consent form

I, Nishwa Siddique, student of MSPH- Final Semester, Al-Shifa School of Public Health, Al- Shifa Eye Hospital, Rawalpindi. I am doing research on Effect of smartphone/tablet use on the dietary patterns of adolescents in secondary schools of Gujranwala city.

**PURPOSE OF THE RESEARCH:**

The purpose of this study is to assess the effect of smartphone/tablet use on the dietary patterns of adolescents in secondary schools of Gujranwala city.

**PARTICIPATION**

I do not anticipate that taking this study will contain any risk or inconvenience to you. Your participation is strictly voluntary and you may withdraw your participation at any time without penalty. I request you to answer the questions as honestly as possible. It will take no longer than 20 minutes to complete a questionnaire. All information collected will be used only for my research and will be kept highly confidential. Your identity and your responses will not be identifiable; all data will be stored anonymously. As this is solely a student project no incentive will be provided. Once study is completed, I would be happy to share the results with you if you desire.

Thank you for agreeing to participate in this study. Your feedback is important.

I have read and understand the information sheet and agree to take part in the study.

Signature: _____

Date: _____

# ANNEXURE: C

## IRB Letter

**AL-SHIFA SCHOOL OF PUBLIC HEALTH**
**PAKISTAN INSTITUTE OF OPHTHALMOLOGY**
**AL-SHIFA TRUST, RAWALPINDI**

MSPH-IRB/13-08
27th Mar, 2023

**TO WHOM IT MAY CONCERN**

This is to certify that **Nishwa Siddique** D/O **Muhammad Siddique** is a student of Master of Science in Public Health (MSPH) final semester at Al-Shifa School of Public Health, PIO, Al-Shifa Trust Rawalpindi. He/she has to conduct a research project as part of curriculum & compulsory requirement for the award of degree by the Quaid-i-Azam University, Islamabad. His/her research topic, which has already been approved by the Institutional Review Board (IRB), is **"Effect of smartphone/tablet use on dietary patterns of adolescents in secondary schools of Gujranwala city".**

Please provide his/her necessary help and support in completion of the research project. Thank you.

