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ASSESSMENT OF BODY MASS INDEX AND DIETARY PATTERN OF COLLEGE STUDENTS RESIDING IN RAWALPINDI AND ISLAMABAD

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ABSTRACT

Dietary practices and nutritional status can affect a person's health in either a favorable or bad way. The major cause of the bad eating habits of college students is their sensory impressions. In order to evaluate the nutritional status and dietary habits of college students living in Rawalpindi and Islamabad, this research was conducted. The study, which involved 600 students from several institutions in twin cities, was cross-sectional. The technique of purposive sampling was used to gather data. Using a questionnaire that included demographic data, anthropometric measurements, clinical signs and symptoms, and food frequency, the respondents' nutritional status was evaluated. In order to evaluate the data, SPSS version 23.0 was used. The paired t-test was applied. The confidence interval was chosen at 95% with a significant level at p value <0.05 after frequencies and percentages were computed. Every college student in our study was between the ages of 16 and 18. The nutritional condition of the majority of students (65.3%) was normal. 3.5% were obese, 14.4% were overweight, and 17.8% were underweight. Students' eating habits showed that those who ate a healthy, balanced diet, were physically active, and slept well had good nutritional status, while those who skipped meals, ate poorly, and were not physically active or slept well were underweight, some were overweight, and a very small percentage were obese. The projected average needs and/or acceptable intakes for all the essential food categories were not met by either gender. It is normal for both male and female students to regularly consume unhealthy foods. It would be advisable that institutions introduce regular programs on nutrition, which are highly emphasized on encouraging proper nutritional habits.

1.0 INTRODUCTION:

The nutritional status determines how effectively the body's need for vital nutrients are being satisfied. It is caused by a number of interconnected elements that are impacted by an individual's physical health as well as the type and quantity of food they consume. In order to determine the nutritional status of an individual or population group that is impacted by nutrient intake and use, nutritional assessment essentially consists of the ABCD: Anthropometric, Biochemical, Clinical, and Dietary examination **(Morley *et al.*, 2021)**. Human health and growth at every stage of life are based on nutrition, which molds and impacts survival, mental and physical development, economic production, and general healthy living. When nutrient needs and consumption are similar, nutritional health is preserved. Normal nutritional status may be maintained with sufficient food consumption and appropriate nutrient use. Malnutrition is a serious public health issue in Pakistan, nevertheless, much as in other developing nations. Unwanted nourishment that results in illness is called malnutrition. It is brought on by an excess, imbalance, or deficiency of nutrients in the diet. It encompasses both overnutrition and undernutrition. Malnutrition may be secondary, meaning it may also be caused by a mistake in metabolism, an interaction between nutrients, or a combination of nutrients and medications used for therapy, or it may be primarily caused by an inadequate supply of one or more important nutrients. Inadequate food consumption and poor nutrient utilization can result in malnutrition. "Malnutrition" include both underweight and overweight individuals. The identification of population groups at risk for deficiencies, the development of persuasive public health nutrition programs for diseases related to nutrition, the prevention of such diseases, and the evaluation of the efficacy of such interventions all depend on data regarding nutritional status, or nutritional assessment **(Elmadfa *et al.*, 2014).**

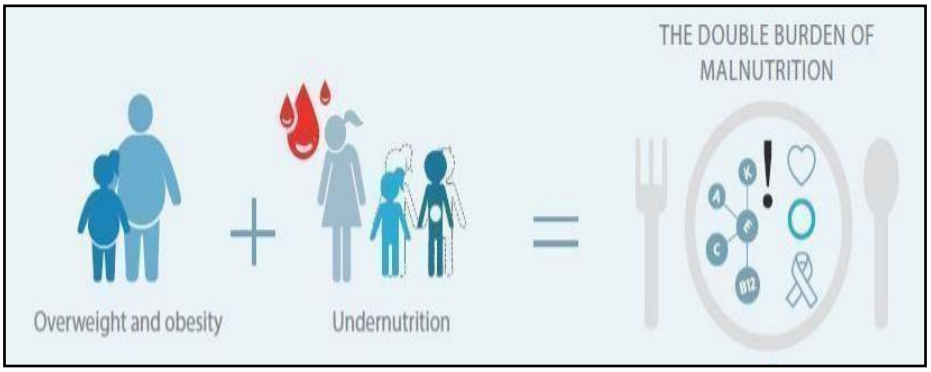

Figure: Double Burden Of Malnutrrition

According to the Global Nutrition Report-2020, Asia has made the least amount of progress toward meeting the global nutrition objectives. A number of the region's nations are on track to reach the nutritional concern objective. When combined, undernutrition and overnutrition destroy both developing and developed countries and jeopardize the advancement and accomplishment of several international health goals.

Dietary pattern (DP) is the basic profile of food and nutrient consumption that is defined by customary eating patterns. A more complete understanding of a population's eating habits can be achieved by analyzing dietary trends. It could be more accurate in forecasting the likelihood of illnesses and nutritional deficiencies that negatively affect a person's capacity for work performance, stamina, focus, and compromised defense mechanism. It also describes the amount, combinations, and frequency of common meals and drinks that women and other demographic

groups consume. Lately, instant and processed meals have become more popular for reasons of entertainment, convenience, and fulfillment. Regular consumption of these meals frequently results in calorie imbalance and safety issues. The primary causes of teenage health issues including obesity and non-communicable illnesses include unhealthy eating habits, sedentary lifestyles, and physical inactivity. As a result, obesity is more common in Pakistan **(Al-Hazzaa *et al.,* 2011)**.

During the adolescence period, in addition to growth rate, nutritional requirements also rise. Requirements for some nutrients are greater in teenagers than in any other age group **(WHO, 2000).** Of all age groups, adolescents have the highest energy needs, requiring 2420 kcal per day **(Woodruff & Duffield, 2000)**. Students are more likely to consume unhealthy foods at this period because they spend more time away from home and develop bad eating habits, which raises their risk of malnutrition, nutritional deficiencies, and other nutrition-related diseases in the future **(Ahmad *et al.,* 2020)**. During this time, dietary preferences shift, and teenagers are drawn to fast food, sugary drinks, fried meals, and other similar fare since these establishments, such as restaurants and college canteens, serve these foods and draw students to them.

Poor nutrition can also induce mental retardation, which will differ in male and female pupils based on their eating patterns **(Manju *et al.,* 2007)**. However, adolescence is a time of numerous physiological and behavioral changes. Inadequate dietary intake can also lead to a rise in body fat, which increases the risk of obesity, which primarily affects females due to hormones and steroids Obesity significantly increases the risk of chronic health conditions in adolescents, including diabetes and cardiovascular diseases. All of this is dependent on eating habits and food choices. Unhealthy eating practices, such as missing meals and eating more fast food, snacks, and energy-dense, highly appetizing foods, have been linked to psychological stress **(Allegri *et al.,* 2011)**. Family dinners are especially crucial in creating healthy eating habits and serve as a gathering point that fosters strong connections that extend beyond health settings **(Pearson *et al.,* 2009)**. Unfortunately, our educational system fails to give information about nutrition **(Donini *et al.,* 2017)**, physical exercise, and stress management, all of which are essential components of a healthy lifestyle.

There isn't much information accessible on college students in Rawalpindi and Islamabad. Previously, only a few research on teenage females living in Islamabad's rural districts were undertaken. The purpose of this study was to determine the nutritional status and dietary pattern of college students in Islamabad and Rawalpindi using anthropometric measurements (i.e. height, weight, head circumference, BMI, and body circumferences), as anthropometry is commonly used to assess nutritional status, growth, and development in adolescents and correlate their nutritional status with their dietary intake. The study's findings offered information on their nutritional status and identified factors influencing their food intake and lifestyle pattern. This study will help us enhance the nutritional status of college students by advising and delivering programs that increase awareness among college students about the impacts of unhealthy eating habits and the need to maintain a healthy nutritional status.

1.1 OBJECTIVES:

The primary objectives of this study were to:

1. Assess the dietary pattern and nutritional status of college students.
2. Explore the relationship between dietary patterns and nutritional status among students.
3. Determine the appropriate and actionable areas of change in students' diet and lifestyle to improve their health and well-being.

2.0 REVIEW OF LITERATURE:

Nutrition is essential for young people's growth. Eating patterns established during adolescence and early adulthood shape long-term behavior and have a significant impact on adulthood. Obesity is becoming increasingly common in both developing and developed countries. One of the primary causes of obesity is dietary changes, both in quantity and quality, which have grown increasingly "Westernized," and are blamed for increasing the incidence of both overweight and obesity across all age categories. College students are heavily exposed to bad eating habits, which contribute to body weight growth. Obesity affects more women than males, according to the World Health Organization. Nevertheless, research made on college students showed more obese boys as compared to girls.

