

Master of Science in Public Health



Prevalence and predictors of Malnutrition among school going adolescents of Kotli Sattian District Rawalpindi

By

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Prevalence and predictors of Malnutrition among school going adolescents of Kotli Sattian District Rawalpindi

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(362802-PIO/MSPH-2020)

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Declaration

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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 I also understand that any quotation from the published or unpublished works of other persons, including other candidates, must be clearly identified as such by being placed inside quotation marks and a full reference to their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.

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ABSTRACT

Introduction:

Malnutrition is one of the major health problems among the adolescents. Prevalence of malnutrition is more common in developing countries which are yet facing shortage of food due to different reasons in different regions of the world. Malnutrition among adolescents is affected by several factors. These factors are although studied in many parts of the world but these are understudied in Pakistan. Therefore, this study aimed to determine the prevalence of malnutrition and its predictors among the adolescent population of the Kotli Sattian, Rawalpindi, Pakistan.

Material and Methods:

This descriptive cross sectional study was conducted among the school going adolescents of the Kotli Sattian, Rawalpindi in approximately 6 months from October 2021 to February 2022. Simple random sampling and a set of inclusion and exclusion criteria was used to enroll participants. A self-adapted questionnaire was used to collect data after taking ethical approval from institutional research board and informed consent from the participants. Chi-square test was applied to assess the association between Malnutrition and various included factors. Multinomial logistic regression was also applied to determine the prediction of malnutrition by various factors through odds ratio.

Results:

The prevalence of underweight, normal weight, overweight and obesity among school going adolescents of study population was 77(22.92%), 117(34.82%), 90(26.79%), and 52(15.48%) respectively. The association between nutritional status and gender, age group, school type, hygiene conditions recent infection history, filtered water use, number of meals per day, daily breakfast, number of siblings, monthly income, mother education, father education, mother occupation, awareness of parents about malnutrition, and family type was statistically significant.

The factors including male gender (OR=3.80, 95%CI=0.11-13.34, p=0.04), mid adolescent age group (OR=4.30, 95%CI=0.40-8.04, p=0.03), recent infection (OR=6.30, 95%CI=4.50-8.10, p=0.009), less number of meals 2times or 3-4times (OR=8.20, 95%CI=1.50-7.20, p=0.01) or (OR=7.50, 95%CI=1.60-8.40, p=0.04), low monthly income up to 20,000Pkr (OR=10.70, 95%CI=2.76-11.10, p=0.02), mother (OR=3.18, 95%CI=2.78-3.64, p=0.03) and father (OR=6.70, 95%CI=5.90-8.90, p=0.04) illiterate educational status were found to predispose students to become underweight significantly. Those factors that increased the possibility of becoming overweight were school type (OR=2.10, 95%CI=1.29-2.90, p=0.04), primary education status of mothers (OR=1.30, 95%CI=0.90-2.10, p=0.01), whereas, factors for increasing the probability of getting obese, were included private school type (OR=1.89, 95%CI=1.10-2.89, p=0.03), mother educational status of illiterate (OR=1.67, 95%CI=0.40-1.99, p=0.01), and nuclear family (OR=1.87, 95%CI=1.50-3.06, p=0.02).

Conclusion:

The prevalence of underweight, overweight, and obesity was significant among study participants. Several factors including gender, age, school type, hygiene condition, recent infection, filtered water use, number of meals, daily breakfast habit, number of siblings, monthly income, parental education, mother occupation, parental awareness about malnutrition and family type were found to predispose adolescents to the malnutrition. Policy makers should make integrated policies for the prevention of malnutrition among adolescents.

Key Words:

Prevalence, Malnutrition, Predictors, School Going, Adolescent, Kotli Sattian, Rawalpindi.

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LIST OF ABBEREVIATION

WHO: World Health Organization

UNICEF: The United Nations International Children's Emergency Fund

BMI: Body Mass Index

OR: Odds Ratio

CI: Confidence Interval

KP: Khyber Pakhtunkhwa

KP: NMD: Khyber Pakhtunkhwa-Newly Merged Districts

ICT: Islamabad Capital

AJK: Azad Jammu and Kashmir

GB: Gilgit-Baltistan

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CHAPTER I: Introduction and Literature Review

INTRODUCTION

Background Information:

Malnutrition indicates deterioration of health due to disproportion of nutrients and energy in the body. Malnutrition is a tranquil crisis and it is one of the most universal reasons for morbidity and mortality among kids and teenagers all over the world. Malnutrition is a major medical issue in almost every part of the world and especially in Southern Asia and Sub-Saharan Africa. In large numbers of the developing nations, stunting, underweight, and micronutrient lacks among adolescents is common due to insufficient nutrition and diseases during childhood together with inadequate diet to fulfill the healthful needs of fast development during adolescence (Bhattarai, S and Bhusal, C. K, 2019).

Adolescents are the individuals of having age range between 10years to 19years. The percentage of adolescents of world's total population is 20% and 84% of this population lives in developing countries (Aparajita Dasgupta et al., 2010). Adolescence denotes a time of progress from youth to adulthood described by fast actual development and improvement, conduct, enthusiastic and socio-mental changes. Youths are more inclined to unfortunate ways of behaving, unhealthy dietary practices, sedentary lifestyles, and psychosocial stresses that shape their characters and way of life designs. Fast physiological changes influence their body's dietary requests and ways of life, convictions and insights about body size and shape impact their dietary decisions.

The supplement prerequisites during pre-adulthood are expanded due to rapid development and improvement, hormonal, physical and social changes and are frequently not met because of poor food choices and practices, peer pressure and unhealthy lifestyles practices make them prone to deficiencies of various essential nutrients. The resultant deficiency of the nutrients could lead to various diseases which can impact every organ of body (Parvez I. Paracha et al., 2016).

According to the Pakistan National Nutrition Survey 2018, 21.10% adolescent boys and 11.80% adolescent girls had underweight, 17.90% adolescent boys and 16.80% adolescent

girls were overweight, while, 7.60% adolescent boys and 5.50% adolescent girls were obese (PAKISTAN NATIONAL NUTRITION SURVEY., 2018).

According to classification of United Nations, in Asian region especially in Southern Asian region countries (Pakistan, India, Bangladesh, Nepal and Sri Lanka) have higher incidence of stunting (71%), wasting (75%), and overweight (30%) and this locality also shows the higher frequency of severe malnutrition as well (Dilshad Ahmad et al., 2020).

Problem Statement:

Nutrition role is very important in stability, advancement and growth in all phases of life. Human beings proceed through various stages of age, including childhood, teenage, adulthood and late adulthood. Adolescence is a very demanding time, which shows that future health mainly depending on adequate nutritional supply. Poor nutrition retards the physical and mental development of the adolescents regardless of gender. Higher nutritional requirements at the age of adolescence link with the fact that adolescents obtain about 50% of their final weight, more than 20% of their final height, and almost 50% of final adult skeletal mass in this phase of their lives. Therefore, caloric and protein are very high in this stage of lives of adolescents (Ayaz A. Samo et al., 2021).

The development shoot in youthfulness requires fast tissue growth with extraordinary supplement prerequisites, including amino acids for development of striated muscle, as well as calcium and vitamin D to oblige bone development. Energy and nourishment necessities should match the requirements of the young people as they commonly participate in actual work or sporting activity (young men on normal more than young ladies), which advantages striated bulk extension. Hunger increments during puberty, and stationary people are more likely to develop obesity if they have approach to high-energy food.

In this manner, low movement levels among teenagers are a key element that underlies expansions in juvenile obesity across the globe. The caloric prerequisite of juvenile guys is higher than that of young adult females, attributable to more noteworthy expansions in stature, weight, and slender weight. Dietary proposals recommend that half or a greater amount of complete everyday calories ought to come from sugar, without any than 10-25% of calories got from sugars, for example, sucrose and high fructose corn syrup. Protein

prerequisites per unit of stature are most elevated for females in the 11-to 14-year age range and for guys in the 15-to 18-year age range, comparing to the standard timing of pinnacle tallness speed. So, adequate diet is very essential in this growing phase of adolescence (Jai K. Das et al., 2017).

A balanced diet is a diet that contains different kinds of foods in certain quantities and proportions so that the requirement for calories, proteins, minerals, vitamins and alternative nutrients is adequate and a small provision is reserved for additional nutrients to endure short length of leanness. When balanced diet is available for all adolescent, they excel in every part of their lives. People with proper and adequate diet can have healthy body and face less diseases because of strong immunity in their bodies. Adequate diet leads to less incidences of chronic diseases (obesity, diabetes mellitus, heart disease, cancers and allergies). Less of chronic diseases incidence leads to less need for the health care and this would reduce burden over the hospital resources especially of developing countries (Burkert, N. T et al., 2014).

Similarly, the quality of life would also be improved as people would be able to focus on the quality of life and its related issues.

Mental health is also good in the people who proper diet. There is evidence in literature that associations exist between common mood issues and eating habits, such as, a proper diet has been linked with good mood and cognition in adolescents. Moreover, the depression, anxiety, stress and other mental diseases are noted less among the adolescent who eat healthy and enrich diet in their daily lives (Oddy, W. H et al., 2009).

Likewise, Brain growth is strongly impacted by several external factors, and adequate diet is one of them and it plays a vital role. The intelligence and cognitive skills are linked with nutrition. Higher intelligence and cognitive skills lead to higher academic performance among the adolescents. When adolescents have proper development of their minds and they show extraordinary results in their academics and other social activities as well (Correa-Burrows. P et al., 2016).

Malnutrition may bring its negative impacts on every aspect of the adolescents. Poor diet leads to chronic diseases (obesity, diabetes mellitus, heart diseases, cancers, and allergies) and infectious diseases (pneumonia and diarrhea). This consequently leads to higher mortality, reduced ability for physical work, decrease academic performance and

performances in other fields of lives. Adolescent overweight/obesity has been greatly linked with higher risk of non-communicable diseases for example hypertension, diabetes mellitus, cancer, stroke, and heart disease. These different forms of ill health leads to lower wages, decrease productivity and higher medical treatment costs. Therefore, the double burden of malnutrition comes in the lives of the adolescents, one related to decreased physical health and other related to decreased production in in every field of life due to poor health either physical or mental (Estecha Querol, S et al., 2021).