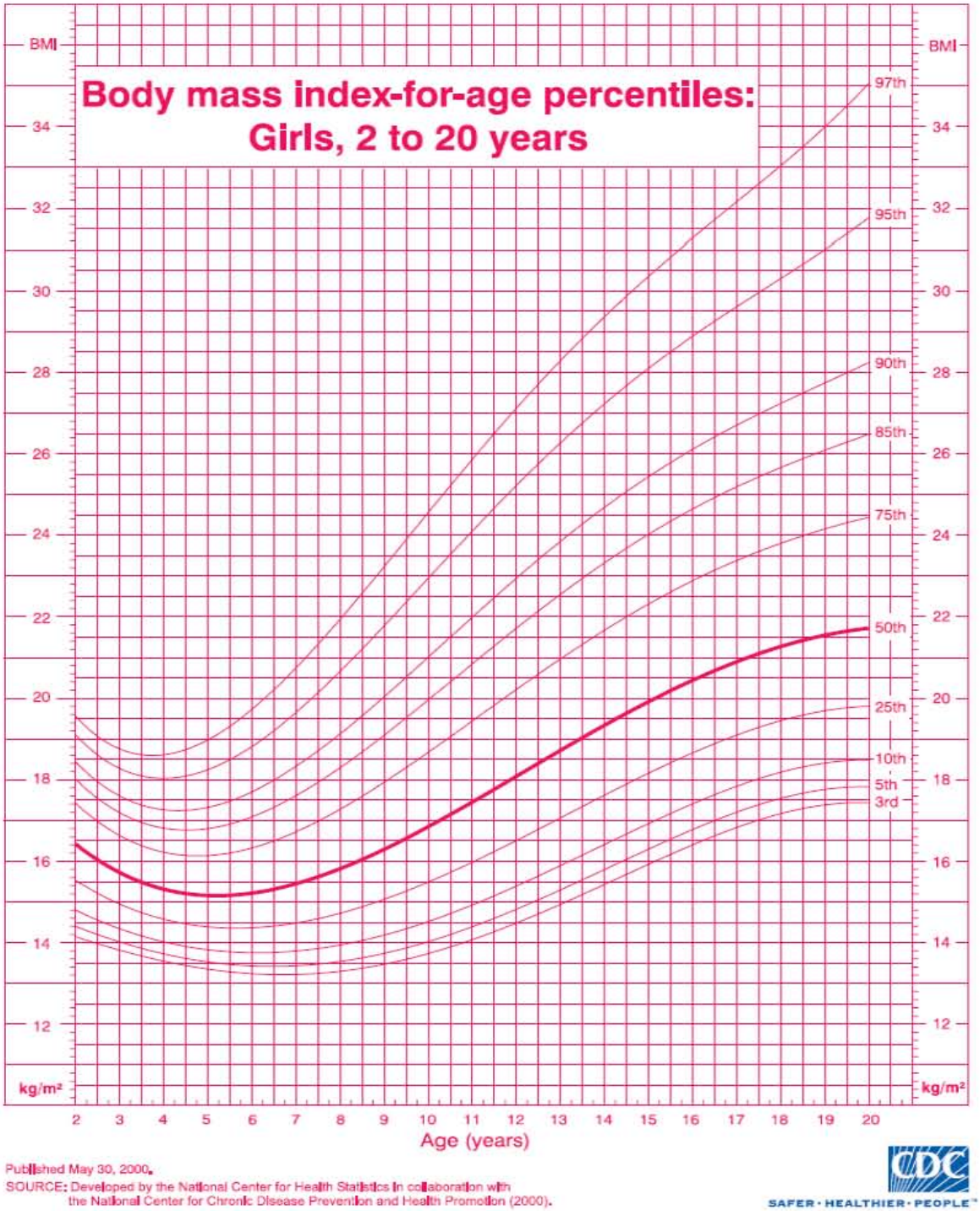
Sincerely.

Dr. Ayesha Babar Kawish
Head
Al-Shifa School of Public Health, PIO
Al-Shifa Trust, Rawalpindi