In Saudi Arabia, another cross-sectional study has been conducted to explore the state of overweight and obesity among male college students living in the Kingdom of Saudi Arabia and the correlation between the body weight status and composition of the students and their eating behaviors. Four-hundred and thirty-five male undergraduate students between the age of 18 years to 24 years were recruited randomly in the College of Health Sciences, Qassim University, Saudi Arabia. A questionnaire about students' eating habits was completed, and their body mass index (BMI), body fat percentage (BF%), and visceral fat level (VFL) were measured. The data were examined with SPSS statistical software, and variables were tested using the Chi-square test. The findings revealed that 21.8% of the pupils were overweight, while 15.7% were obese. Total body fat exceeded normal limits in 55.2% of the subjects, whereas VFL was increased in 21.8 percent of the participant. The frequent modes of eating were to eat meals with the family, to eat twice a day (with breakfast), and also have snacks and fried food. Fruits and vegetables, with exceptions representing dates, were of low consumption by most of the students. Good positive correlations were detected between BMI, body fat percentage (BF%), and VFL ($P < 0.001$). Moreover, BMI and VFL indicated a highly adverse relationship with the regularity of having meal together with family. The same trends were found between BMI and the frequency of snacking and between VFL and the habitual consumption of dates. The findings revealed the need for strategies and coordinated efforts at all levels to minimize the propensity of overweight, obesity, and increased body fat, as well as encourage healthy eating habits in our kids **(Al-Rethaiaa *et al.*, 2010)**.

Meyer *et al.,* 2011 found that students consume too many energy-dense, high fat, and high sugary meals, which is associated to the development of obesity, which is then linked to comorbidities such as hypertension, type 2 diabetes, and cardiovascular disease.

Al-Hazzaa *et al.,* 2011 performed a study in which 600 teenagers answered questions on their socio-demographic features, lifestyle behaviors, eating habits, frequency of food intake, health, and food awareness knowledge. The sample students were selected randomly. The BMI classes were determined by measuring weight and height with portable standing electronic scale and portable stadiometer respectively. Among female students, 28 percent of the cases were underweight, as opposed to 11 percent in the male students. The survey established that there were 49 percent and 64 percent of normal waist circumferences of male with respect to female students. The female students were found to be more prone as compared to boys to take part in regular physical activity (15%). Sleeping hours were more in the case of male students as compared to girls. About 46 percent and 55 percent eating habits of male and female students respectively indicated eating fast food at least once a week. Among the female students, meal skipping was predominant (72%). It was revealed that a big percentage of the male students (72%) claimed to have inadequate consumption of vegetables and fruits. The main reason why

males consumed fast-food was convenience (31%) whereas 32% of females stated that it is a choice. The results revealed that female students had better knowledge of nutrition as compared to males.

Studies have shown that students are more susceptible to bad eating habits and are known to consume "junk food." These bad eating habits are likely the result of a lack of understanding of the long-term consequences of their eating habits. Other studies have related students' lifestyles, particularly breakfast eating, to their mental capacities, which are reflected in academic success. The diet of vegetables, fruits, low-fat dairy, wholegrains, nuts, and physical activity has been demonstrated to be protective against obesity and other chronic illnesses **(Zhao *et al*., 2011)**.

Adolescents' growth and development depend heavily on their dietary consumption. Poor food choices and low nutritional intake cause widespread nutrition-related illnesses, which frequently raise the risk of a variety of diseases. A cross-sectional research was done to analyze demographic questionnaires with lifestyle and health-related questions, as well as a 3-day food diary to assess nutritional consumption. Female adolescents consumed substantially less total energy than male adolescents. Male participants drank considerably more micronutrients than female adolescents, but females consumed more caffeine than male participants. Both men and women did not satisfy the projected average vitamin and mineral requirements or consume acceptable amounts of these nutrients **(Rifat-uz-Zaman & Ali, 2013).**

During college, bad food patterns and low levels of physical exercise predispose students to future health-related concerns **(Aljadani *et al.,* 2013)**, resulting in a rise in overweight and obesity between the ages of 16 and 18. Adolescence, as a transitional stage of life, offers a unique chance to promote and improve future health and wellness. Another study found that aberrant weight states, such as underweight, overweight, obesity, and central obesity, were associated with an elevated risk of anemia **(Rathi *et al.,* 2015)**.

Paracha *et al.,* 2016 conducted comparative research to analyze the nutritional status, dietary behaviors, and physical activity of teenagers attending public and private schools in Karachi, Pakistan. A random sample of 201 teenagers (101 boys and 100 girls) was chosen to assess their weight, height, waist and hip circumferences, percent body fat, and lean body mass. Dietary habits, socioeconomic level, the frequency and kind of physical activity, and their reactions were documented. Adolescents attending private schools showed better nutritional status, eating habits, and physical activity levels compared to those in public schools. Their better performance was partly linked to parental education and income. The study also found that adolescent girls in both sectors were more prone to nutritional deficiencies, often because of poor dietary choices. This vulnerability might be due to negative attitudes and behaviors, peer pressure, food preferences, autonomy to choose junk foods over healthy options, or parental gender bias that favors boys.

Khan *et al*., 2016 Conducted descriptive cross-sectional research on school and college going students in Karachi, Pakistan in state and private schools and colleges. Under the auspices of convenience sampling, a sample size of 171 students between the ages of 14 to 19 years, both males, and female, was randomly chosen. The junk food intake of most students was high and of all kinds including chips, packaged fruit juices, flavored milk, ice creams, and frozen yogurts at homes and at schools. These foods were full of sugar, fats, cholesterol and bad substances. Major trends and patterns in dieting, eating and health in both the privileged and the less privileged students were similar. The research indicated that a high number of teenagers showed lack of physical activity, unhealthy eating habits, and they were overweight at whatever socioeconomic status and ethnic group. A positive contribution of the study was the increased level of physical activity of

school-going adolescents when compared to college students designating mid-adolescence stage as a decisive moment in health promotion.

Khan *et al*., 2019 performed descriptive cross-sectional study, which was applied in Multan District and data was collected in other schools. Children between age 3-18 years were recruited through simple random sampling technique. Weight, height, and body mass index (BMI) were measured with trained nutritionists, lifestyle patterns, physical exercise and eating choices were also assessed. A sample population size made up of 1,872 children was analyzed and 10 percent of them were found to be overweight and 5 percent obese. The result indicated that obesity is more prevalent by a margin among children in private school than in the public school. The respondents most frequently said that they eat fast food once or twice a week, an aspect that led to higher rates of overweight and obesity. On the whole, the research indicated worrying prevalence of overweight and obesity in children attending both the Government and the Private educational institutions in Multan that was directly linked to poor eating habits, the lack of physical activity and the sedentary habit.

Pop *et al*., 2021 conducted a cross-sectional study to identify dietary habits and health-related behaviors among students. A number of 403 students participated in the study and provided answers to a specially constructed questionnaire. Students usually slept 6 h/day, and one-third had self-imposed diet restrictions to control their weight. It was observed that students generally did not meet the recommended intake of fruit and vegetables, and there was a notable decline in the consumption of bread and vegetables. and significant increases in fat intake and cigarette smoking. A positive correlation was identified between age and weight and age and BMI, meaning that, as students aged, their weight and BMI increased. The more students slept per night, the less fast food they consumed. About one-third of students were found to have a healthy diet. More than half of the students ate cereals daily, 32.01% ate fruits daily, and 29.28% ate dairy every day. It was found that more female students consumed adequate quantities of fruit and vegetables than their male counterparts, while the consumption of milk and milk substitutes was low. So the study concluded that frequent consumption of unhealthy items is common among both male and female students.

Mizia *et al*., 2021 conducted a cross-sectional study in Poland to characterize youth nutrition behavior and nutrition related knowledge. The study group consisted of 307 high school students, 59% females and 41% males, aged between 15 and 19. The males showed a significantly higher intensity of adverse health traits compared to the females. More than half of the males presented insufficient knowledge about food and nutrition. Regardless of gender, the study showed a positive correlation between adolescents' level of knowledge and the healthy diet pattern and a negative correlation between their level of knowledge and the unhealthy diet pattern.

3.0 MATERIALS AND METHODS:

3.1. Study Design:

The study was a cross-sectional, it is the type of study that measures the exposure and outcome of a sample in a given time. Such study involves looking at data from a population at one specific point in time.