Undernutrition leads to poor intelligence to due to poor brain growth and that affects all aspect of the lives of undernourished persons. Poor cognitive functions lead to poor performance that create pressure and stress over the mind of undernourished people. It shows that mental health and physical health are associated with each other (Haghighi, M., et al 2013).

Undernutrition leads to deficiencies of various essential macronutrients and micronutrients. These deficiency leads to poor functioning of body organs.

For examples deficiency of vitamin A leads to eye problems. Deficiency of calcium and Vitamin D leads to poor bone health. Vitamin K deficiency leads to bleeding. This all indicates that malnutrition in any form either undernutrition, or overweight/obesity has its dangerous impacts over every part of the body (Guedes, P. M et al., 2019).

Malnutrition is a global problem at every age of the world population. It is more prevalent in the developing countries where no adequate food availability, poor sanitation, poor hygiene, large family size, low monthly income, low education, recurrent infection, no awareness about the malnutrition or balanced diet, sedentary lifestyles and many other factors like these have been predisposing people to the malnutrition.

Malnutrition prevalence varies in different part of the world and even malnutrition prevalence varies within the same country and it is because of the specific factors of that particular region or country that have specific role in the causation or predisposition of malnutrition in the population of the specific region or locality.

The prevalence of the malnutrition in the Pakistan is high as this country belongs to a group of countries which are yet in developing stage. According to study the prevalence of stunting, thinness, and overweight among Pakistani adolescent population was 3.90%, 9.09%, and 7.98% respectively. The stunting and overweight were more prevalent among

girl adolescents than boy adolescents while thinness was more prevalent among boy adolescents than girl adolescents (Estechea Querol, S et al., 2021).

According to a national nutrition survey that was conducted in Pakistan during 2018 by the health ministry of Government of Pakistan. The prevalence of malnutrition is high in Pakistan, and one more important thing that this survey revealed is that the prevalence of malnutrition is different among adolescents of different localities within the Pakistan. (PAKISTAN NATIONAL NUTRITION SURVEY 2018).

The difference in the prevalence within the same country and in different regions of the world is due to particular factors.

These factors in various studies in various countries have been studied and identified, however, in Pakistan those factors that predispose adolescents to the malnutrition in any form underweight, overweight or obesity, are understudied. Therefore, the main problem is the identification of those factors in Pakistan and its specific localities, so that, specific measures could be applied for those factors to lower down the prevalence of malnutrition among Pakistani adolescent population.

Malnutrition is a global problem and its more common in the developing countries like Pakistan. Its prevalence and its determinants vary in different countries and even within the same country.

According to Pakistan Adolescent Nutrition Strategy and Operational Plan 2020, the prevalence of underweight, overweight and obesity among Pakistani adolescents was (boys=21.10%, girls=11.80%), (boys=17.80%, girls=16.80%), and (boys=7.70%, girls=5.50%) respectively.

Furthermore, the prevalence of underweight, overweight and obesity varies in different provinces of the Pakistan. According to Pakistan National Nutrition Survey 2018, The prevalence of underweight among adolescent girls was highest (16.6%) in Sindh, followed by Balochistan (12.2%) and Azad Jammu Kashmir (12.1%), and it was lowest in Gilgit-Baltistan (6.0%) and Khyber Pakhtunkhwa (6.2%).

Prevalence of overweight among adolescent girls was highest in KP-NMD (35.6%), followed by KP (23.8%) and Balochistan (22.7%). It was lowest in Sindh (11.0%) and GB (11.9%). Obesity was found to be highest in KP-NMD (17.5%), followed by Balochistan (9.1%) and KP (8.5%), and lowest in GB (2.3%) and Sindh (3.1%).

Similarly, for boys the prevalence of underweight was highest in Sindh (30.6%) followed by ICT (20.8%), AJK (19.6%) and Punjab (18.0%). Prevalence of overweight among adolescent boys was highest in KP-NMD (40.5%) followed by Balochistan (32.9%) and KP (26.7%). It was lowest in Sindh (12.1%), especially in rural areas (7.8%) followed by GB (13.8%) and AJK (13.9%). Obesity among adolescent boys was, again, highest in KP-NMD (27.9%) followed by Balochistan (17.1%) and KP (11.7%).

The variation in the prevalence in malnutrition in the worlds and within same countries, indicates that there are different factors that determine the prevalence of malnutrition in different locations. Those factors are well studied in different parts of the world, however, those factors which are associated with malnutrition prevalence in Pakistan are understudied and need attention.

Identification of these factors could be very helpful as by identifying these factors, strategies could be made by health authorities for the prevention of the malnutrition. After controlling the malnutrition by applying the strategies for the elimination of the potential risk factors of malnutrition, adolescents which are known as future of any nation and future leaders of the nation, they would be able to excel in every aspect of their lives. When young generation would be healthy and then they would not only make their lives better, but the country of this young generation would also lead to a road of prosperity and greatness.

Objectives:

1. To determine the prevalence of malnutrition among the school going adolescents of Kotli Sattian, district Rawalpindi
2. To determine the predictors of the malnutrition among the adolescents
3. To find out the association of malnutrition with sociodemographic characteristics of adolescents

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Literature Review

In a time period of the 8 years from 2009 to 2016, a cross sectional study was conducted in South Asian countries including Pakistan, India, Bangladesh, Afghanistan, Sri Lanka, Maldives, Bhutan, and Nepal among 24,053 adolescents to check the prevalence of malnutrition and factors associated with it. The gross prevalence of stunting, thinness and overweight in South Asia was 13%, 10.8% and 10.8% respectively. Among these countries the highest prevalence of stunting was in Afghanistan (28.20%), while lowest prevalence of stunting was in Pakistan (3.90%). Likewise, the highest prevalence of thinness was in Sri Lanka (18.60%), whereas its prevalence was lowest in Bhutan (1.50%). Similarly, the prevalence of overweight was highest in the in Afghanistan (19.00%), while it was lowest in Pakistan (8.00%). The factors associated with malnutrition among South Asian adolescents were age, hygiene conditions, social help, sedentary lifestyles, and tobacco utilization (Estecha Querol, et al., 2021).

A study that was conducted in Nepal during the 7 months period from April to October 2017, with descriptive cross sectional design among school going 510 adolescents. The aim of this study was to assess the prevalence of malnutrition and risk factors for malnutrition among its study population. The overall prevalence of malnutrition among the study population was 25.70%. The prevalence of underweight, overweight, and obesity was 21.80%, 3.10%, and 3.10% respectively. The factors that were linked significantly with underweight was religion, family type, family income, school type, daily intake of green leafy vegetables, and school sports. While the gender and religion were only linked factors with overweight or obesity (Bhattarai, S., & Bhusal, C. K., 2019).

In cross sectional study that was performed in the India from June 2016 to May 2017 among the 2400 school going adolescent girls. The study was aimed to determine the malnutrition population among adolescent girls by using BMI for age cutoff classification of girls of WHO.

The prevalence of the underweight was (47.00%), the prevalence of overweight was (5.90%), and the prevalence of obesity was (2.70%) among the study population of this study. The girls with early adolescent age group were more suspected to underweight. The girls who belonged to upper and middle socioeconomic statuses were more likely to develop obesity. Furthermore, religion, family type, parent education, and physical activity were directly linked with the overweight and obesity (Ahmad, S et al., 2018).

A study with that was conducted at Ethiopia from April 16 to April 2018 among 365 school going adolescents. This study used cross sectional design. The objectives of the study were to check the prevalence of the malnutrition and factors linked with it among the adolescents of the Ethiopia. The prevalence of stunting, underweight, overweight/obesity was (15.70%), (6.30%), and (8.20%) respectively. Stunting was linked with snack consumption and nutrition adequate ratio negatively and positively respectively. Thinness was linked with male gender and less number of meals per day. Th association between the overweight/ obesity and dietary diversity score and nutrition adequate ratio was also present (Mulu Birru, G at al., 2021).

Another cross sectional study in the Ethiopia was conducted from May 18 to June 10, 2015 among 690 school going adolescents. This study was aimed at determining the malnutrition and its linked factors among study population by applying a questionnaire filled through interview and anthropometric calculations of study population.

The gross prevalence of stunting was (5.20%), prevalence of thinness was (4.70%), and the prevalence of was (5.00%). The factors that were associated with thinness were male gender, government school, mother with no formal education, less number of meals per day and recent infection. The students with their own houses had higher prevalence of overweight/obesity. The students whose mothers had education of secondary grade were likely to develop stunting (Teferi, D. Y et al 2018).

A study that was performed among the school going adolescent of the seven African countries and these countries included Egypt, Ghana, Malawi, Benin, Djibouti, Mauritania, Malawi, and Morocco. This cross sectional study was conducted among 25815 adolescent students in the during four years from 200 to 2010.

The study was aimed to assess the prevalence of malnutrition and its associated potential risk factors among its study population. Underweight prevalence was ranged from lowest in Egypt (12.60%) to highest in Djibouti (31.90%), while overweight prevalence varied from lowest in Ghana (8.70%) to highest in Egypt (31.40%). The prevalence of obesity ranges from lowest in Benin (0.60%) to highest in Egypt (9.30%). The underweight was associated with the male gender and late teenage group, while overweight/obesity was linked with early teenage and female (Manyanga, T et al., 2014).

A study cross sectional study that was conducted among 393 female adolescents with age range of 10 years to 19 years from October 2019 to December 2019 in Sindh, Pakistan. The study was performed with objectives of determining the prevalence of the stunting and thinness and factors linked with among the enrolled population. The prevalence of stunting was (32.10%), while prevalence of thinness was (10.68%) among study population. The stunting was more prevalent among the adolescents whose parents monthly income was 15,000 Pakistani rupees per month (Samo, A. A et al., 2021).

A study with cross sectional design was carried out among 2160 school going adolescents of Indonesia during 2017. The objectives with which this research was conducted included assessment of the prevalence of thinness, stunting, and overweight, furthermore, the factors associated with it. The prevalence of stunting, thinness and overweight was (boys=21.00%, girls=25.00%), (boys=11.00%, girls=5.00%), and (boys=11.00%, girls=11.00%) respectively. High household income and high education status were protective against stunting in study population. Older teenagers were more likely to get stunted. Girls were less prone to thinness. High household income was linked with overweight, while high mother education was protective against overweight (Maehara, M et al., 2019).

