ASSESSMENT OF BODY MASS INDEX AMONG THE UNDERGRADUATE COLLEGE STUDENTS OF DISTRICT BAJAUR: A CROSS SECTIONAL STUDY

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Abstract- Obesity is a preventable medical condition characterized by increased fats deposition in the body as a result of increased caloric intake or decreased physical activity. Having excess body weight was once perceived to be a phenomenon of the developed world. However, in recent years, it has extended to developing countries. In 2014, global disease estimates showed that Pakistan stands at number eight among the 10 countries hosting half of the 693 million obese individuals in the world.
A cross sectional study was conducted across different colleges of District Bajaur, i.e Government Post Graduate college Khar, Government Degree college Barkholozai, Government Degree college Nawagi, and Government Girls Degree college Khar. The BMI of all studied participants were calculated by using formula:

$$BMI = \text{weight (kg)}/\text{height (m}^2)$$

According to calculated formula for BMI total of 274 persons were investigated, out of which, 2 (0.729%) were reported very severely under-weight, 7 (2.55%) were severely under-weight, 41 (14.96%) were under weight, 197 (71%) were normal BMI, 25 (9.1%) were over-weight, 1 (0.364%) were obese class –I, and 0 (0%) were obese class – II and 1 (0.364%) were obese class – III.

keywords- Body mass index, obesity, under-weight, over-weight

I. INTRODUCTION

BMI has been the most widely used measure of weight-related health risk because direct measures of body fats, for example, skin fold measurements and under-weighing, are more invasive and costly methods. To date, BMI is the best available anthropometric estimate of body fatness for public health purposes (Hall *et al*., 2008). Higher BMIs usually mean higher body fat, and as BMI increases, especially from values equal to or greater than 30, health risks increase (Hiza *et al*., 2000).

Overweight refers to a condition in which an individual has a higher body weight than what is considered healthy for their height. It is typically assessed using the Body Mass Index (BMI), which takes into account a person's weight in relation to their height. Underweight is a condition where an individual's body weight is below the recommended range for their height. This can indicate inadequate nutrition and potential health risks. According to the World Health Organization (WHO), severe underweight is defined as having a body mass index (BMI) below 16.0, while underweight is typically defined as having a BMI below 18.5 (WHO, 2020).

Globally, the World Health Organization (WHO) classifies overweight and obesity on the basis of body mass index (BMI), excluding Asians, who have a much lower cut-off due to their higher risk of morbidity secondary to obesity (James *et al.,* 2001). Obesity has serious health effects, and it is a known independent risk factor for many non-communicable diseases, including cardiovascular diseases, hypertension, type II diabetes mellitus, hyper lipidemia, osteoarthritis, obstructive sleep apnea, and certain cancers (Campos *et al., 2006).* Obesity can lead to catastrophic financial losses in a community through increased health-related expenditure for treatment of non-communicable diseases while reducing the overall productivity of the society (Campos *et al*., 2006).

This association of obesity with non-communicable diseases makes this problem a priority public health issue of the 21st century. It was estimated in 2008 that 1.46 billion adults in the world are overweight and 502 million are obese, and 170 million of the children around the world are obese or overweight (Swinburn *et al*., 2011; Campos *et al*., 2006). Obesity was previously considered a major public health issue in developed countries only, but for the last two decades, due to rapid social and environmental transitions, it has been identified that obesity has increased three times in middle and low-income countries, affecting people of all age groups, including children, while these countries are already fighting severe issues related to malnutrition, especially in children (Hossain *et al*., 2007).

As per the WHO, around 26% of women in Pakistan suffer from the trouble of obesity, while just 19% of men are obese. A report from 2013 revealed that the rate was 28% for men and 38% for women, which is a huge gap between the two genders. Obesity is higher in urban areas (56% in men and 67% in women) as compared to rural areas. Even in youth, obesity is also growing at a fast pace. As per 2013 statistics, it was 10%, which is a massive figure. In 2010, approximately 3.4 million people died because of obesity (steiner et al., 2017).

In Pakistan, the urban population, particularly women, shows a considerable higher burden of obesity as compared to men and women from the rural population. Girls from all age groups are predominantly more obese as compared to boys. Most of the studies have estimated child obesity among school-going children of different ages and need careful interpretation (Tanzil, 2016).