3.2. Sampling Technique:

Purposive sampling was used in the research study. It is a non-probability sampling that involves the samples being drawn from that part of the population that is close to hands and easy to interview.

Inclusion Criteria: Male and female intermediate college students, between ages 16-18 years who were willing to participate.

Exclusion Criteria: Male and female intermediate college students under 16 years of age and over 18 years of age.

- College students residing outside Rawalpindi and Islamabad.

3.3. Sample Size:

The study included a total of 600 subjects, in which half of the students (300) were from Islamabad (150 males and 150 females) and remaining half of the students (300) were from Rawalpindi (150 males and 150 females). The study data was collected over the time period of three months (April 2022-June 2022).

3.4. Ethical Approval:

Ethical approval was obtained from Research Committee, University Institute of Diet and Nutritional Sciences (UIDNS), University of Lahore, Islamabad Campus. Consent to conduct the study was taken by the concerned institution and from students, prior to collecting the data.

3.5. Data Collection:

Data was collected from Superior College, Punjab College, KIPS College & Exploreville College through a pre-tested structured questionnaire. The questionnaire consisted of five sections; details are given below:

- Demographic Information: includes information about name, gender, age, father's occupation, parent's education, and income.
- Anthropometric Data: includes height, weight and BMI. Height was measured in cm with the help of Stadiometer and the weight in kg by using electronic scale. Body mass index (BMI) was calculated using WHO body mass index classification.
- Clinical History: includes presence of disease, food allergy/intolerance, and use of medication or supplements.
- Assessment of Physical Activity: includes different levels of physical activity.
- Dietary Data: includes questions related to dietary pattern and food consumption through food frequency method.

3.6. Data/Statistical Analysis:

The collected data was entered into Microsoft Excel 2019 and analyzed using the Statistical Package for the Social Sciences (SPSS) software, Version 23. Linear regression and Analysis of Variance (ANOVA) tests were performed. The software was utilized to compute frequencies and percentages for various variables.

4.0 RESULTS AND DISCUSSIONS:

4.1. Frequency distribution based on Age:

A total of 600 students participated in the study. Out of these 50%% were females and 50% were males, the percentage of which is represented in the pie chart given below. The students who participated in the study had their ages from 16 to 18 years. Bar graph shows that 6.0% males and 8.5% females were of age 16, 28.0% males and 20.5% females were of age 17 and 16.0% males and 21.0% females were of age 18. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

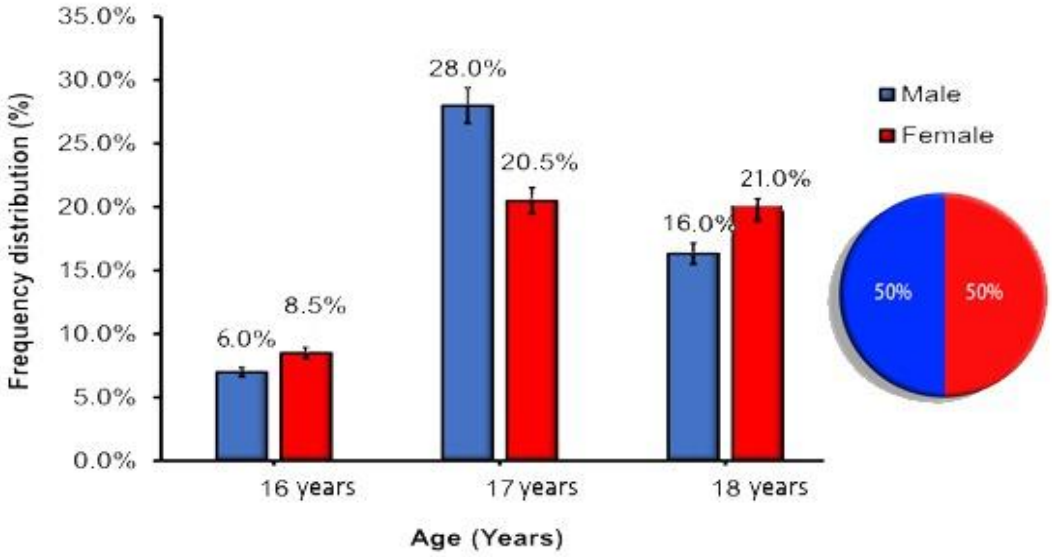

Figure 1. Frequency distribution of participants based on age groups (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.2. Frequency on the basis of monthly family income:

The frequency distribution here was conducted on the basis of monthly family income. Monthly family income of 5.2% males and 6.0% females was less than Rs. 40,000, 24.8% males and 26.0% females was between Rs. 40,000 to Rs. 80,000, and 20.0% males and 18.0% females was above Rs. 80,000. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

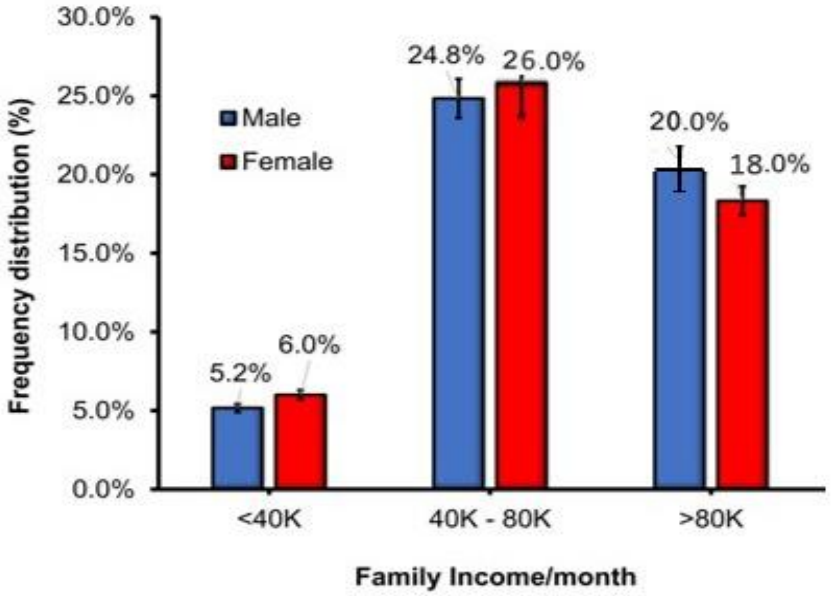

Figure 2. Frequency distribution of participants based on family income/month (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.3. Frequency on the basis of Family education:

It is comprised on two goups related to frequency distribution based on mothers's education and father's education. Father's of about 44.0% males and 45.3% females were educated, and father's of 7.3% males and 3.3% females were uneducated. Mother's of 41.8% males and 40.0% females were educated, and mother's 9.5% males and 8.7% females were uneducated. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

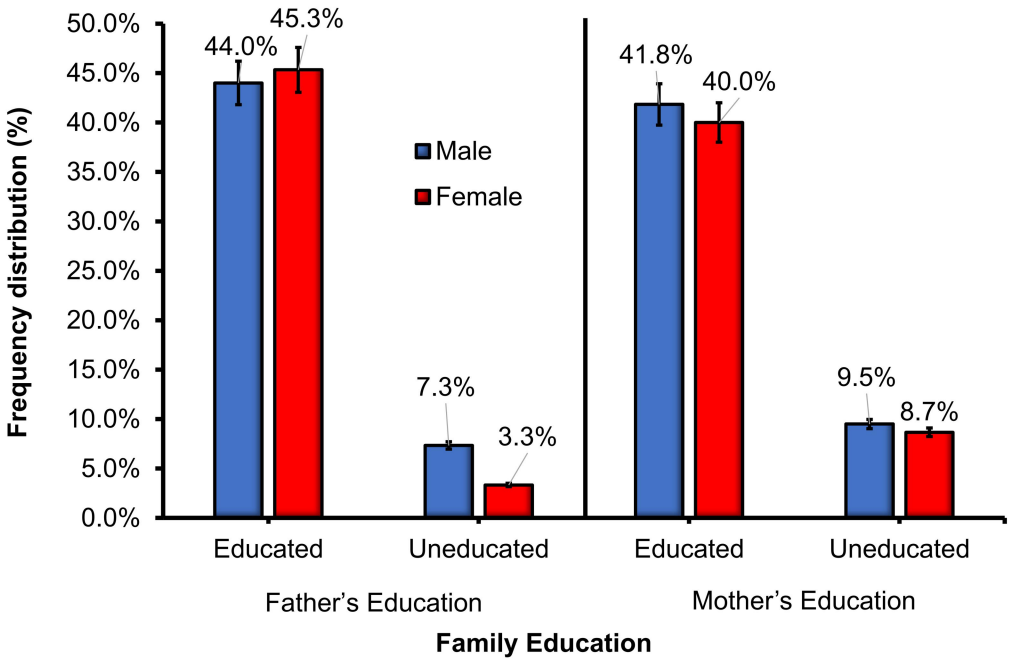

Figure 3. Frequency distribution of participants based on family education (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.4. Frequency on the basis of Residence area:

There were total 600 students who participated in the study. Out of which 50% were from Islamabad (25.0% females and 25.0% males) and 50% were from Rawalpindi (25.0% females and 25.0% males), the percentage of which is represented in the pie chart given below.