One study was conducted among 206 the Afghan adolescent refugees living in Pakistan during 2020 from March to April. The study was cross sectional in design. The study aimed to determine the prevalence of malnutrition among the Afghan adolescent refugees. It indicated that prevalence of the thinness, stunting and overweight/obesity was 4.40%, 35.30%, and 14.80% respectively. There was also high prevalence of deficiencies of various micronutrients including vitamin D= 80.50%, Vitamin B12=41.90%, and Folate=28.20% (Saeedullah, A et al., 2021).

A National Nutrition survey in Pakistan that was conducted during 2018 indicated the prevalence of malnutrition in various locations of the Pakistan. This survey was conducted by Health Ministry of Pakistan in collaboration with UNICEF and its aim was to check the prevalence of malnutrition among Pakistani population in its different areas. The gross prevalence of the underweight, overweight, and obesity was (girls=11.80%, boys=21.10%), (girls=16.80%, boys=17.80%), and (girls=5.50%, boys=7.60%) respectively. The prevalence of malnutrition in different areas of Pakistan was different such as in Punjab, underweight, overweight and obesity for girls=10.50%, 17.60% and 5.50% respectively while underweight, overweight and obesity for boys=18.00%, 18.00%, and 7.50% respectively, in Sindh, underweight, overweight and obesity girls=16.60%, 11.00% and 3.10% respectively while underweight, overweight and obesity for boys=30.60%, 12.10%, and 4.70% respectively, in Khyber Pakhtunkhwa(KP), underweight, overweight and obesity girls=6.40%, 23.70% and 8.50% respectively while underweight, overweight and obesity for boys=12.90%, 26.70%, and 11.70% respectively, in Balochistan, underweight, overweight and obesity girls=12.40%, 22.50% and 9.00% respectively while underweight, overweight and obesity for boys=12.50%, 32.90%, and 17.10% respectively, in Islamabad Capital Territory(ICT), underweight, overweight and obesity girls=8.90%, 18.50% and 7.30% respectively while underweight, overweight and obesity for boys=20.80%, 14.40%, and 6.50% respectively, in Khyber Pakhtunkhwa-newly merged districts(KP-NMD), underweight, overweight and obesity girls=6.80%, 35.6% and 17.50% respectively while underweight, overweight and obesity for boys=7.80%, 40.50%, and 27.90% respectively, in Azad Jammu and Kashmir (AJK), underweight, overweight and obesity girls=12.10%, 14.40% and 4.30% respectively while underweight, overweight and obesity for boys=19.60%, 13.90%, and 4.30% respectively, and in Gilgit-Baltistan (GB) underweight, overweight and obesity girls=6.00%, 11.90% and 2.30% respectively while underweight, overweight and obesity for boys=7.80%, 13.80%, and 3.90% respectively.

The difference in prevalence in different areas of Pakistan demands the identification of the factors that bring this variation in prevalence of malnutrition (Pakistan National Nutrition Survey., 2018)

CHAPTER II: METHODOLOGY

RESEARCH METHODOLOGY

Study Design:

This descriptive cross sectional study was performed by using self-adapted questionnaire on which all relevant information was noted.

Study Area:

This study was carried out at private and government schools of Kotli Sattian, Rawalpindi, Pakistan.

Duration of Study:

This study was completed in approximately 6 months after approval from institutional review board (IRB) from October 2021 to February 2022.

Data Source:

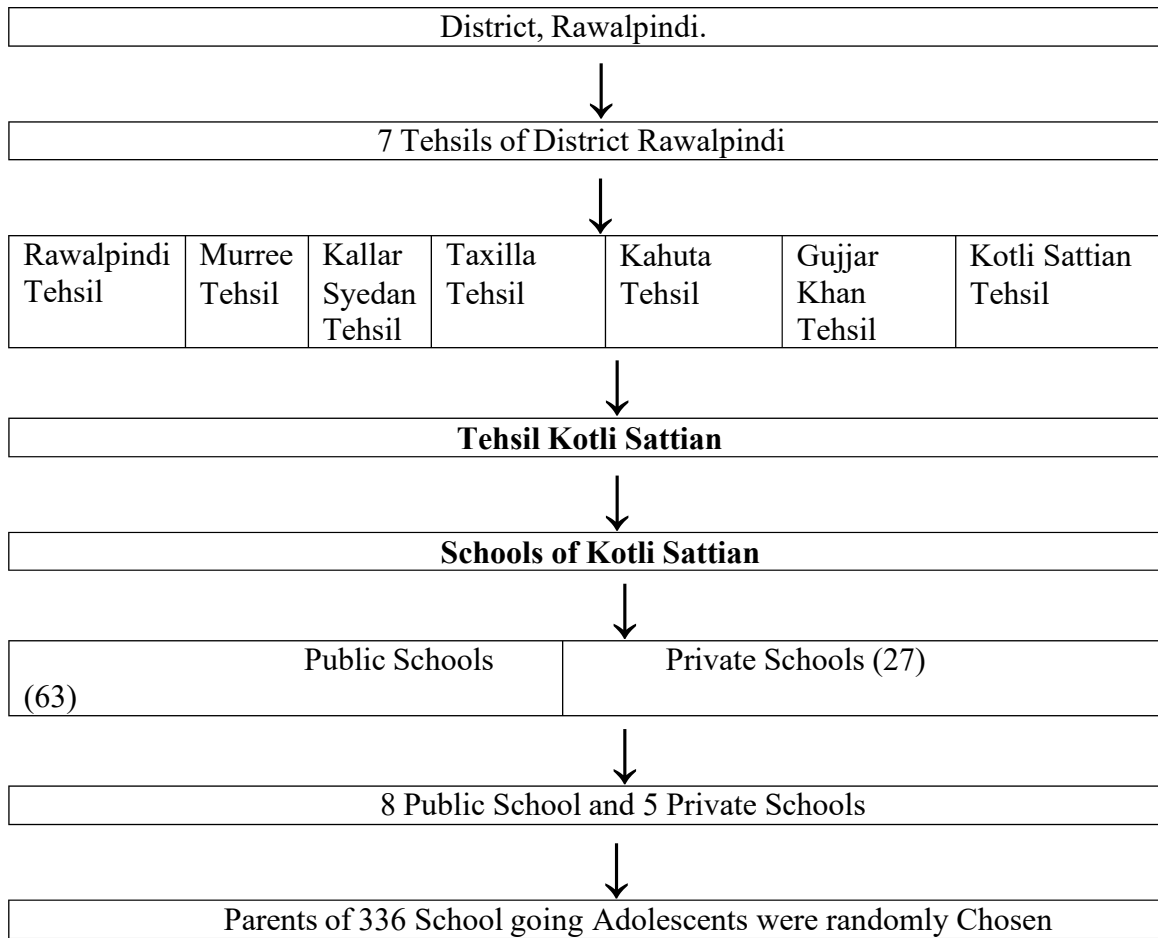
Data was collected through the interview of parents of children by applying an adapted questionnaire and by calculating the BMI of adolescents after taking their height in meters and weight in kilograms values.

Study Population:

The population of the study was school going adolescents of the various schools of Kotli sattian, Rawalpindi, Pakistan.

Sample Technique:

The multistage sampling technique was applied for the selection of participants. Participants were selected through following technique as given below.



Sample Size:

The sample size is calculated by using **Open-Epi Menu** software, by taking previous prevalence of undernutrition among adolescent as 32.31%, margin of error as 5% and confidence interval as 95%. The estimated sample size for the current study is 336 (Samo, A. A et al., 2021).

Sample Size for Frequency in a Population

Population size (for finite population correction factor or fpc)(N) 1000000
Hypothesized % frequency of outcome factor in the population (p) 32.31%±0.5
Confidence limits as % of 100 (absolute +/- %)(d) 5%
Design effect (for cluster surveys-DEFF) 1

Sample Size(n) for Various Confidence Levels

Confidence Level(%)	Sample Size
95%	336
90%	144
90%	237
97%	412
99%	581
99.9%	947
99.99%	1323

Equation
Sample size n = [DEFF * Np(1-p)] / [(d²/Z²)(1-a/2)²(N-1) + p*(1-p)]

Results from OpenEpi, Version 3, open source calculator—SSPropor
Print from the browser with ctrl P
or select text to copy and paste to other programs.

Sample Selection:

An established inclusion and exclusion criteria, was also applied among the randomly selected adolescents.

Inclusion Criteria:

Parents of both gender male and female students with age range from 10 years to 19 years and who were willing participate were recruited to in the study.

Exclusion Criteria:

Parents whose children was less than 10 years age or above 19 years, had any congenial abnormality, and who were not willing to participate were excluded from the study.

Variables in the Study:

Dependent variable was malnutrition/nutritional status based on BMI for age among the adolescents, while independent variables included gender of adolescent (Boy or Girl), age group (Early adolescent 10-13years, Mid adolescents= 14-16years, Late Adolescent= 17-19years), school type (Private or), hygiene condition (Good or Poor based on examination performed for the assessment of hygiene of oral, nail, hair and overall hygiene), history

of recent infection (Infection within last two months such as cholera and respiratory infection), use of filtered water (Yes or No), frequency of meals per day(2or less times, 3-4times, above 4times), daily breakfast (Yes or No), number of siblings (2 or less, 3-5, above 5), monthly income of parents (up to 20,000Pkr, 21,000 to 50,000Pkr, Above 51,000Pkr Per month), father education (Illiterate, Primary, Middle, Matric, above Matric), mother education (Illiterate, Primary, Middle, Matric, above Matric),, mother occupation (Working Lady or House wife), awareness of parents about malnutrition (Yes Or No and it was assessed by showing pictures of the underweight, normal weight, overweight, and obese children), and family type (Nuclear and Joint).