Obesity is not a single disorder but a heterogeneous group of conditions with multiple causes. Body weight is determined by an interaction between genetic, environmental, and psychosocial factors acting through the physiological mediators of energy intake and expenditure. Although genetic differences are of undeniable importance, the marked rise in the prevalence of obesity is best explained by behavioral and environmental changes that have resulted from technological advances (Bouchard *et al*., 1990).

2. METHOD AND MATERIALS

2.1. Study area

The study area lies at an altitude of 1126 m above sea level, and the land mass of the district lies between 34°-30° and 34°-58° north latitudes and 71°-11° and 71°-58° east longitudes. It is a district in the Malakand Division of Khyber Pakhtunkhwa Province in Pakistan. The area of District Bajaur is about 1,290 sq km, and its population is about 1,093,684 according to the 2017 census. It has seven Tehsils, and the number of village councils is 120, while the number of neighborhood councils is 7. To its west lies the Kunar Valley, from which it is separated by a series of rugged Hindukush hills and intermittent mountain passes, Nawa Pass, Ghakhi Pass, and Leti Sar being the notable ones. district, Mohmand Agency.

Figure 0.1Map of the study area *(Arif,M et al., 2022)*

A cross sectional study was conducted for assessment of body mass index among the undergraduate student of different colleges of District Bajaur, which include Government Post Graduate Khar, Government Degree College Barkolozai, Government Girls Degree College Khar, Government Degree College Nawagi.

2.2. Data collection criteria

In a cross-sectional study that aimed to assess BMI (body mass index) among undergrad students in colleges, specific data collection criteria were crucial. Firstly, participant selection was inclusive of a diverse sample of undergraduate students from various colleges to ensure representation. This involved implementing random sampling techniques or including students from different disciplines. Secondly, age range criteria were determined, considering the typical age range of undergraduate students, generally between 18 and 25 years. Additionally, gender distribution was accounted for to capture potential differences in BMI among male and female students. Moreover, ethnicity data were collected to explore potential variations in BMI across different racial or ethnic groups within the student population. Lastly, data on lifestyle factors such as physical activity levels, dietary habits, and wellness practices were considered to understand their potential influence on BMI.

2.3. Ethical Approval and Informed Consent

Ethical approval ensured that the study adhered to ethical guidelines and safeguarded the well-being and rights of the participants. Informed consent involved providing detailed information about the study, including its purpose, procedures, potential risks and benefits, and the participants' rights. Ethical approval was taken from ethical committee of the concerned colleges. Consent was taken of all participants before filling the questionnaire.

2.4. The Questionnaire

A close ended questionnaire was used for collection of data from the study population. The questionnaire contained a series of question related to student's height, weight age, socioeconomic status, family history and life style. Questionnaire was filled up for each student through face to face interviews.

2.5 Data Analysis

Data was collected from the study participants and were analyzed by using Microsoft excel and various statistical software.

3. RESULTS

3.1. Value of BMI across the college students of District Bajaur

A cross-sectional study was conducted at Government Post Graduate College Khar, Government Degree College Barkholozai, Government Degree College Nawagai and Government Girls Degree College Khar Bajaur. The BMI of all study participants was calculated using the formula:

$$BMI = Weight\ (kg)/Height\ (m^2)$$

A total of 274 participants were investigated. Out of these participants, 2 (0.729%) were classified as very severely underweight, 7 (2.55%) as severely underweight, 41 (14.96%) as underweight, 197 (71%) as having a normal BMI, 25 (9.1%) as overweight, 1 (0.364%) as obese class I, and 1 (0.364%) as obese class III. There was no participant in the obese class II category.

Table3.1 Value of BMI across the college students of District Bajaur

S.No	Category by BMI	Results	Percentage
1	Very severely under weight	2	0.73%
2	Severely under weight	7	2.55%
3	Under weight	41	14.96%
4	Healthy	197	71%
5	Over weight	25	9.15%
6	Obese class I	1	0.36%
7	Obese class II	0	0%
8	Obese class III	1	0.36%
9	Total	274	100%

3.2. Gender wise distribution of BMI among college students of District Bajaur

Total 40 Female participants were investigated, out of which, 1 (2.5%) were very severely underweight 2 (5%) were severely underweight, 4 (10%) were underweight 30 (75%) were healthy, 3 (3.5%) were overweight, 0 (0%)were obese class –I, 0 (0%) were obese class – II, 0 (0%) were obese class – III.