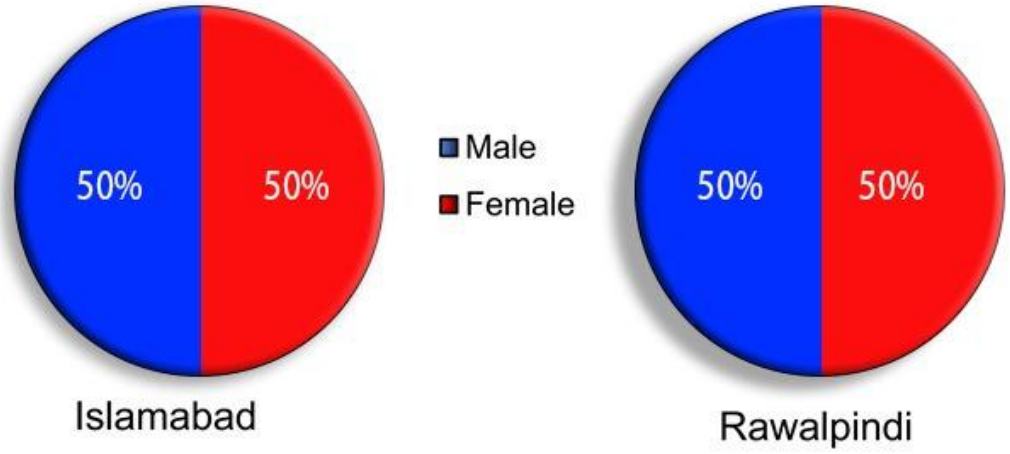

Figure 4. Frequency distribution of participants based on residence area (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.5. Frequency distribution based on BMI:

Our study included 600 male and female students, aged between 16-18 years who participated in this study. About 9.6% male and 8.2% females were underweight, 31.5% males and 33.8% females were normal, 7.7% males and 6.7% females were overweight, 2.2% males and 1.3% females were obese. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

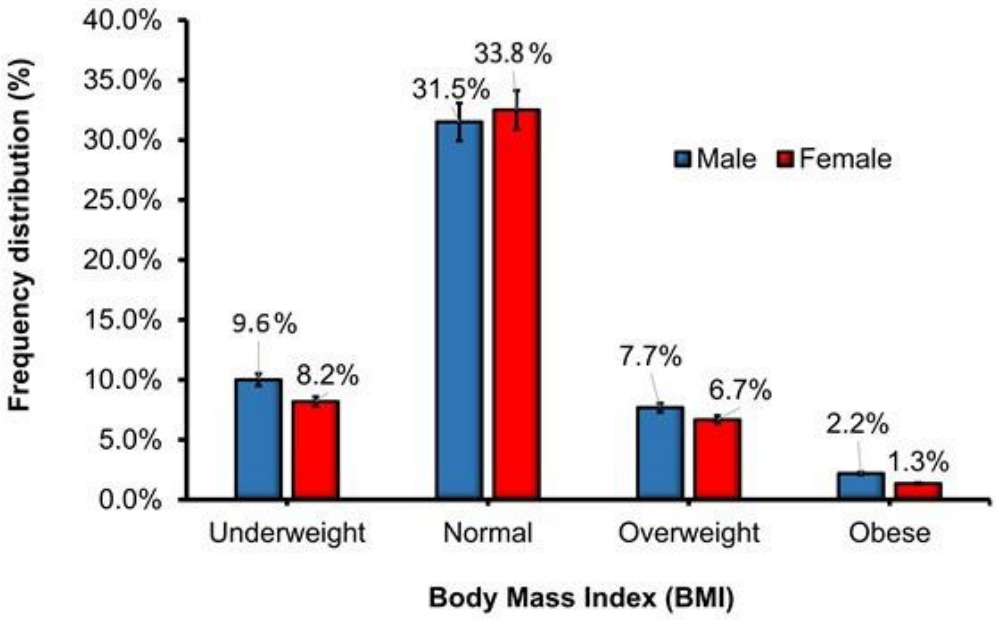

Figure 5. Frequency distribution of participants based on body mass index (BMI) (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.6. Frequency distribution of male participants on the basis of Clinical history:
The frequency distribution here was conducted on the basis of clinical history of male participants. About 4.0% male participants had disease and 46.0% were healthy. 3.0% males had food allergy and 47.0% had no food allergy. 10.2% males were taking supplements and 39.8% were not taking any supplements. 6.5% males were taking medications and 43.0% were not taking any medication. 43.5% male participants were satisfied with their body weight and 9.5% were not satisfied with their body weight. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

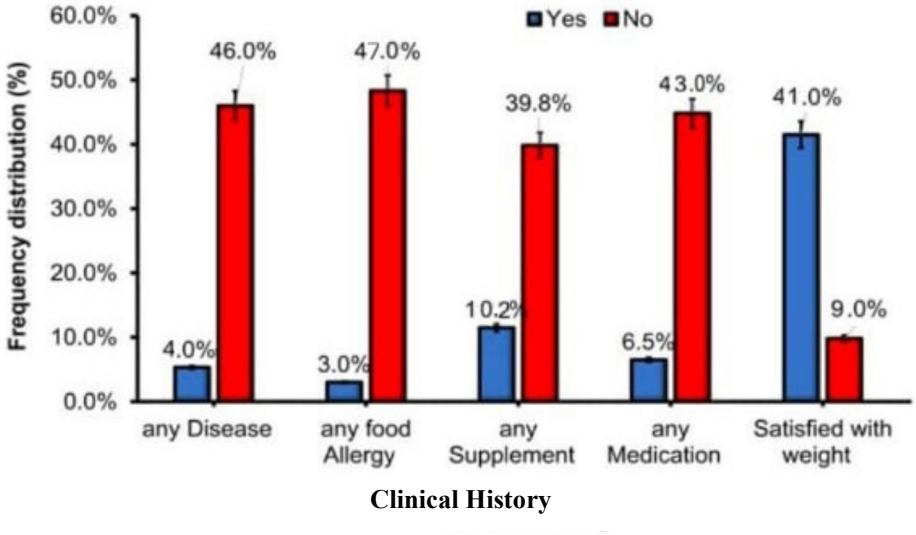

Figure 6. Frequency distribution of male participants based on clinical history (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error

4.7. Frequency distribution of female participants on the basis of Clinical history:
The frequency distribution here was conducted on the basis of clinical history of female participants. About 9.5% female participants had disease and 40.5% were healthy. 4.8% females had food allergy and 45.2% had no food allergy. 25.0% females were taking supplements and 25.0% were not taking any supplements. 4.5% females were taking medications and 45.5% were not taking any medication. 36.3% female participants were satisfied with their body weight and 13.7% were not satisfied with their body weight. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