Data Collection Procedure:

Data was collected by the researchers and it was obtained through a sociodemographic adapted questionnaire by interviews of parents of school going adolescents. Questionnaire had two sections. Section ‘A’ of questionnaire was related to the potential risk factors for the malnutrition, while section ‘B’ was about the calculation of the BMI. A section was filled by interview of the parents, whereas, section B was filled by measuring height and weight of the adolescents and then final calculation of the BMI. After that WHO standard cut offs Of BMI for age were used to categorize participants into underweight, normal weight, overweight, and obese categories.

Data Collection Tool:

Data was collected through adapted questionnaire which was composed of options for each question in it. It had two sections. Section ‘A’ of questionnaire was related to the potential risk factors for the malnutrition, while section ‘B’ was about the calculation of the BMI. For the measurement of the height and weight we used measuring tape for height in meters and weighing machine for weight in kilograms. Then WHO cut offs for age was used to classify the adolescents into four classes such as underweight, normal weight, overweight, and obese. Its details are given below.

Classification based on WHO standard Cut offs of BMI for age 5-19years.

Nutritional status of the study population was assessed in terms of the by most common used method such as BMI (Body mass index). It has been used in international researches as well as tool for the assessment of the nutritional status (Ahmad, S et al., 2018).

BMI depends upon the two factors height and weight and it is calculated by the following formula.

$$\text{BMI} = \text{weight}/\text{height}^2$$

Weight is measured in kilograms while height in meters.

According to WHO, based on the BMI for age cut offs, participants could belong to any of these below given classes.

Nutritional Status based on Standard deviation(SD) from BMI cut offs for age according to WHO 2007

Underweight: underweight: <-2 SD

Normal: $-2 < \text{SD} < +1$

Overweight: $>+1$ SD (Equivalent to BMI 25 kg/m² at age 19 years)

Obese: $>+2$ SD (Equivalent to BMI 30 kg/m² at age 19 years)

A pilot study was performed among 50 participants to assess the inter scale reliability and inter scale consistency of used questionnaire for our study population via calculating Cronbach alpha value which was 0.810 and this value indicates a good inter scale reliability of self-adapted questionnaire. Questionnaire is given in the Appendix A.

Data Analysis Procedure:

Coding of the Data:

After the completion of the data collection from the adolescents and their parents at various schools of Kotli Sattian, Rawalpindi, Pakistan, data was entered in the SPSS (Statistical Package for Social Sciences) software version 26 for the statistical analysis of the data. A code book was made for the easy entry of the data into SPSS and it is attached at the start of the appendix A. Section A which was related to Socio demographic factors consisted of 15 questions, while, section B which was related to the calculation of the BMI had 3 questions.

Data Entering:

After the allocation of proper codes to the all questions in the SPSS according code book, data was entered in the SPSS version 26. Data of 336 participants were entered into SPSS software. Data of qualitative demographic variables was entered in SPSS by using the codes that was assigned to each category. While data of quantitative variables was entered in numerical form. Quantitative variables were converted into categorical for further analysis. Data was reevaluated for the correction and missing values in it.

Data Cleaning:

After rechecking of data for its correction and missing values, it was corrected and cleaned.

Data Analysis:

Data was analyzed using statistical package for social science (SPSS) version 26. Descriptive and inferential statistics were applied. During descriptive analysis mean and standard deviation for quantitative variables while for categorical variables, frequencies and percentages were calculated.

Whereas, during inferential statistics association of malnutrition with sociodemographic variables was assessed by using Chi-square test. The prediction of malnutrition by included factors was checked through odds ratio by using multinominal logistic regression.

A **p-value** ≤ 0.05 was considered statistically significant.

Ethical Consideration:

The ethical approval from the IRB (Institutional Review Board) of Al-Shifa School of Public Health, for research topic was obtained from the ethical committee after presentation of research synopsis before the committee. Permission was also obtained from the schools whose students were enrolled in this research study. Informed consent form was also taken from all participants after the explanation of the objectives of the study before the collection of the data. Informed consent form is given in appendix B. The information collected from the participants was only used for the purpose of research and it was also assured before that collection to the participants. Confidentiality and privacy were also secured and maintained throughout the research by hiding the identification of the participants on the questionnaire. The participants were free to participate and free to leave research study at any stage of the interview.

Operational Definitions:

Malnutrition:

Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients (WHO, 2020).

Adolescents:

According to World Health Organization (WHO) adolescents are the individuals with age range of 10-19 years (WHO, 2022).

Predictors:

Independent variables in research that provide information about the associated dependent variables through regression analysis.

CHAPTER IV: RESULTS

Out of 336 participants were boys 159(47.32%) while were girls 177(52.68%). The prevalence in study population of different nutritional statuses was underweight (22.92%), normal weight (34.82%), overweight was (26.79%), obese (15.48%). The means of age and BMI for study population were 16.79 with SD (standard deviation) ± 4.89 years and 23.40 with $SD \pm 5.03$ respectively. Figure 1 shows the prevalence of various nutritional statuses of the study population.

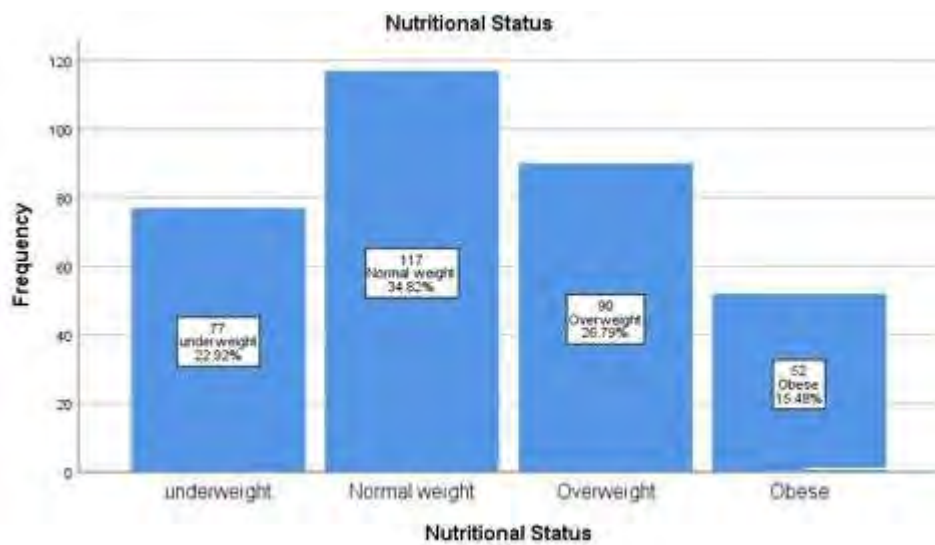


Figure 1: Shows the distribution of study population based on their nutritional status

Table 1: Sociodemographic characteristics of the study population

Variable	Number/Percentages	
Gender	Boys	159(47.32%)
	Girls	177(52.68%)
Age Group	Early Adolescent	98(29.20%)
	Mid Adolescent	111(33.00%)
	Late Adolescent	127(37.80%)
School Type	Private	132(39.30%)
	Government	204(60.70%)
Hygiene Condition	Good	159(47.30%)
	Poor	177(52.70%)
Recent History Infection	Yes	170(50.60%)
	No	166(49.40%)
Filtered Water Use	Yes	176(52.40%)
	No	160(47.60%)
Frequency Of Meals Per Day	2times	129(38.40%)
	3-4times	96(28.80%)
	Above 4times	111(33.00%)
Daily Breakfast	Yes	196(58.30%)
	No	140(41.70%)
Number of Siblings	2 or less	113(33.60%)
	3-5	142(42.30%)
	Above 5	81(24.10%)
Monthly Income	Up to 20,000Pkr	147(43.70%)
	21,000-50,000Pkr	90(26.80%)
	Above 50,000Pkr	99(29.50%)
Mother Education	Illiterate	87(25.90%)
	Primary	90(26.80%)
	Middle	60(17.90%)
	Matric	51(15.20%)
	Above Matric	48(14.30%)
Father Education	Illiterate	89(26.50%)
	Primary	81(24.10%)
	Middle	46(13.70%)
	Matric	81(24.10%)
	Above Matric	39(11.60%)
Mother Occupation	House Wife	207(61.60%)
	Working Lady	129(38.40%)
Awareness about Malnutrition of Parents	Yes	175(52.10%)
	No	161(47.90%)
Family Type	Nuclear	142(42.20%)
	Joint	194(57.80%)

Table 1 shows the sociodemographic characteristics of the study population along with the percentages of the study population based various included variables in the study.

Table 2: Association between nutritional status and gender

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under--weight	Normal Weight	Over-weight	Obese	Total	
Gender	Boys	43(27.00%)	75(47.10%)	22(13.80%)	19(11.90%)	159(100%)	0.0001
	Girls	34(19.20%)	42(23.70%)	68(38.40%)	33(18.60%)	177(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

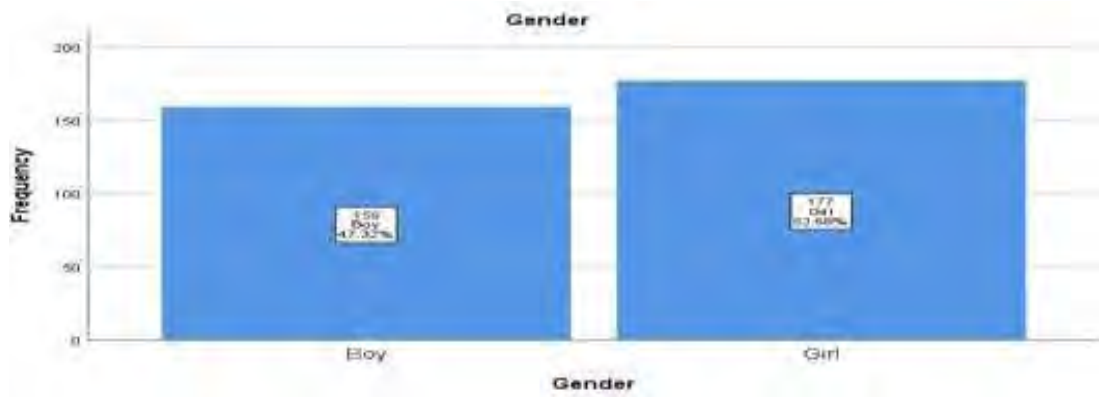


Figure 2: Shows the distribution of study population based on gender

Table 2 shows that association between nutritional status and gender was statistically significant, underweight was more prevalent among the boys, whereas, overweight and obesity was more common among girls. Figure 2 displays the percentages of boys and girls in study population.

