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Research Paper

Obesity and Overweight Prevalence and Its Association with Diet and Physical Activity Among Female Teachers

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Abstract: Obesity pervades all age groups, particularly among individuals with overnutrition and sedentary lifestyle. It is recognized globally as a serious health concern associated with various risks. A study investigated the prevalence of overweight and obesity involving 107 female teachers aged 25 to 55 years in Gilgit city's schools and colleges. Chi-square tests were conducted to determine significant differences among categorical variables, with a significance level set at ($p<0.05$) *for* statistical test. Herein, results showed that among the participants, 56% of teachers were classified as obese, 25% as overweight and 19% as having a normal weight. Moreover, 57.8% led sedentary lifestyles, with 26.5% categorized as having low activity levels ($p<0.05$). Additionally, the intake of fruits and vegetables was alarming low (<1 serving size) in obese individuals, while their consumption of meat and fast/junk foods exceeded recommended intake levels ($p<0.05$). Conclusively, this study highlights that many obese or overweight participants maintain sedentary lifestyles, consume excessive amounts of fast foods, and have inadequate fruit and vegetable intake contrary to health recommendations. Thus, lower physical activity, frequent consumption of fast food, and limited intake of fruits and vegetables were significantly associated with higher rates of overweight and obesity among the teachers.

Keyword: Obesity, Prevalence, Female teacher, BMI, Physical activity

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1. Introduction

Obesity refers to the excessive accumulation of body fat. The world health organization (WHO) has established the body mass index (BMI) as the standard measure to determine the threshold between normal weight and obesity. BMI is calculated by dividing weight in kilograms by the square of height in meters (Kim, 2016). According to WHO, obesity has been identified as the leading public health challenge of the 21st century and the 2nd most significant preventable cause of death, after smoking (Formiguera and Canton, 2014). It is associated with a

range of fatal conditions, including heart disease, diabetes, dyslipidemia, and certain cancers. Poor diet habits can also lead physiological disorders in the health (Younas et al., 204). In fact, obesity affects approximately 650 million adults worldwide and has been shown to have negative impacts on various body systems and functions, leading to a variety of health complications (WHO, 2021; Elerian et al., 2016; Hussein et al., 2019).

The complications of obesity can arise during childhood and often persist into adulthood, increasing the risk of morbidity and mortality later in life (George, 2004). One of the major complications hypertension, which substantially elevated the risk of cardiovascular disease and premature death (JAMA, 2003). Moreover, obesity is influenced by genetic and environmental factors, but some effects have been inconsistent (Gahagan, 2011; Sherina and Ahmad, 2004). It was noticed that unhealthy dietary behaviors and environmental factors have been identified as the dominant contribution to the rapid increase in obesity over the past two decades (Abdul-Rasoul, 2012). In developing countries, females, individuals from higher-income households, with lower levels of physical activity are more susceptible to obesity risk factors (Ogdon, 2004).

Pakistan is among the countries facing a high and growing burden of overweight and obesity, especially among adult women. Basit et al. (2021) reported the higher prevalence of both generalized (58%) and central obesity (62.7%) in female compared to males populations, indicating overweight and obesity problems. Moreover, the prevalence of obesity among teaching faculty at different university in Punjab was 39.3%, with a sedentary life style among teachers being associated with a higher prevalence of obesity (Sabar et al., 2020). The World Obesity Atlas 2025 shows that the number of adults with obesity is projected to more than double between 2010 and 2030 (from 524 million to 1.13 billion), and most countries lack comprehensive policies to counter rising obesity rates.

Given their influential role in society, teachers' health status has implications not only for their own well-being but also for the health behaviors of future generations. Despite the global and national evidence, there is a notable lack of region-specific data**,** particularly from remote and underserved areas such as Gilgit city**.** No comprehensive data currently exist on obesity prevalence and its associated risk factors among female teachers in Gilgit**,** creating a critical gap in knowledge needed for evidence-based health planning. Understanding obesity patterns in this population is essential for developing targeted interventions and policies tailored to local socio-cultural and environmental contexts.