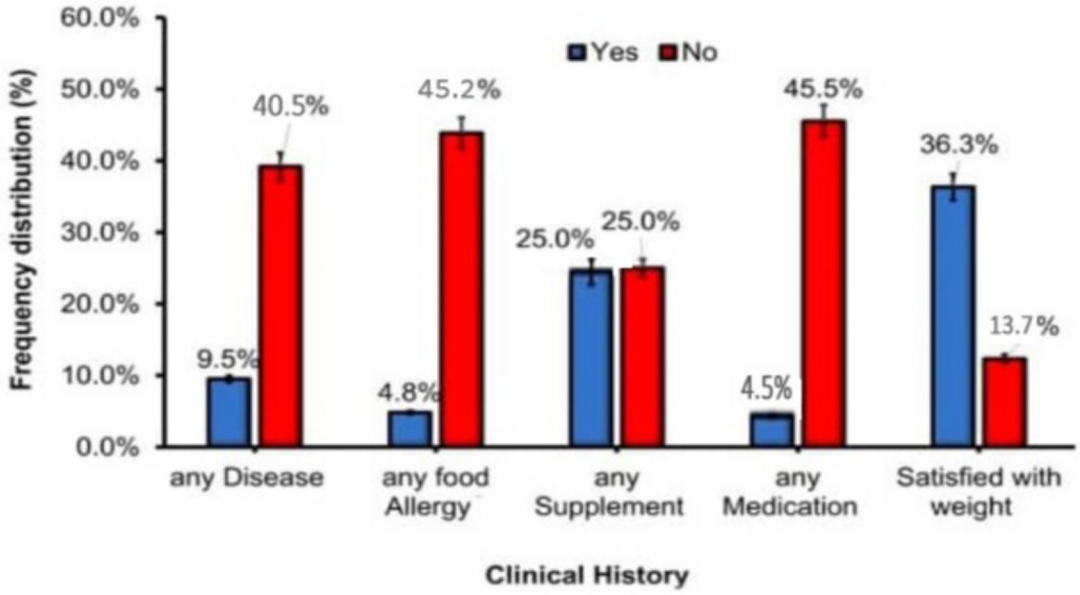

Figure 7. Frequency distribution of female participants based on clinical history (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.8. Frequency Distribution On The Basis Of Dietary Pattern:

The frequency distribution here was conducted on the basis of dietary pattern which included frequencies such as 2–3 times per day, once daily, more than 2–3 times per week, and rarely.

4.8.1. Frequency distribution based on Carbohydrates consumption:

About 80.5% participants were consuming carbohydrate foods 2-3 times a day, 11.8% were consuming carbohydrate foods once a day, 5.7% were consuming carbohydrate foods >2-3 times per week, and 2.0% participants were consuming carbohydrate foods rarely. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.8.2. Frequency distribution based on Protein consumption:

About 11.3% participants were consuming protein foods 2-3 times a day, 29.8% were consuming protein foods once a day, 54.2% were consuming protein foods >2-3 times per week, and 4.7% participants were consuming protein foods rarely. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.8.3. Frequency distribution based on Fruits consumption:

About 8.0% participants were consuming fruits 2-3 times a day, 11.7% were consuming fruits once a day, 76.7% were consuming fruits >2-3 times per week, and 3.7% participants were consuming fruits rarely. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.8.4. Frequency distribution based on Vegetables consumption:

About 3.5% participants were consuming vegetables 2-3 times a day, 15.7% were consuming vegetables once a day, 63.3% were consuming vegetables >2-3 times per week, and 17.5% participants were consuming vegetables rarely. As mentioned in the

figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.8.5. Frequency distribution based on Dairy products consumption:

About 13.5% participants were consuming dairy products 2-3 times a day, 32.8% were consuming dairy products once a day, 41.7% were consuming dairy products >2-3 times per week, and 12.0% participants were consuming dairy products rarely. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.8.6. Frequency distribution based on Packaged or processed snacks consumption:

About 3.2% participants were consuming packaged or processed snacks 2-3 times a day, 7.7% were consuming packaged or processed snacks once a day, 65.0% were consuming packaged or processed snacks >2-3 times per week, and 24.2% participants were consuming packaged or processed snacks rarely. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.8.7. Frequency distribution based on Eating out or Ordering food:

About 8.0% participants were eating out or ordering food 2-3 times a day, 11.8% were eating out or ordering food once a day, 70.2% were eating out or ordering food >2-3 times per week, and 10.0% participants were eating out or ordering food rarely. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

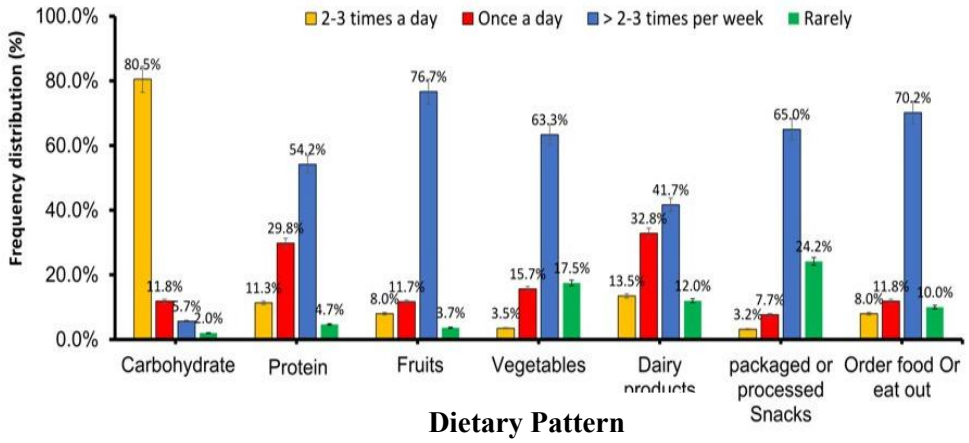

Figure 8. Frequency distribution of all the participants based on Dietary pattern (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.9. Frequency distribution based on Coffee/Tea consumption:

The frequency distribution here was conducted on the basis of daily coffee/tea consumption. About 4.0% males and 10.3% females never had coffee/tea daily, 32.0% males and 27.7% females consume 1-2 cups of coffee/tea per day. 11.0% males and 10.0% females consume 3-4 cups of coffee/tea daily, and 2.8% males and 2.0% females consume more than 4 cups of coffee/tea daily. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

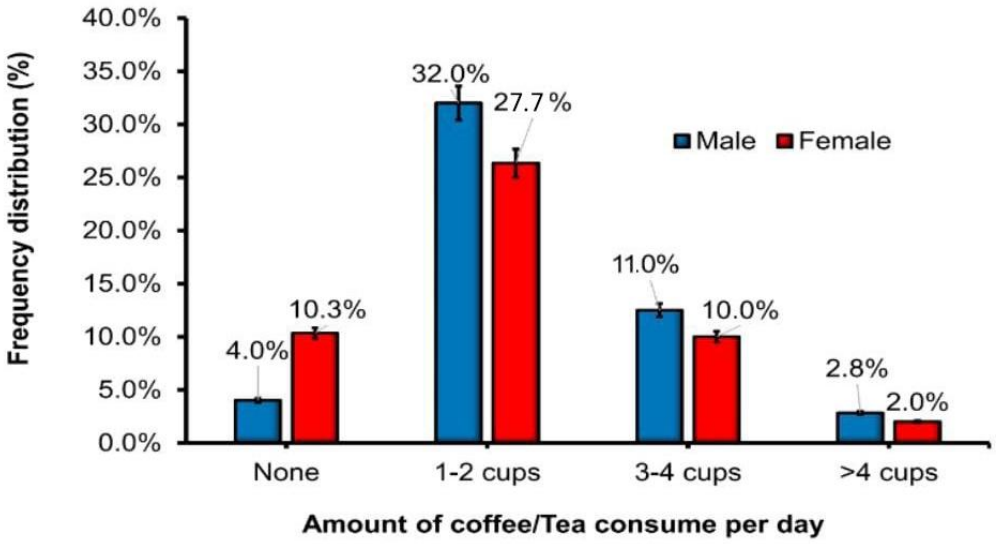

Figure 9. Frequency distribution of all the participants based on amount of tea/coffee consumed per day (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.10. Frequency distribution based on number of Meals per day:

Frequency distribution here was conducted on the basis of number of meals taken by the respondents in a day. 12.0% males and 5.0% females were taking 1 meal/day, 7.0% males and 6.0% females were taking 2 meals/day. 10.0% males and 14.0% females were taking 3 meals/day, 11.7% males and 11.7% females were taking 4 meals/day. 6.5% males and 5.0% females were taking 5 meals/day and only 4.8% males and 8.3% females were taking more than 5 meals/day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