Table 3: Association between nutritional status and age group

Parameter s		Cross Tabulation and Chi-Square test Analysis					p- value
		Nutritional Status					
		Under-- weight	Normal Weight	Over -weight	Obese	Total	
Age group in years	10 to 13	18(18.40%)	45(45.90%)	20(20.40%)	15(15.30%)	98(100%)	0.000 2
	14 to 16	46(41.40%)	36(32.40%)	25(22.50%)	4(3.60%)	111(100%)	
	17 to 19	13(10.20%)	36(28.30%)	45(35.40%)	33(25.90%)	127(100%)	
Total		77 (22.90%)	117 (35.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 3 indicates that association between nutritional status and age group was statistically significant, underweight was more prevalent among the mid adolescents (14-16 years) age group, whereas, overweight and obesity was more common late adolescent age group (17-19 years). The early age(10-13years) group had prevalence in between of mid and late adolescent age groups.

Table 4: Association between nutritional status and school type

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under--weight	Normal Weight	Over-weight	Obese	Total	
School Type	Private	20(15.20%)	40(30.30%)	45(34.10%)	27(20.40%)	132(100%)	0.001
	Government	57(27.90%)	77(37.50%)	45(22.10%)	25(12.20%)	204(100%)	
Total		77 (22.90%)	117 (35.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 4 indicates that association between nutritional status and school type was statistically significant, underweight was more prevalent among the students of government school, while, overweight and obesity was more common among the students of the private type.

Table 5: Association between nutritional status and hygiene condition

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under--weight	Normal Weight	Over-weight	Obese	Total	
Hygiene condition	Good	15(9.40%)	75(47.20%)	44(27.70%)	25(15.70%)	159(100%)	0.001
	Poor	62(35.00%)	42(23.70%)	46(26.00%)	27(15.30%)	177(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 5 indicates that association between nutritional status and hygiene condition was statistically significant, underweight was more prevalent among the students with poor hygienic conditions, whereas, overweight and obesity prevalence was almost similar among the both groups of children based on hygienic condition

Table 6: Association between nutritional status and recent infection

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under--weight	Normal Weight	Over-weight	Obese	Total	
History of Recent Infection	Yes	53(31.20%)	50(29.40%)	43(25.30%)	24(14.10%)	170(100%)	0.002
	No	24(14.50%)	67(40.40%)	47(28.30%)	28(16.90%)	166(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 6 indicates that association between nutritional status and recent infection history was statistically significant, underweight was more prevalent among the students with recent infection history, while, overweight and obesity was little more common among the students with no recent infection history.

Table 7: Association between nutritional status and filter water use

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under--weight	Normal Weight	Over-weight	Obese	Total	
Filter water use	Yes	26(14.80%)	77(43.80%)	47(26.60%)	26(14.80%)	176(100%)	0.001
	No	51(31.90%)	40(25.00%)	43(26.90%)	26(16.20%)	160(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

25

Table 7 indicates that association between nutritional status and filter water use was statistically significant, underweight was more prevalent among the students who did not use filter water, while, overweight and obesity was also little more common among the students who used unfiltered water.

Table 8: Association between nutritional status and frequency of meals

Parameters		Cross Tabulation and Chi-Square test Analysis					
		Nutritional Status					p-value
		Under--weight	Normal Weight	Over-weight	Obese	Total	
Frequency of Meals per Day	2 times	60(46.50%)	25(19.40%)	27(20.90%)	17(13.70%)	129(100%)	0.0001
	3-4 times	13(13.50%)	47(49.00%)	22(23.00%)	14(14.50%)	96(100%)	
	Above 4times	4(3.60%)	45(40.60%)	41(36.90%)	21(18.90%)	111(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 8 indicates that association between nutritional status and frequency of meals per day was statistically significant, underweight was more prevalent among the students whose frequency of meals per day was less than 2times, while, overweight and obesity was more common among the students whose frequency of meals per day was above 4times. Students with the frequency range of meals per day 2-4 times had in between trend of these nutritional statuses.

Table 9: Association between nutritional Status and daily breakfast

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under--weight	Normal Weight	Over-weight	Obese	Total	
Daily Breakfast	Yes	32(16.30%)	70(35.70%)	56(28.60%)	38(19.40%)	196(100%)	0.035
	No	45(32.10%)	47(33.60%)	34(24.30%)	14(10.00%)	140(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 9 indicates that association between nutritional status and daily breakfast intake was statistically significant, underweight was more prevalent among the students who did not take daily breakfast, while, overweight and obesity was more common among the students who did take daily breakfast.

Table 10: Association between nutritional status and number of siblings

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under--weight	Normal Weight	Over-weight	Obese	Total	
Number of siblings	2 or less	27(23.90%)	47(41.60%)	22(19.50%)	17(15.00%)	113(100%)	0.04
	3 to 5	23(16.20%)	58(40.80%)	39(27.50%)	22(15.50%)	142(100%)	
	Above 5	27(33.30%)	12(14.80%)	29(35.80%)	13(16.10%)	81(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 10 indicates that association between nutritional status and number of siblings was statistically significant, underweight was more prevalent among the students with number of siblings above 5, and overweight was also common among students with siblings more

than 5, while the obesity was more common among students with sibling number between 3-5.

Table 11: Association between nutritional status and monthly income

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under-weight	Normal Weight	Over-weight	Obese	Total	
Monthly Income	Up to 20,000	59(40.10%)	54(36.70%)	26(17.70%)	8(5.50%)	147(100%)	0.001
	21,000 to 50,000	6(6.70%)	30(33.30%)	28(31.10%)	26(28.90%)	90(100%)	
	Above 50,000	12(12.10%)	33(33.30%)	36(36.40%)	18(18.20%)	99(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 11 indicates that association between nutritional status and monthly income was statistically significant, underweight was more prevalent among the students whose parents' monthly income was up to 20,000Pkr, and overweight most prevalent among the students whose parents' monthly income was above 50,000Pkr, while obesity was more common among the students whose parents' monthly income was between 20,000-50,000Pkr.

Table 12: Association between nutritional status and mother education

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under--weight	Normal Weight	Over-weight	Obese	Total	
Mother Education	Illiterate	48(55.20%)	11(12.60%)	11(12.60%)	17(19.60%)	87(100%)	0.001
	Primary	12(13.30%)	25(27.80%)	37(41.10%)	16(17.80%)	90(100%)	
	Middle	7(11.70%)	26(43.30%)	21(35.00%)	6(10.00%)	60(100%)	
	Matric	6(11.80%)	36(70.70%)	5(9.80%)	4(7.90%)	51(100%)	
	Above Matric	4(8.30%)	19(39.60%)	16(33.30%)	9(18.80%)	48(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 12 indicates that association between nutritional status and mother education was statistically significant, underweight was more prevalent among the students whose mothers were illiterate, and overweight and obesity were most common among the students whose mothers' educational level was primary.

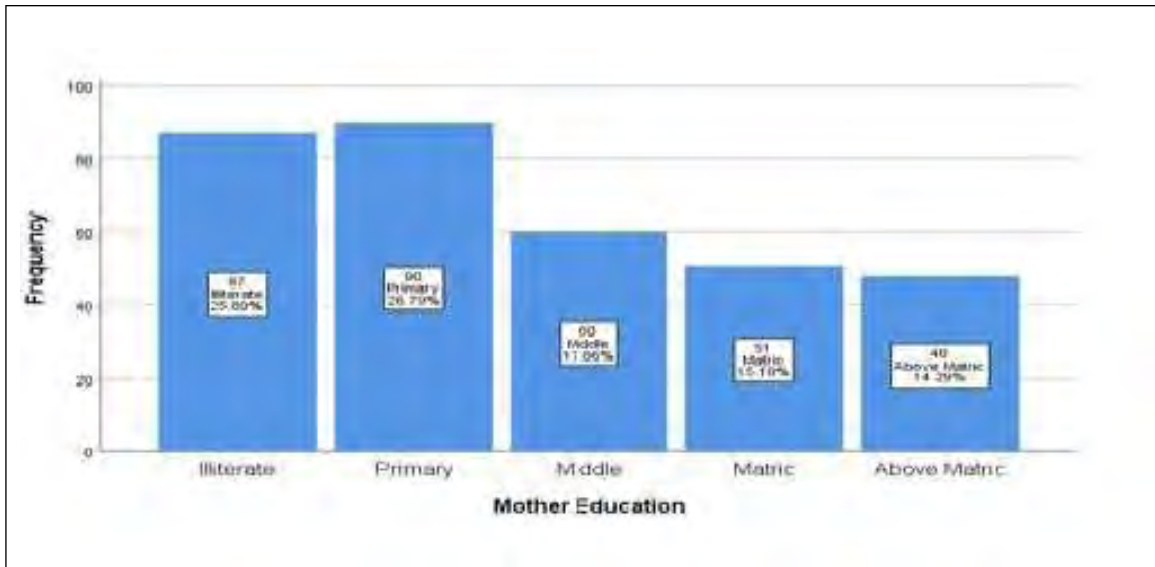


Figure 3: Shows the distribution of study population based on mother education

Table 13: Association between nutritional status and mother education

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under-weight	Normal Weight	Over-weight	Obese	Total	
Father Education	Illiterate	41(46.10%)	19(21.30%)	17(19.10%)	12(13.50%)	89(100%)	0.003
	Primary	14(17.30%)	36(44.40%)	23(28.40%)	8(9.90%)	81(100%)	
	Middle	8(17.40%)	11(24.00%)	14(30.40%)	13(28.20%)	46(100%)	
	Matric	10(12.30%)	32(39.50%)	33(40.70%)	6(7.50%)	81(100%)	
	Above Matric	4(10.20%)	19(48.70%)	3(7.70%)	13(33.40%)	39(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 13 indicates that association between nutritional status and father education was statistically significant, underweight was more prevalent among the students whose fathers were illiterate, and overweight and obesity were most common among the students whose fathers' educational levels were matric and above matric respectively.