Total 234 male participants were investigated, out of which 1 (0.42%)were very severely under-weight, 5(2.13%) were severely under-weight, 37 (15.81%) were under weight, 167, (71.4%) were healthy, 22 (9.4%) were overweight, 1 (0.42%) were obese class – I, 0 (0%) were obese class – II, 1 (0.42%) were obese class– III.

Table3.2.Gender wise distribution of BMI across District Bajaur

S. No	Category of BMI	Female	Percentage	Male	Percentage
1	Very severely under weight	1	2.50%	1	0.42%
2	Severely under weight	2	5%	5	2.13%
3	Under weight	4	10%	37	15.81%
4	Healthy	30	75%	167	71.40%
5	Over weight	3	7.50%	22	9.40%
6	Obese class-I	0	0%	1	0.42%
7	Obese class-II	0	0%	0	0%
8	Obese class-II	0	0%	1	0.42%
9	Total	40	100%	234	100%

3.3. College wise distribution of BMI

A total of 145 individuals were selected from Government Post Graduate College Khar, out of which 1 (0.68%) was reported as very severely underweight, 2 (1.37%) were severely underweight, 21 (14.5%) were underweight, 98 (68%) were healthy, 21 (14.5%) were overweight, 1 (0.68%) was obese class-I, 0 (0%) were obese class-II, and 1 (0.68%) was obese class-III.

A total of 56 individuals were selected from Government Degree College Barkholozai, out of which 0 (0%) were very severely underweight, 1 (1.78%) was severely underweight, 12

(21.4%) were underweight, 42 (75%) were healthy, 1 (1.78%) was overweight, 0 (0%) were obese class-I, 0 (0%) were obese class-II, and 0 (0%) were obese class-III.

A total of 33 individuals were selected from Government Degree College Nawagai, out of which 0 (0%) were very severely underweight, 2 (6%) were severely underweight, 4 (12%) were underweight, 27 (82%) were healthy, 0 (0%) were overweight, 0 (0%) were obese class-I, 0 (0%) were obese class-II, and 0 (0%) were obese class-III.

A total of 40 individuals were selected from Government Girls Degree College Khar. Out of these 40, 1 (2.5%) was very severely underweight, 2 (5%) were severely underweight, 4 (10%) were underweight, 30 (75%) were healthy, 3 (7.5%) were overweight, 0 (0%) were obese class-I, 0 (0%) were obese class-II, and 0 (0%) were obese class-III.

Table 3.3.1. Distribution of BMI of government degree college Barkholozai.

S No.	Category by BMI	Results	Percentage
1	Very severely under weight	0	0%
2	Severely under weight	1	1.78%
3	Under weight	12	21.40%
4	Normal (Healthy)	42	75%
5	Over weight	1	1.78%
6	Obese class – I	0	0%
7	Obese class –	0	0%
8	Obese class	0	0%
9	Total	56	100%

Table3.3.2 Distribution of BMI among students of Government Post Graduate College Khar Bajaur.

S No.	Category by BMI	Results	Percentage
1	Very severely under weight	1	0.69%
2	Severely under weight	2	1.37%
3	Under weight	21	14.50%
4	Normal (Healthy)	98	68%
5	Over weight	21	14.50%
6	Obese class – I	1	0.69%
7	Obese class – II	0	0%
8	Obese class –III	1	0.69%
9	Total	145	100%

Table 3.3.3. Distribution of BMI of Government Degree College Nawagai

S .No	Category of BMI	Result	Percentage
1	Very severely under weight	0	0%
2	Severely under weight	2	6%
3	Under weight	4	12%
4	Normal (Healthy)	27	82%
5	Over weight	0	0%
6	Obese class – I	0	0%
7	Obese class – II	0	0%
8	Obese class –III	0	0%
9	Total	33	100%