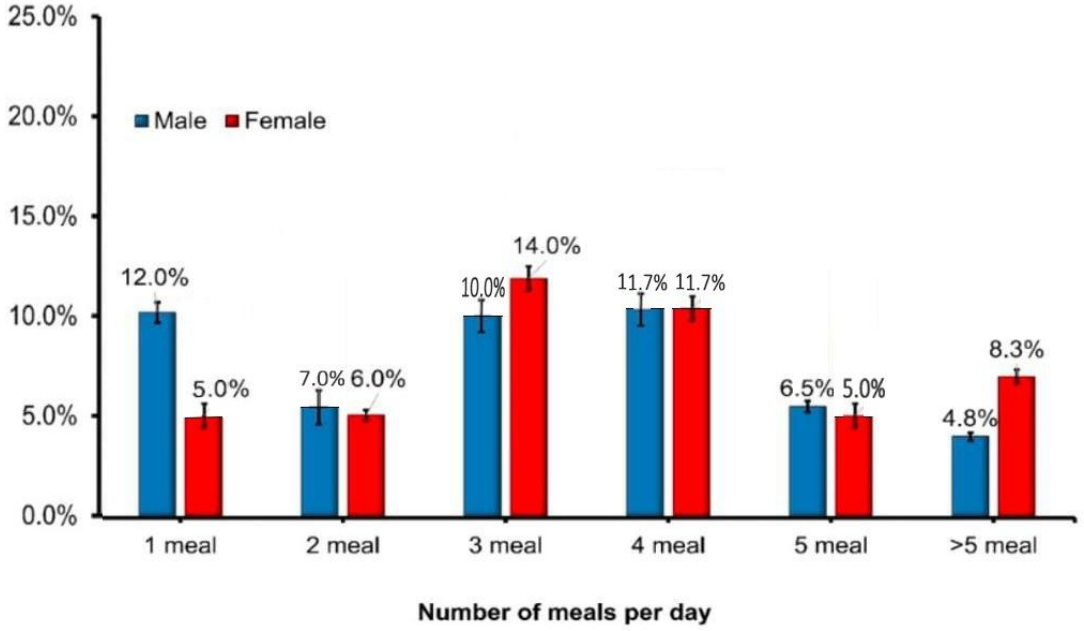

Figure 10. Frequency distribution of all the participants based on number of meals in a day (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.11. Frequency distribution on the basis of Water consumption:

The frequency distribution here was conducted on the basis of daily water consumption. About 8.2% males and 4.3% females only take 2-4 glass of water per day, 19.6% males and 15.7% females take 4-6 glass of water per day. 12.0% males and 20.5% females take 6-8 glass of water and only 10.2% males and 8.2 females take more than 8 glass of water respectively. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

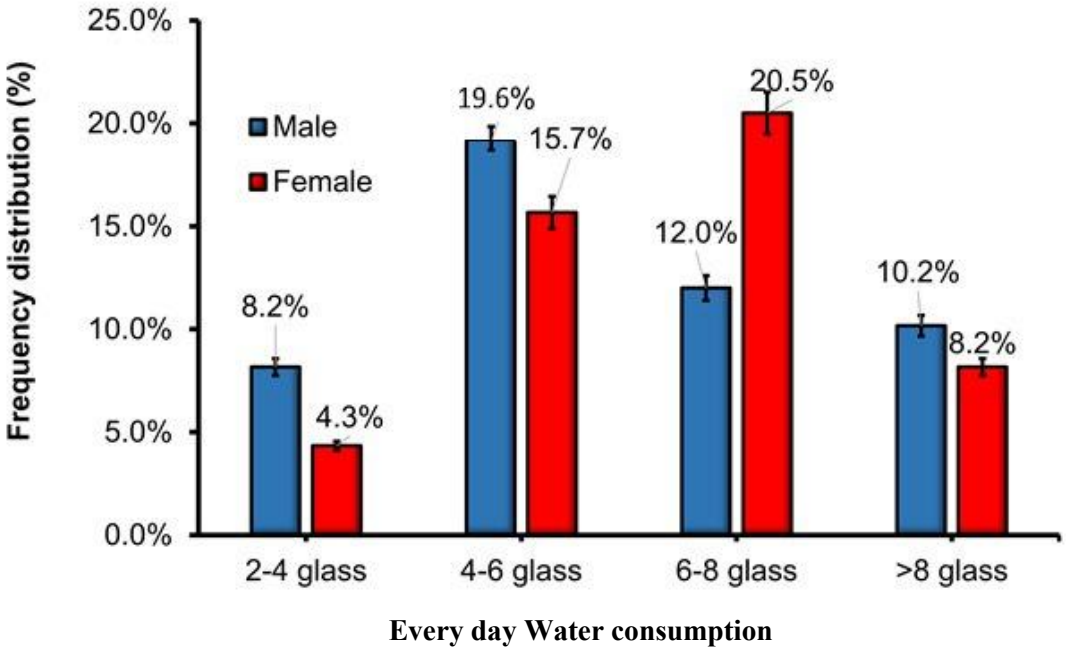

Figure 11. Frequency distribution of all the participants based on water consumed every day (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.12. Frequency distribution based on meal consumption at College cafeteria:

The frequency distribution here was conducted on the basis of meal consumption at college cafeteria. About 4.0% males and 4.3% females never had meal at college cafeteria, 12.5% males and 14.2% females occasionally consume meal at college cafeteria. 24.8% males and 24.2% females often consume meal at college cafeteria and 8.7% males and 7.3% females daily consume meal at college cafeteria. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

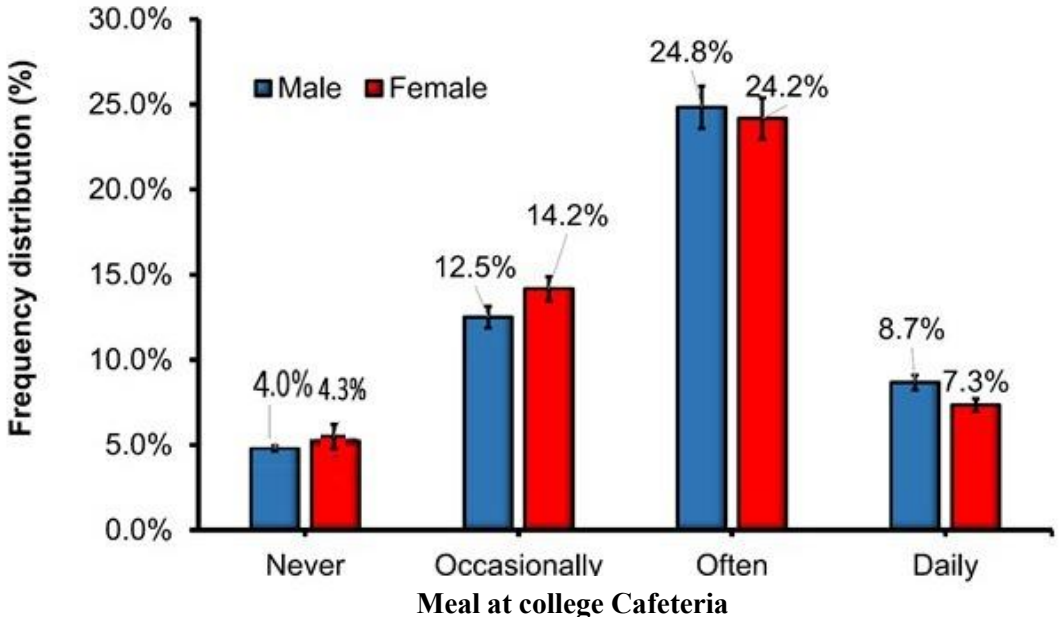

Figure 12. Frequency distribution of all the participants based on consumption of meal at college cafeteria (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.13. Frequency distribution on the basis of Sleeping hours:

Data related to sleeping habits was gathered from each participant which includes sleeping hours from less than 6 hours, 6-7 hours, 8-9 hours, and more than 9 hours. About 8.6% males and 4.8% females had less than 6 hours of sleep, 15.3% males and 18.4% females had 6-7 hours of sleep, 14.3% males and 21.5% females had more 8-9 hours of sleep, and 11.8% males and 5.3% females had more than 9 hours of sleep. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

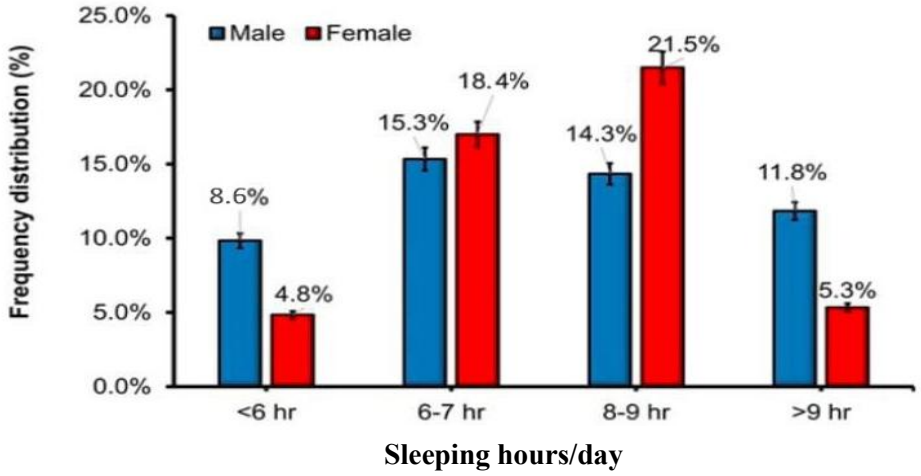

Figure 13. Frequency distribution of all the participants based on sleeping hours (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.14. Frequency distribution on the basis of Physical activity:

Data related to physical activity on daily basis was gathered from each participant which includes sedentary, light, moderate and highly active. About 15.7% males and 22.8% females were sedentary, 20.0% males and 19.7% females were light active. 10.3% males and 6.5% females were moderately active and 4.0% males and 1.0% females were highly active. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

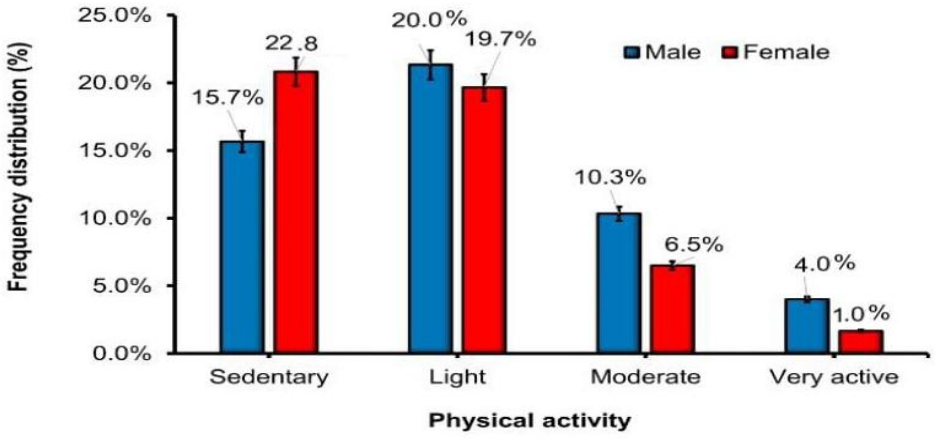

Figure 14. Frequency distribution of all the participants based on physical activity (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.15. Frequency Distribution Based On Food Frequency Questionnaire:

The frequency distribution here was conducted on the basis of food frequency questionnaire which includes once a week, 2–3 times per week, once a day, and 2–3 times a day.

4.15.1. Frequency distribution on the basis of Vegetables consumption:

About 11.5% participants were taking vegetables once a week, 47.7% participants were taking vegetables 2-3 times per week, 24.7% were taking vegetables once a day, and 16.2% were taking vegetables 2-3 times a day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.15.2. Frequency distribution on the basis of Cereals consumption:

About 13.2% participants were taking cereals once a week, 54.8% participants were taking cereals 2-3 times per week, 18.8% were taking cereals once a day, and 13.2% were taking cereals 2-3 times a day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.15.3. Frequency distribution on the basis of Fruits consumption:

About 24.8% participants were taking fruits once a week, 52.3% participants were taking fruits 2-3 times per week, 16.3% were taking fruits once a day, and 6.5% were taking fruits 2-3 times a day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.15.4. Frequency distribution on the basis of Milk and milk products consumption:

The proportions of the people consuming milk and milk products were approximately 14.0%, 23.0%, 54.8%, 8.2% consumed them on a weekly, twice or thrice a week, daily, and 2-3 times a day basis respectively. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.15.5. Frequency distribution on the basis of Meat and meat products consumption:

About 49.2% participants were taking meat and meat products once a week, 36.5% participants were taking meat and meat products 2-3 times per week, 10.8% were taking meat and meat products once a day, and 3.5% were taking meat and meat products 2-3 times a day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

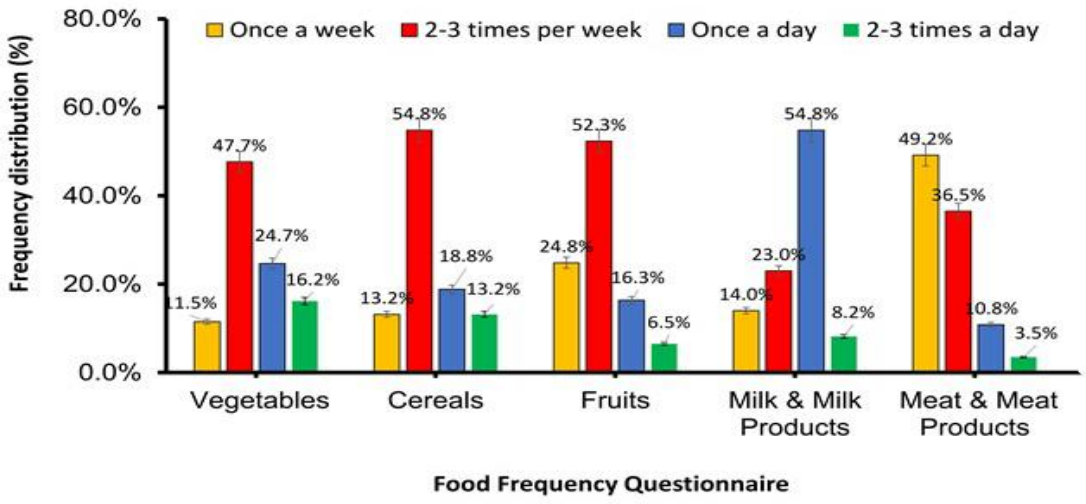

Figure 15. Frequency distribution of all the participants based on Food frequency questionnaire (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

4.16.1. Frequency distribution on the basis of Sweets consumption:
About 40.2% participants were taking sweets once a week, 47.7% participants were taking sweets 2-3 times per week, 8.5% were taking sweets once a day, and 3.7% were taking sweets 2-3 times a day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.16.2. Frequency distribution on the basis of Bakery items consumption:
About 54.7% participants were taking bakery items once a week, 30.7% participants were taking bakery items 2-3 times per week, 8.2% were taking bakery items once a day, and 6.5% were taking bakery items 2-3 times a day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.16.3. Frequency distribution on the basis of Ice-cream consumption:
About 65.0% participants were taking ice-cream once a week, 28.7% participants were taking ice-cream 2-3 times per week, 5.8% were taking ice-cream once a day, and 0.5% were taking ice-cream 2-3 times a day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.16.4. Frequency distribution on the basis of Nuts consumption:
About 9.2% participants were taking nuts once a week, 48.5% participants were taking nuts 2-3 times per week, 27.7% were taking nuts once a day, and 14.7% were taking nuts 2-3 times a day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

4.16.5. Frequency distribution on the basis of Fats consumption:
About 11.0% participants were taking fats once a week, 21.5% participants were taking fats 2-3 times per week, 63.7% were taking fats once a day, and only 3.8% were taking fats 2-3 times a day. As mentioned in the figure below error bar represents standard deviation of mean data (n=600). 95 % confidence interval was taken with 5 % error.

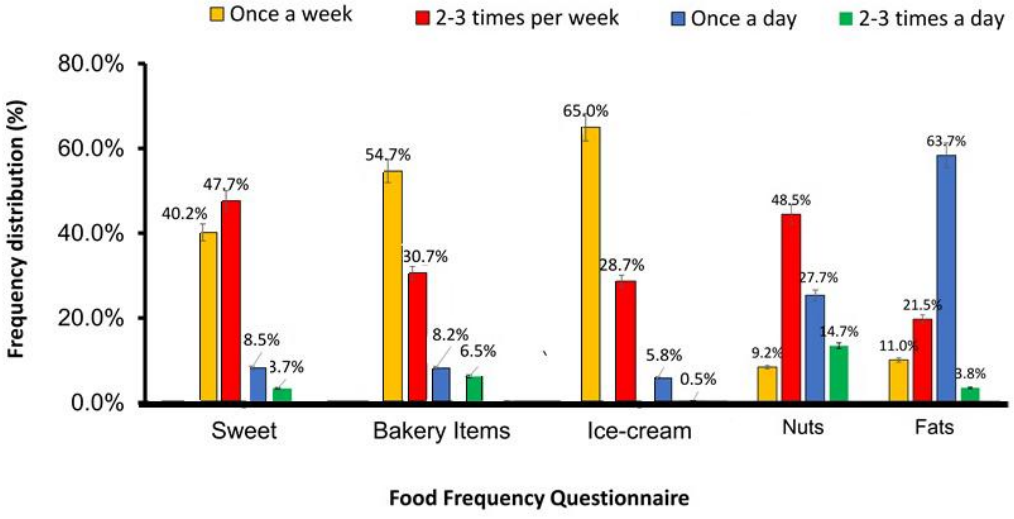

Figure 16. Frequency distribution of all the participants based on Food frequency questionnaire (n=600). Error bar represents mean ± standard deviation. 95 % confidence interval was taken with 5 % error.