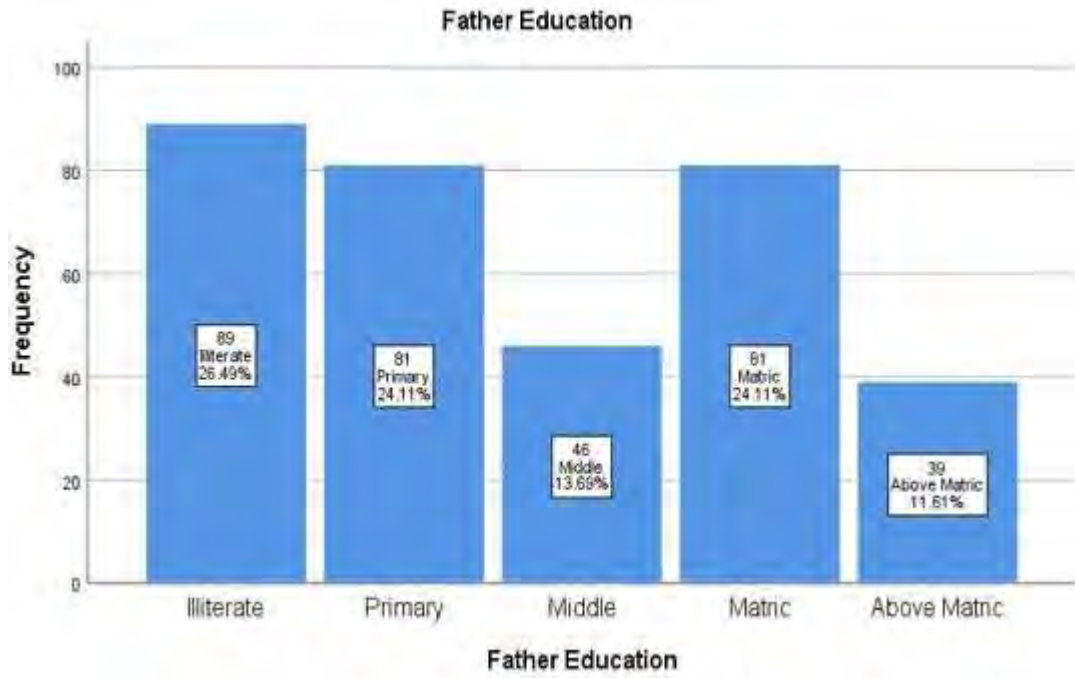


Figure 4: Shows the distribution of study population based on father education

Table 14: Association between nutritional status and mother occupation

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under-weight	Normal Weight	Over-weight	Obese	Total	
Mother Occupation	House Wife	30(14.50%)	79(38.20%)	57(27.50%)	41(19.80%)	207(100%)	0.004
	Working Lady	47(36.40%)	38(29.50%)	33(25.60%)	11(8.50%)	129(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Figure 5: Shows the distribution of study population based on mother education

Table 14 indicates that association between nutritional status and mother occupation was statistically significant, underweight was more prevalent among the students whose mothers were working women, and overweight and obesity were most common among the students whose mothers were house wives.

Table 15: Association between gender nutritional status and awareness of malnutrition about malnutrition

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under-weight	Normal Weight	Over-weight	Obese	Total	
Awareness about malnutrition of Parents	Yes	33(18.90%)	83(47.40%)	37(21.10%)	22(12.60%)	175(100%)	0.02
	No	44(27.30%)	34(21.10%)	53(32.90%)	30(18.70%)	161(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 15 indicates that association between nutritional status and awareness about the malnutrition of parents was statistically significant, underweight, overweight, and obesity all were more prevalent among the students whose parents had no awareness about the malnutrition.

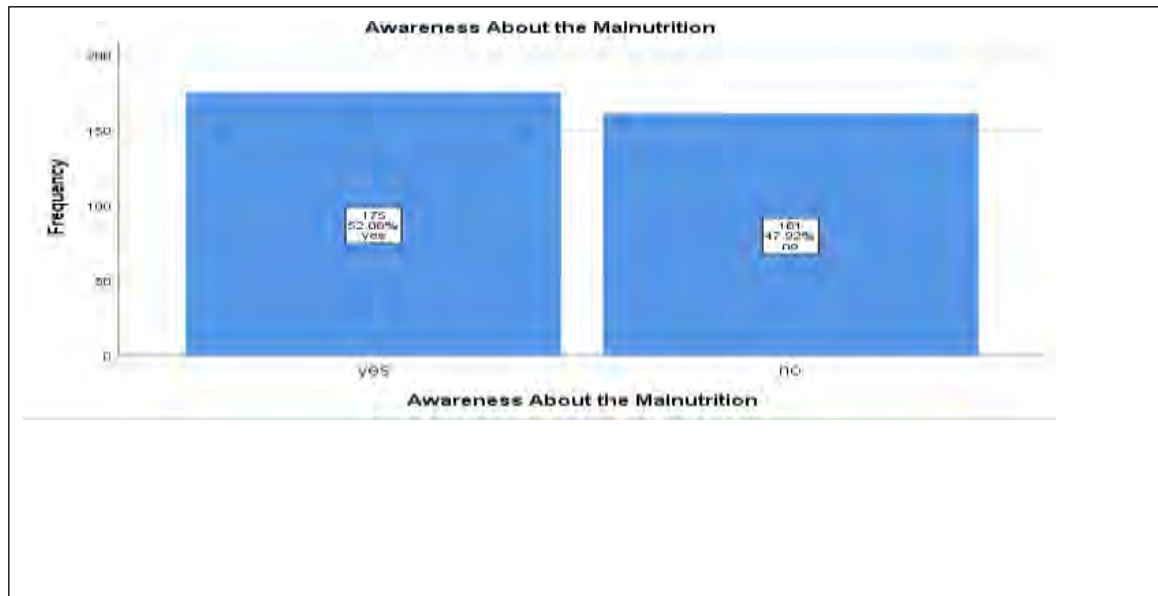


Figure 5: Shows the distribution of study population based on awareness of parents about malnutrition

Table 16: Association between gender nutritional status and family type

Parameters		Cross Tabulation and Chi-Square test Analysis					p-value
		Nutritional Status					
		Under--weight	Normal Weight	Over-weight	Obese	Total	
Family Type	Nuclear	27(19.00%)	45(31.70%)	40(28.20%)	30(21.10%)	142(100%)	0.024
	Joint	50(25.80%)	72(37.10%)	50(25.80%)	22(11.30%)	194(100%)	
Total		77 (22.90%)	117 (34.80%)	90 (26.80%)	52 (15.50%)	336 (100%)	

Table 16 indicates that association between nutritional status and family type was statistically significant, underweight was more prevalent among the students who part of joint families, while, overweight an obesity were most common among the students who belonged to nuclear families.

Number of Meals per Day	2 times	8.20 1.50-7.20 0.01	0.60 0.40-2.09 0.30	0.60 0.56-1.62 0.10
	3 to 4 times	7.50 1.60-8.40 0.04	0.70 0.34-2.87 0.20	0.65 0.60-0.90 0.90
	Above 4 times	Reference	Reference	Reference
Breakfast Intake	Yes	0.50 0.20-0.80 0.01	1.30 1.19-4.30 0.75	2.09 1.90-4.76 0.08
	No	Reference	Reference	Reference
Number Of Siblings	2 or less	0.70 0.70-4.30 0.01	0.55 0.23-3.00 0.30	1.01 0.67-1.88 0.05
	3 to 5	0.57 1.87-4.10 0.13	0.70 0.29-2.25 0.17	1.10 1.00-2.20 0.10
	Above 5	Reference	Reference	Reference
Monthly Income	Up to 20,000	10.70 2.76-11.10 0.02	0.50 0.22-0.81 0.29	0.30 0.10-0.90 0.05
	From 21,000 to 50,000	8.45 0.50-15.01 0.50	0.90 0.29-1.70 0.10	1.58 1.01-2.92 0.40
	Above 50,000	Reference	Reference	Reference
Mother Education	Illiterate	3.18 2.78-3.64 0.03	0.450 0.10-1.90 0.06	1.67 0.40-1.99 0.01
	Primary	2.98 3.81-2.33 0.06	1.30 0.90-2.10 0.01	1.50 1.09-1.67 0.30
	Middle	2.54 1.76-2.30 0.10	1.10 0.40-2.10 0.20	0.89 0.66-1.00 0.06
	Matric	2.06 1.16-3.60 0.30	0.10 0.10-0.20 0.10	0.49 0.23-0.50 0.05
	Above Matric	Reference	Reference	Reference

Table 17: Multinomial logistic regression for factor associated with underweight, overweigh, and obesity among school going adolescents

Variables		Underweight OR 95% CI p-value	Overweight OR 95% CI p-value	Obese OR 95%CI p-value
Gender		3.80	0.35	0.88
	Boys	0.11-13.34	0.20-0.50	0.36-2.10
Age Group in years	Girls 10 to 13	0.04 Reference	0.03 Reference	0.01 Reference
		3.30	0.60	0.50
	14 to 16	0.13-7.90 0.05 4.30	0.50-0.80 0.07 0.80	0.43-0.94 0.05 0.12
		0.40-8.04	0.60-1.70	0.10-0.90
School Type	17 to 19	0.03 Reference	0.60 Reference	0.81 Reference
	Private	0.23 0.10-0.52	2.10 1.29-2.90	1.89 1.10-2.89
Hygiene Condition	Government	0.01 Reference	0.04 Reference	0.03 Reference
	Good	0.94 0.30-3.10	1.01 0.25-1.09	1.09 0.50-1.30
Recent Infection	Poor	0.01 Reference	0.09 Reference	0.07 Reference
	Yes	6.3 4.50-8.10	0.60 0.56-1.10	0.89 0.76-1.20
Filter Water Use	No	0.009 Reference	0.06 Reference	0.05 Reference
	Yes	0.70 0.30-2.20	1.10 0.44-4.01	0.95 0.90-1.80
Use		0.18	0.20	0.04
	No	Reference	Reference	Reference
	Primary	M	5.32	1.98
		at	3.40-3.70	0.3 2.08
Middle	ri c	0.40 4.58 3.94-	1.01-2.01 0.4	

4.30	0.35
1.90-3.50	0.2
0.31	3-
5.45	1.1
1.86-5.89	2
0.44	0.05
6.65	0.63
2.43-5.89	0.6
0.27	0-
	2.3
	4
	0.16
	0.29
	0.22
	-
	.1.0
	9
	0.07

	Above Matric	Reference	Reference	Reference
Mother Occupation	House Wife	0.40 0.30-0.90 0.006	1.15 0.81-4.65 0.90	1.53 1.09-3.23 0.30
	Working Lady	Reference	Reference	Reference
Awareness about Malnutrition	Yes	0.64 0.30-1.40 0.04	1.20 0.60-1.20 0.80	0.70 0.67-1.20 0.02
	No	Reference	Reference	Reference
Family Type	Nuclear	0.50 0.44-1.20 0.001	1.27 0.37-1.20 0.05	1.87 1.50-3.06 0.02
	Joint	Reference	Reference	Reference

OR=Odds ratio, CI= Confidence interval, abbreviations used in above table

Boys were 3.80times more prone to underweight than girls (OR=3.80, 95%CI=0.11-13.34, p=0.04), while boys were less predisposed to overweight (OR=0.35, 95%CI=0.20-0.50, p=0.03), and obesity (OR=0.88, 95%CI=0.36-2.10, p=0.01), significantly as compared to girls.