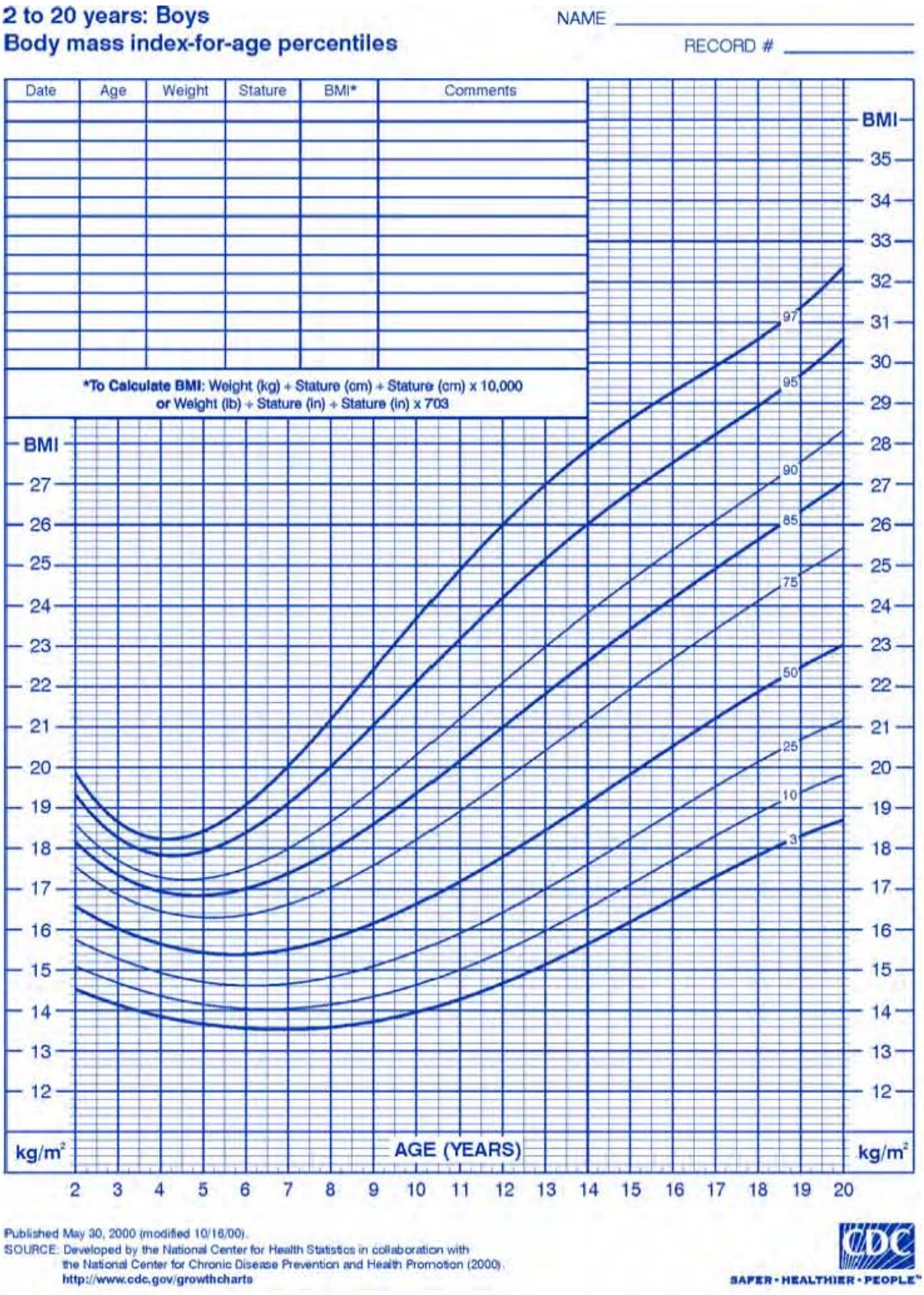
AL-SHIFA TRUST, JEHLUM ROAD, RAWALPINDI – PAKISTAN
Tel: +92-51-5487820-472 Fax: +92-51-5487827
Email: info@pmhlahore.org Web Site: www.pmhlahore.org

# ANNEXURE: D

## BMI-for-age Percentile (Girls)



# BMI-for-age Percentile (Boys)



# ANNEXURE: E

## Scale Reliability

**Reliability Statistics**

| Cronbach's Alpha | N of Items |
|---|---|
| .829 | 12 |

**Figure 10: Relibility of outcome variable (FFQ)**

# ANNEXURE: E

## Gantt chart

| Activities | March 2023 | April 2023 | May 2023 | June 2023 | July 2023 | August 2023 |
|---|---|---|---|---|---|---|
| Literature search | | | | | | |
| Synopsis writing and IRB approval | | | | | | |
| Pilot testing | | | | | | |
| Data collection and entry | | | | | | |
| Data analysis | | | | | | |
| Writeup | | | | | | |
| Thesis submission | | | | | | |

# ANNEXURE: F

## Budget

| Budget item | Transport | Stationery and internet | Printing | Publishing |
|---|---|---|---|---|
| Pilot testing | 500 Rs/- | 5000 Rs/- | 8000 Rs/- | - |
| Data collection | 10,000 Rs/- | 25,000 Rs/- | - | - |
| Thesis write-up | 1,000 Rs/- | 5,000 Rs/- | 8,000 Rs/- | 25,000 Rs/- |
| Total expenditure | 16,000 Rs/- | 35,000 Rs/- | 16,000 Rs/- | 25.000 Rs/- |
| Grand total | 92,000 Rs/- | | | |