Table 1: Linear regression analysis of demographic analysis with gender as independent variable

Table 1 shows linear regression of gender as an independent variable in which age, education of mother and father, and address showed non-significant results. Income showed significant result which is less than the value of p=0.05.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.820	.217		12.993	.500
	Age	.066	.078	.041	.842	.400
	Gender	.046	.045	.050	1.019	.309
	Income	.069	.032	.105	2.121	.035
	Father's Education	.042	.054	.057	.790	.430
	Mother's Education	.052	.051	.071	1.021	.308
	Address	.006	.053	.007	.120	1.904
a. Independent Variable: Gender						

Table 2: ANOVA TABLE

The result in ANOVA table showed that over all study is non-significant regarding gender which is p=.080. Gender was taken as independent variables.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.456	7	1.208	2.415	.080[b]
	Residual	211.042	422	.500		
	Total	219.498	429			
a. Independent Variable: Gender b. non-significant						

Table 3: Linear regression analysis of anthropometric measurements with gender as independent variable

In our results Height showed highly significant result which is less than p=0.05. Weight and BMI showed the non-significant results.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.346	.233		5.769	.000
	Height (cm)	.106	.031	.149	3.382	.001
	Weight (kg)	.102	.058	.091	1.766	.078
	BMI	.396	.062	.328	6.372	.080

a. Independent Variable: Gender

Table 4: ANOVA TABLE

ANOVA table showed the non-significant results of gender as an independent variable which is more than p=0.05.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.999	3	13.000	31.064	.060[b]
	Residual	178.269	426	.418		
	Total	217.267	429			
a. Independent Variable: Gender						

Table 5: Linear regression analysis of clinical history with gender as independent variable

Table 5 showed the linear regression of gender as an independent variable in which occurrence of disease showed the non-significant result which is more than p=0.05. Other constants showed the significant results of over all study.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.777	.229		12.124	.000
	Do you have any Disease?	.072	.082	.063	.879	.080
	Do you have any food Allergy?	-.058	.077	-.051	-.760	.008
	Do you take any Supplement?	-.217	.080	-.165	-2.710	.007
	Are you on any Medication?	.172	.064	.174	2.697	.007
	Are you Satisfied with your body weight?	.169	.060	.176	2.821	.005
a. Independent Variable: Gender						

Table 6: ANOVA TABLE

ANOVA table showed highly significant results of gender as an independent variable which is p=0.000.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45.294	5	9.059	8.040	.000[b]
	Residual	477.750	424	1.127		
	Total	523.044	429			
a. Independent Variable: Gender						

Table 7: Linear regression analysis of dietary pattern with gender as independent variable

Table 7 showed linear regression of dietary pattern with gender as independent variable in which all consents showed significant results.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.031	.400		2.581	.000
	How often do you consume Carbohydrate foods?	-.164	.075	-.141	-2.168	.001
	How often do you eat Protein foods?	.344	.065	.317	5.271	.000
	How often do you consume Fruits?	.057	.065	.052	.873	.003
	How often do you eat Vegetables?	-.034	.102	-.020	-.335	.008
	How often do you consume Dairy products?	.043	.108	.023	.400	.009
	How often do you consume packaged or processed Snacks?	.306	.072	.218	4.260	.000
	How often do you Order food Or eat out?	.035	.093	.022	.378	.006
a. Independent Variable: Gender						

Table 8: ANOVA TABLE

ANOVA table showed the highly significant results which is p=0.000.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	71.807	8	8.976	8.374	.000[b]
	Residual	451.237	421	1.072		
	Total	523.044	429			
a. Independent Variable: Gender						

Table 9: Linear regression analysis of dietary pattern with gender as independent variable

Table 9 showed the linear regression of dietary pattern with gender as independent variable in which home made lunch, fixed eating times, following fad diet, diet conscious and smoke showed highly significant results and other showed non-significant results.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Do you bring home made Lunch to college?	2.177	.303		7.185	.000

	Do you have Fixed eating times?	-.044	.057	-.053	-.776	.008
	Are you currently following any Fad diet?	.072	.049	.093	1.448	.008
	Do you Worry about what you eat?	.051	.049	.065	1.031	.303
	Are you Diet conscious?	-.024	.077	-.019	-.305	.000
	Do you ever Lose weight?	.127	.082	.095	1.560	.119
	Do you ever Gain weight?	-.007	.054	-.007	-.134	.893
	Do you Smoke?	-.020	.070	-.017	-.281	.000
a. Independent Variable: Gender						

Table 10: ANOVA TABLE

ANOVA table showed non-significant results which is greater than p=0.05.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.519	8	.815	1.322	.230[b]
	Residual	259.446	421	.616		
	Total	265.965	429			
a. Independent Variable: Gender						

5.0 SUMMARY:

Nutritional assessment involves interpreting data from dietary, laboratory, anthropometric, and clinical studies. It aims to evaluate the nutritional status of individuals or populations based on nutrient intake and utilization. Nutrition surveys are typically conducted to determine the nutritional health of a specific group, identify those at risk of chronic malnutrition, address existing nutritional issues, and guide evidence-based nutrition policies and intervention effectiveness. Analyzing dietary patterns provides a broader understanding of food consumption behaviors within a population.

We examined nutritional status and dietary pattern of the students. The questionnaire includes demographics, anthropometrics, clinical history, physical activity, and dietary information. The data has been collected then analyzed using paired t-test. As indicated by literature review and research on the topic, the result showed that Poor eating behaviors contribute to inadequate nutritional status and elevate the risk of chronic diseases later in life. Therefore, it is crucial to implement nutrition awareness programs aimed at enhancing nutrition-related knowledge, promoting healthy lifestyle changes, and encouraging appropriate dietary interventions to support overall well-being. The main objective of our study was to assess nutritional status and dietary pattern of college students (adolescents aged 16-18). To explore relationship between nutritional status and dietary pattern in college students and determine the appropriate and actionable areas of change in student's diet and lifestyle and to improve their health.

The criteria of the study were students aged from 16 to 18 years residing in Islamabad and Rawalpindi and it was a purposive sampling technique, applied to the adolescents comprised of 600 subjects.

Study results showed that nutritional status is related to dietary practices with significant results. Family income, lifestyle, and nutrition knowledge also showed significant results. Other correlations of constants were non-significant.

The socio-demographic, anthropometric measurements, clinical history, and dietary pattern were analyzed. The characteristics include BMI, food frequency and physical activity. The results showed that standard deviation mean ± SD (n=600) and $p < 0.05$ = Significant Difference *$p<0.01$ = Highly Significant Difference. In socio-demographic data where frequency distribution depends on age, the higher frequency was seen in the age group was 17. Then we have seen frequency distribution based on BMI where majority of the females and males were under healthy ranges. Female students were more healthy as compared to male students as they were more conscious about what they eat. Another frequency distribution was seen that was based on monthly family income in which highly significant results were found between income and health status.

Frequency distribution based on dietary pattern also showed highly significant results. Another frequency distribution was seen that was based on physical activity level in which high frequency of male students were involved in light physical activity as compared to female students. Then we have seen sleeping hours per day in which frequency of female students who sleep 8-9 hours per day was high as compared to male students.

5.1 CONCLUSION:

- This study concluded that there was no significant association between nutritional status of both genders (male and female college students) of Islamabad and Rawalpindi.
- Those students who followed healthy diet had normal nutritional status while those followed unhealthy dietary pattern were mostly underweight or overweight.
- Highly significant association was found between nutritional status and dietary pattern of students.

5.2 RECOMMENDATIONS:

- Colleges should educate students about nutrition knowledge through seminars and different nutrition related programs.
- Healthy food should be served in the college cafeteria.
- Colleges should educate parents and staff about healthy eating through newsletters and other channels.

Author's contribution:

Hurria Ahmed and Nasir Hussain conceptualized and wrote the manuscript and other authors drafted, and revised the manuscript.

Ethics approval and consent to participate:

Not applicable.

Competing Interest:

The authors declared no conflict of interest.

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AUTHOR CONTRIBUTION

Author	Contribution
Hurria Ahmed*	Substantial Contribution to study design, analysis, acquisition of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Nasir Hussain	Substantial Contribution to study design, analysis, acquisition of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Tooba Afnan	Substantial Contribution to acquisition and interpretation of Data

	Has given Final Approval of the version to be published
Ummara Irfan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Khadija Zain Sani	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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