Table 3.3.4. Distribution of BMI of Government Girl's Degree College Khar Bajaur

S No	Category of BMI	Result	Percentage
1	Very severely under weight	1	2.50%
2	Severely under weight	2	5%
3	Under weight	4	10%
4	Normal (Healthy)	30	75%
5	Over weight	3	7.50%
6	Obese class – I	0	0%
7	Obese class – II	0	0%
8	Obese class –III	0	0%
9	Total	40	100%

3.4. Age wise distribution of BMI Among the college students

The studied population was divided into two groups based on age. A total of 118 participants aged 19-20 years were investigated. Among them, 1 (0.847%) was very severely underweight, 3 (2.54%) were severely underweight, 23 (19.5%) were underweight, 98 (83%) were healthy, 1 (0.847%) was overweight, and 0 (0%) were obese class-I, obese class-II, and obese class-III.

A total of 156 participants aged 21-25 years were investigated. Among them, 1 (0.64%) was very severely underweight, 4 (2.56%) were severely underweight, 18 (11.53%) were underweight, 91 (58%) were healthy, 40 (26%) were overweight, 1 (0.64%) was obese class-I, 0 (0%) were obese class-II, and 1 (0.64%) was obese class-III.

Table 3.4.1. Age wise distribution of BMI from 19 to 20 years

S.No	Category of BMI	Result	Percentage
1	Very severely under weight	1	0.85%
2	Severely under weight	3	2.54%
3	Under weight	23	19.50%
4	Normal (Healthy)	98	83%
5	Over weight	1	0.85%
6	Obese class - I	0	0%
7	Obese class - II	0	0%
8	Obese class -III	0	0%
9	Total	118	100%

Table3.4.2 Age wise distribution of BMI from 21 to 25 year

S.No	Category of BMI	Result	Percentage
1	Very severely under weight	1	0.64%
2	Severely under weight	4	2.56%
3	Under weight	18	11.53%
4	Normal (Healthy)	91	58%
5	Over weight	40	26%
6	Obese class - I	1	0.64%
7	Obese class - II	0	0%
8	Obese class -III	1	64%
9	Total	156	100%

3.5. Distribution of BMI related to socioeconomic status of the participants.

The studied population were divided into different categories on the basis of socio-economic status of the college students. About 19 participants were fallen in high socio-economic group. Among them, 0 (0%) were very severely underweight, 0 (0%) were severely underweight, 0 (0%) were underweight, 3 (15.8%) were healthy, 14 (74%) were overweight, 1 (5.26%) was obese class-I, 0 (0%) were obese class-II, and 1 (5.26%) were obese class-III.

The number of individuals in 2nd group (Middle Socio-economic status) were 214. Among them, 1 (0.467%) was very severely underweight, 3 (1.40%) were severely underweight, 14 (6.54%) were underweight, 185 (86%) were healthy, 11 (5.14%) were overweight, 0 (0%) were obese class-I, 0 (0%) were obese class-II, and 0 (0%) were obese class-III.

The number of individuals in 3rd group (low Socio-economic status) were 41. Among them, 1 (2.43%) was very severely underweight, 4 (9.75%) were severely underweight, 27 (66%) were underweight, 9 (22%) were healthy, 0 (0%) were overweight, 0 (0%) were obese class-I, 0 (0%) were obese class-II, and 0 (0%) were obese class-III.

Table3.5. *Distribution of BMI related to socioeconomic status of the participants*

3.6. Distribution of BMI in relation to exercise in the study participants.

Among the study participants 222 were doer of regular exercise, out of which 1 (0.45%) were very severely under- weight, 4 (1.80%) were severely underweight 20 (9%) were under weight, 184 (82%) were healthy, 12 (5.40%) were overweight, 0(0%) were obese class –I, 0 (0%) were obese class –II, 0(0%) were obese class –III. Among the study participants 52 were not doer of regular exercise, out of which 1 (1.92%) were very severely under- weight, 3 (5.76%) were severely underweight 21 (40%) were under weight, 12 (23%) were healthy, 13 (25%) were overweight, 1(1.92%) were obese class –I, 0 (0%) were obese class –II, 1(1.92%) were obese class –III.