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Students with mid adolescent age group was 4.30times more susceptible to underweight than early and late age adolescent age groups significantly (OR=4.30, 95%CI=0.40-8.04, p=0.03). Students with private school type were less prone to underweight (OR=0.23, 95%CI=0.10-0.52, p=0.01), while, 2.10times more predispose to get overweight (OR=2.10, 95%CI=1.29-2-.90, p=0.04), and 1.89times more prone to obesity (OR=1.89, 95%CI=1.10-2.89, p=0.03), as compared to students of government school statistically significantly. School going students with good hygiene were less susceptible to underweight (OR=0.94, 95%CI=0.30-3.10, p=0.01) significantly in comparison to students with poor hygiene. Students with recent infection were 6.30times more predisposed to underweight (OR=6.30, 95%CI=4.50-8.10, p=0.009) significantly than the students with no recent infection. Students who used filtered water were less prone to become obese (OR=0.95, 95%CI=0.90-1.80, p=0.04) significantly. Adolescents with number of meals 2 times per day were 8.20times and with number of meals between 3-4times, were 7.50times

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more susceptible to get underweight (OR=8.20, 95%CI=1.50-7.20, p=0.01) (OR=7.50, 95%CI=1.60-8.40, p=0.04) significantly and respectively, than adolescents with number of meals more than 4 times per day. Students who took daily. Daily breakfast intake habits were also protective against underweight (OR=0.50, 95%CI=0.20-0.80, p=0.01) significantly. Less than 2 number of siblings was also protective against underweight (OR=0.70, 95%CI=0.70-430, p=0.01) significantly among adolescents. Participants whose home monthly income was up to 20,000Pkr were 10.70 times more susceptible to become underweight (OR=10.70, 95%CI=2.76-11.10, p=0.02) significantly than students whose home income was above 50,000Pkr. Adolescents whose parents were illiterate were predisposed to get underweight 3.18 times due to mother illiterate educational status (OR=3.18, 95%CI=2.78-3.64, p=0.03) and 6.70 times due to father illiterate educational status (OR=6.70, 95%CI=5.90-8.90, p=0.04). Adolescents whose mother education was primary were 1.30 times more susceptible to get overweight than students whose mothers had educational status was above matric (OR=1.30, 95%CI=0.90-2.10, p=0.01). Students with mothers' educational level of illiterate were also predispose to obesity (OR=1.67, 95%CI=0.40-1.99, p=0.01).

Adolescents whose mothers were house wives were less susceptible to get underweight significantly (OR=0.40, 95%CI=0.30-0.90, p=0.006) in compared to the adolescents whose mothers were working women. Students whose parents were aware about malnutrition were less prone to get underweight (OR=0.64, 95%CI=0.30-1.40, p=0.04) and obese (OR=0.70, 95%CI=0.67-1.20, p=0.02) significantly. Adolescents who were part of nuclear family less susceptible to get underweight (OR=0.50, 95%CI=0.44-1.20, p=0.001) significantly, and they were more prone to become obese (OR=1.86, 95%=1.50-3.06, p=0.02) than students who lived in joint families.

CHAPTER V: DISCUSSION

This project with cross sectional design of study has highlighted the prevalence of malnutrition and its predictors among school going adolescents of Kotli Sattian, Rawalpindi, Pakistan. The prevalence of underweight, normal weight, overweight and obesity among school going adolescents of study population was 77(22.92%), 117(34.82%), 90(26.79%), and 52(15.48%) respectively. The prevalence of underweight, overweight, and obesity in a study of Nepal was 21.8%, 3.1% and 0.8% respectively. In a research that was performed in India the proportion of underweight, overweight, and obese students were 47.0%, 5.9%, and 2.7%, respectively (Ahmad, S et al., 2018). This difference in prevalence of underweight, overweight, and obesity could be due multiple factors that vary in location to location.

The association between nutritional status and gender was statistically significant, underweight was more prevalent among the boys, whereas, overweight and obesity was more common among girls. Similar, results were presented by a study that was conducted In Pakistan (Ahmad, D et al., 2020).

Age group was also associated with nutritional status statistically significant, underweight was more prevalent among the mid adolescents (14-16 years) age group, whereas, overweight and obesity was more common late adolescent age group (17-19 years). The early age(10-13years) group had prevalence in between of mid and late adolescent age groups. This finding was also supported by a research that was performed in Indonesia (Maehara, M et al., 2019).

Nutritional status was also influenced by school type and association between these was also statistically significant, underweight was more prevalent among the students of government school, while, overweight and obesity was more common among the students of the private type. A study of Nepal in literature also showed consist finding in its result (Bhattarai, S., & Bhusal, C. K., 2019).

It was also noted that association between nutritional status and hygiene condition was statistically significant, and underweight was more prevalent among the students with poor hygienic conditions, whereas, overweight and obesity prevalence was almost similar among the both groups of children based on hygienic condition. Hygienic conditions have been reported as significant predictor of malnutrition in another research of Pakistan (Ahmad, D et al., 2020).

The association between nutritional status and recent infection history was statistically significant, and underweight was more prevalent among the students with recent infection history, while, overweight and obesity was little more common among the students with no recent infection history. Similar role of infection in causing the malnutrition has been displayed by the research that was carried out at Southern Ethiopia (Teferi, D. Y et al., 2018).

Nutritional status and filter water use were linked statistically significant, and underweight was more prevalent among the students who did not use filter water, while, overweight and obesity was also little more common among the students who used unfiltered water. It was also noted in the Pakistani research (Ahmad, D et al., 2020).

Frequency of meals per day was also an important predictor of nutritional status and frequency of meals per day were associated statistically significant, and underweight was more prevalent among the students whose frequency of meals per day was less than 2times, while, overweight and obesity was more common among the students whose frequency of meals per day was above 4times. Students with the frequency range of meals per day 2-4 times had in between trend of these nutritional statuses. These findings were consistent with the results of a projected performed in North Ethiopia (Gebregyorgis, T et al., 2016).

Breakfast daily intake and nutritional status were linked statistically significant, and underweight was more prevalent among the students who did not take daily breakfast, while, overweight and obesity was more common among the students who did take daily breakfast. Breakfast was also noted by the research to influence the nutritional status and it was conducted in China (Li, L et al., 2018).

The association between nutritional status and number of siblings was statistically significant, underweight was more prevalent among the students with number of siblings

above 5, and overweight was also common among students with siblings more than 5, while the obesity was more common among students with sibling number between 3-5. A study that was carried out at presented similar research of North Ethiopia (Gebregyorgis, T et al., 2016).

Nutritional status and monthly income had significant relationship, and underweight was more prevalent among the students whose parents' monthly income was up to 20,000Pkr, and overweight most prevalent among the students whose parents' monthly income was above 50,000Pkr, while obesity was more common among the students whose parents monthly income was between 20,000-50,000Pkr. Monthly income has been noted in other research of Indonesia as well as a significant predictor of malnutrition (Maehara, M et al., 2019).

The relationship between nutritional status and mother education was statistically significant, underweight was more prevalent among the students whose mothers were illiterate, and overweight and obesity were most common among the students whose mothers' educational level was primary. Association between nutritional status and father education was also statistically significant, underweight was more prevalent among the students whose fathers were illiterate, and overweight and obesity were most common among the students whose fathers' educational levels were matric and above matric respectively. A study of North Ethiopia also showed the importance of parents' education in the determination of the nutritional status of their adolescents (Gebregyorgis, T et al., 2016).

Mother occupation was associated with adolescent nutritional status statistically significant, and underweight was more prevalent among the students whose mothers were working women, and overweight and obesity were most common among the students whose mothers were house wives. A research that was conducted in India displayed similar role of mother occupation on adolescents nutritional status (Pal, A et al., 2017).

The association between nutritional status and awareness about the malnutrition of parents was statistically significant, underweight, overweight, and obesity all were more prevalent among the students whose parents had no awareness about the malnutrition. Awareness

was also noted as significant predictor of nutritional status in a research as well that was conducted at Sri Lanka (Ekanayake, S et al., 2003).

The association between nutritional status and family type was statistically significant, underweight was more prevalent among the students who part of joint families, while, overweight an obesity were most common among the students who belonged to nuclear families. Family type has been suggested a important determinant of nutritional status of adolescents in a study of Nepal (Bhattarai, S., & Bhusal, C. K., 2019).

CONCLUSIONS AND WAY FORWARD

A significant proportion of study population had underweight, overweight, and obesity. The factors including gender, age group, school type, hygiene condition, recent infection, filter water, frequency of meals per day, breakfast intake, number of siblings, monthly income, mother education, father education, mother occupation, awareness of parents about malnutrition, and family type were associated with nutritional status of school going adolescents.

The students who had male gender, mid adolescent age group, government school type, poor hygiene, recent infection history, unfiltered water, less frequency of meals per day, no daily breakfast intake, high number of siblings, low monthly income, mother with low educational status, father with low educational status, working mother, parents with no awareness about malnutrition, and joint family type were more predisposed to underweight, whereas, student who had female gender, early and late adolescents age groups, private school type, good hygiene, no history of infection, used filtered water, high frequency of meals, daily breakfast intake, less number of siblings, high monthly income, parents with high educational level.

Parents with no awareness about malnutrition, and nuclear family type were more susceptible to overweight and obesity. In a nutshell, it's agreeable that malnutrition is multifactorial and several factors predict it's prevalence, so, a multidisciplinary approach is required to prevent malnutrition among adolescents.

- Multidisciplinary approach is needed to prevent malnutrition among adolescents.
- Gender and age specific measures should be taken against malnutrition.
- Students should be taught about the importance of the balanced diet.
- Students and their parents should be encouraged to take care of their hygiene.
- Students should be motivated to drink filtered water.
- Students should be taught about the importance of daily breakfast, number of meals per day and about the quantities of each meal.
- Importance of family planning should be told to the parents.
- Adequate monthly income should be there for all families.

- Parents should be educated.
- Parents and students should be taught about the negative effects of the malnutrition.
- Parents should check the dietary habits of their children and should give them proper time
- Parents should be made aware about the malnutrition.

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Appendix-A

Variables and options for each variable and scale for their measurement.

NO	Variables	Operational Definition	Scale of Measurement
1	Gender	Boys and Girls	Nominal
2	Age	Age in years	Scale
3	Age Group	Three age groups	Ordinal
4	School Type	Two school Types	Nominal
5	Hygiene Condition	Good or poor	Nominal
6	History of Recent Infection	Yes or No	Nominal
7	Use of Filter Water	Yes or No	Nominal
8	Frequency of Meals per Day	Three groups based on meal frequency per day	Ordinal
9	Daily Breakfast	Yes or No	Nominal
10	Number of Siblings	Three groups based on number of siblings	Ordinal
11	Monthly Income	Three groups based on the monthly income	Ordinal
12	Mother Education	Five groups based on mother education level	Ordinal
13	Father Education	Five groups based on father education level	Ordinal
14	Mother occupation	House wife or Working lady	Nominal
15	Awareness of Parents about Malnutrition	Yes or No	Nominal
16	Family Type	Nuclear or Joint	Nominal
17	Body Mass Index	Based on height and wight	Scale
18	Nutritional Status	Four groups based on BMI	Ordinal

Coding Sheet in SPSS Software for Data entry

No	Variable Name	Variables Label	Code	Code Titles
1	gender	Gender	1	Boy
			2	Girl
2	age	Age	-	-
3	agegroup	Age Group	1	10 to 13 years
			2	14 to 16 years
			3	17 to 19 years
4	schooltype	School Type	1	Private
			2	Government
5	hygienecondition	Hygiene Condition	1	Yes
			2	No
6	historyofrecentinfection	History of Recent Infection	1	Yes
			2	No
7	useoffilterwater	Use of Filter Water	1	Yes
			2	No
8	frequencyofmealsperday	Frequency of Meals per Day	1	2times
			2	3 to 4times
			3	Above 4times
9	dailybreakfast	Daily Breakfast	1	Yes
			2	No
10	numberofsiblings	Number of Siblings	1	2 or less
			2	3 to 5
			3	Above 5
11	Montlyincome	Monthly Income	1	Up to 20,000
			2	21,000 to 50,000
			3	Above 50,0000

12	fathereducation	Father Education	1	Illiterate
			2	Primary
			3	Middle
			4	Matric
			5	Above Matric
13	mothereducation	Mother Education	1	Illiterate
			2	Primary
			3	Middle
			4	Matric
			5	Above Matric
14	motheroccupation	Mother occupation	1	House Wife
			2	Working Lady
15	awarenessofparents- -aboutmanutrition	Awareness of Parents about Malnutrition	1	Yes
			2	No
16	familytype	Family Type	1	Nuclear
			2	Joint
17	Bodymassindex	Body Mass Index	-	-
18	nutritionalstatus	Nutritional Status	1	Underweight
			2	Normal
			3	Overweight
			4	Obese

Questionnaire

(Prevalence and predictors of malnutrition among school going adolescents of Kotli Sattian, District Rawalpindi)

1. Gender

- a) Male
- b) female

2. Age group

- a) 10 to 13years
- b) 15 to 16years
- c) 17 to 19years

3. School type

- a) private
- b) government

4. Hygiene condition

- a) good
- b) poor

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5. History of recent infection

- a) Yes
- b) No

6. Filter water use

- a) Yes
- b) No

7. Frequency of meal per day

- a) 2times per day
- b) 3-4days per day
- c) 4 or above per day

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8. Daily breakfast intake

- a) Yes
- b) No

9. Number of siblings

- a) 2 or less
- b) 3 or 5
- c) above 5

10. Monthly income of parents

- a) Up to 20,000
- b) 21,000 to 50,000
- c) 51,000 and above

11. Mother education

- a) Illiterate
- b) Primary
- c) Middle
- d) Matric
- e) above Matric

12. Father Education

- a) Illiterate
- b) Primary
- c) Middle
- d) Matric
- e) Above Matric

13. Mother occupation

- a) House wife
- b) working Lady

14. Awareness of parents about Malnutrition by asking about malnutrition definition or general concept.

- a) No
- b) Yes

15. Family type

- a) Nuclear
- b) Joint

16. Height

..... (in meters)

17. Weight in kilograms

..... (in kilograms)

18. Body Mass Index =
(Weight/ heights²)

.....

Appendix B – Consent Form

Title of study

Prevalence and Predictors of Malnutrition among school going adolescents of Kotli Sattian District Rawalpindi

Principal investigator:

Dr. _____

Purpose:

Malnutrition, in all its forms, is a main predictor of a country's well-being. The most vulnerable population for malnutrition is adolescents who are considered as the future of a country. Pakistan, being a developing country, is facing many challenges and one of them is nutritional issues of the adolescents. Nutritional deficiencies in this age group can have detrimental effects in later life especially malnutrition of adolescent girls can lead to anemia and other complications during pregnancy.

Therefore, the current study will be undertaken to find out the prevalence and main predictors of malnutrition among adolescents in Kotli Sattian District Rawalpindi. The findings of the study will help to develop strategies to tackle this issue and make improvements.

Procedure:

Data will be collected using a questionnaire that will collect information about socio-demographics of the adolescents along with evaluation of malnutrition through BMI for age.

Time required:

It is anticipated that it will take almost 15-20 minutes to collect data from a student.

Voluntary participation:

Your child's participation in this study is voluntary. It is up to you to decide whether or not your child will take part in this study. If you decide to allow your child to take part in this

study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

Confidentiality:

Data will be completely anonymous and reported in aggregate form. Your child's name will not be collected at any time. After data collection, the questionnaires will be password-protected. Once submitted the researcher will not be able to withdraw responses due to anonymity and de-identified data.

Risks:

There will be no serious risk linked with study.

Benefits:

There will be no direct benefit of this study but it will help to highlight the major predictors of malnutrition among adolescents.

Payment:

No payment will be given for participating in the study.

Right to withdraw from the study:

You have the right to withdraw your child from the study at any time without penalty.

Contact information:

If you have questions about the study, please contact the following individual

Dr. _____

Contact # _____

Consent

I have read and I understand the provided information and have had the opportunity to ask questions. 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 understand that I will be given a copy of this consent form. I voluntarily agree to allow my child to take part in this study.

Name of Guardian _____

Signature of Guardian _____

Date _____ (DD/MM/YY)

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this Informed Consent Form (ICF) has been provided to the participant.

Name of Researcher/person taking the consent _____

Signature of Researcher /person taking the consent _____

Date _____(DD/MM/YY)

ANEXURE-II

Purposed Budget

Budget Item	Transport	Stationery and Internet	Printing	Publishing
Pilot testing	500 Rs/-	5000 Rs/-	5000 Rs/-	-
Data collection	10,000 Rs/-	7,000 Rs/-	-	-
Thesis writeup	1,000 Rs/-	5,000 Rs/-	8,000 Rs/-	8,000 Rs/-
Total expenditure	16,000 Rs/-	17,000 Rs/-	13,000 Rs/-	8,000 Rs/-
Grand total	54,000 Rs/-			

Appendix-D Gantt Chart

Activities	March 2022	April 2022	May 2022	June 2022	July 2022	August 2022	September 2022
Literature search							
Synopsis writing and IRB approval							
Pilot testing							
Data collection and entry							
Data analysis							
Write-up							
Thesis submission							

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

No. MSPH-IRB/12-34
Date: 01st Oct, 2021

TO WHOM IT MAY CONCERN

This is to certify that **Muhammad Hassaan Sajjad S/O Sajjad Ahmad** 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 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 research topic which has already been approved by the Institutional Review Board (IRB) is **“Prevalence and predictors of Malnutrition among school going adolescents of Kotli Sattian District Rawalpindi”**.

Please provide him necessary help and support in completion of the research project. Thank you.

Sincerely,



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



Email: deoserwp@gmail.com

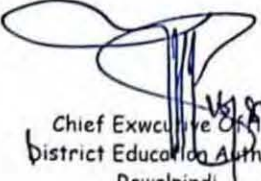
Phone: 051-5535935

No. 2887 /G-I

OFFICE OF THE
DISTRICT EDUCATION OFFICER (SE)
RAWALPINDI
Date 16-8 /2022

SUBJECT: PERMISSION TO CONDUCT RESEARCH IN SCHOOLS OF TEHSIL KOTLI SATTIAN.

This is certified that Muhammad Hassaan Sajjad S/O Sajjad Ahmed is a student of M.Sc (PH) Final Semester at Al-Shifa School of Public Health PIO, Al-Shifa Trust Rawalpindi. He is allowed to conduct a research project as part curriculum & compulsory requirement for the award of degree by the Quaid-e-Azam University, Islamabad. His approved topic of research is "Prevalance and predictors of malnutrition among school going adolescents of Tehsil Kotli Sattian District, Rawalpind".


Chief Executive Officer
District Education Authority
Rawalpindi