Table 3.6. Distribution of BMI Based on Exercise

s.No	Category of BMI	Regular exercise	percentage	No-exercise	Percentage
1	Very severely underweight	1	0.45%	1	1.92%
2	Severely underweight	4	1.80%	3	5.76%
3	Under weight	20	9%	21	40%
4	Healthy	184	82%	12	23%
5	Over weight	12	5.40%	13	25%
6	Obese class-I	0	0%	1	1.92%
7	Obese class-II	0	0%	0	0%
8	Obese class-III	0	0%	1	1.92%
9	Total	222	100%	52	100%

4. DISCUSSION

Overweight and obesity are well-known health problems worldwide, with prevalence among the adult population varying significantly from 15% to 60% (WHO, 2018). In the last two decades, Asian developing countries have become more vulnerable to this serious public health threat. Although there has been a need for updated population-based data on the prevalence of obesity among adults in Pakistan, few regional studies (Khan et al., 2017) with adults have identified the escalating rates of overweight and obesity. Therefore, we conducted such a study.

This study was carried out at the District level in Bajaur, KPK, Pakistan. A cross-sectional study was conducted across different colleges in Bajaur, with a total of 274 participating students (boys and girls). Among them, 0.0729% were reported as very severely underweight, 2.55% were severely underweight, 14.96% were underweight, 71% were normal weight, and 9.1% were overweight.

Our results are also comparable to earlier local literature. For example, an urban Karachi survey showed a 28% prevalence of overweight/obesity, using a BMI cutoff point of 25.0 kg/m² (Khan et al., 2017). Another study by Khan et al. (2017) reported

an obesity prevalence of 4.8% for Balochistani adults, with an obesity rate of 8.0% for Peshawar adults (Khan et al., 2003). A

S.No	Category of BMI	High socioeco status	percentage	Middle socioeco status	percentage2	Low socioeco status	Percentage3
1	Very severely under weight	0	0%	1	0.47%	1	2.43%
2	Severely under weight	0	0%	3	1.40%	4	9.75%
3	Under weight	0	0%	14	6.54%	27	66%
4	Healthy	3	15.80%	185	86%	9	22%
5	Over weight	14	74%	11	5.14%	0	0%
6	Obese class-I	1	5.26%	0	0%	0	0%
7	Obese class-II	0	0%	0	0%	0	0%
8	Obese class –III	1	5.26%	0	0%	0	0%
9	Total	19	100%	214	100%	41	100

study mentioned that 25.0% of adults in Pakistan were either overweight or obese (Arif et al., 2014). However, in this study, an abnormal BMI was defined using 23.0 kg/m². Some regional disparities in the prevalence of overweight (29.0%–46%) and obesity (20.8%–27.85%) were also observed among Pakistani adults (Aslam et al., 2010). This variation could be due to different ethnicities, age ranges, and the use of WHO-recommended BMI cutoff points for the Asia Pacific Region instead of international cutoffs for defining obesity.

5. CONCLUSION:

The body mass index inclines were observed to examine the patterns and explanations behind obesity. The study identified the socio-economic, statistical, and dietary attributes that impacted corpulence among male and female students in Bajaur, KPK, Pakistan. There was found to be a solid and noteworthy inverse connection between BMI and the height and weight of the respondent. In universities and schools, the unfortunate availability of junk food increases consumption, which leads to obesity. The occupation of the respondent and the amount of property owned by the respondent were also found to be strongly significant with BMI, as desk jobs that lead to obesity will also increase, and if the house is owned by the respondent, then he has more money for other activities as he is paid rent for a house. A healthy breakfast and supper drive the body into great and sound condition, and leaving breakfast likewise was found to have a negative effect on the health and weight of individuals. Cooking for dinner is essential for the strength of individuals, and so is the kind of ingredients used in cooking, like if it is cooked in butter, it is supposed to increase the weight more than food cooked in oil. On the whole, the factors that were found to increase weight included higher consumption of fast food, a sedentary way of life, higher consumption of red meat, and hereditary factors. The results of the present research show that, for some factors, there is a moderately positive correlation between marital status and BMI. As per this examination, the genetics of the individual are most important when talking about male weight gain (Boyles, 2008). The primary reasons for weight gain in males in Pakistan are their dietary patterns (higher consumption of meat, rice, and their choice of beverages), wake-up time, late-night exposure to radiation like TV, laptops, and mobilephones, less physical exercise, and occupation. This

examination is intended to contribute to the existing literature as it involves a collection of parameters for subjective research that have not been used before.

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