Therefore, the present study aims to determine the prevalence of obesity among female teachers in Gilgit city and to identify associated risk factors, including dietary habits, physical activity levels, and socio-demographic characteristics. The findings are expected to support the development of effective health promotion strategies and contribute to improving the overall well-being of teachers and the broader community.

2. Materials and Methods

2.1 Samples

This cross-sectional study was conducted from 1st June to 29 December 2023, involved 107 female teachers aged 25-55 from government schools and colleges in Gilgit region. Pregnant volunteers and those with chronic diseases were excluded based on self-report through verbal communication during participant recruitment. Participants were recruited using convenience sampling based on availability and willingness to participate.

2.2 Study Design

This study employed a school-based cross-sectional design to assess the prevalence of overweight and obesity among female school teachers. The study was conducted in

the Gilgit region of Pakistan. Participants were female teachers recruited from selected government and private girls' schools and colleges located in Gilgit city, including Government Girls High School No. 1, Government Girls High School No. 2, Amphary Girls Middle School, Baseen Girls Middle School, Highlander Public School, Al-Asar Public School and College, Al Mustafa Public School and College, and the Girls' Degree College Gilgit.

2.3 Ethical Approval and Informed Consent

Ethical approval was obtained from the Education Ethics Committee on 4th April, 2023. Permission was also granted by relevant institutional authorities. Written informed consent was obtained from all participants, who were informed of their right to withdraw from the study at any stage without consequences.

2.4 Data collection tools

The study used a self-designed questionnaire to collect the demographic, anthropometric, and clinical data from the individuals. Additionally, the WHO stepwise survey questionnaire to collect data on lifestyle factors associated with obesity (Stahl & smedman, 2008). Participants were guaranteed the right to discontinue the study at any time and for any purpose. If a participants had any query related to the questions, the data collectors conveyed an explanation.

2.5 Demographics, Anthropometric measurements

Demographic parameters like age, gender, socioeconomic status, education, ethnicity, income and contact information were recorded. Further, anthropometric measurements like height (cm) was measured by Stadiometer scale and weight (Kg) through Burer Germany (BG-42). Body mass index (BMI), waist circumference and mid upper arm circumference (MUAC) were calculated using body measuring tape (Mosteller, 1987). Moreover, BMI calculation was based upon the BMI chart as suggested by the WHO, it was considered by dividing the body weight by height in meters squared (kg/m^2) and the results were categorized into four groups: ≤ 18.4 kg/m^2, 18.5-24.9 kg/m^2, 25.0-29.9 kg/m^2, and ≥ 30 kg/m^2 categorized as underweight, normal weight, overweight and obese, respectively. Moreover, the body composition of the volunteers included weight (Kg), body fat (%), body water (%), muscle mass (%), bone mass (Kg) and active metabolic rate (AMR) (Kilocalories) were recorded using the Bio-Electrical Impedance based scale; BG-42 (Burer, Germany) (Hussain et al., 2017).

Waist circumference was measured midway between the lower margin last rib and the iliac crest using a non-stretchable measuring tape. Measurements were categorized as follows: >94 cm for males and >80 cm for women indicated an increased risk of metabolic complications, while values >102 cm for male and >88 cm for women indicated a substantially increased risk (WHO, 2013).

This study therefore proposes the following references, MUAC>31.1cm to indicate obesity, MUAC =30.1cm to <31.1cm to indicate overweight, MUAC = 25.4 to <30.1cm to indicate normal weight and MUAC $\leq$ 25.4 cm to indicate underweight respectively.

2.6 Dietary intakes assessment

Volunteers dietary intake was evaluated using a Food Frequency Questionnaire (FFQ). The number of servings consumed by each volunteer was calculated to determine the mean number of servings for each food group. These values were compared with recommended serving size based on standard nutritional references and contemporary dietary guidelines.

2.7 Statistical analysis

The results were analyzed using SPSS Statistics 21.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to summarize participant characteristics. Cross-tabulations were performed with BMI categories and selected dietary and lifestyle

variables. Chi-square tests were applied to assess associations between categorical variables, with statistical significance set at $p < 0.05$. Continuous variables were expressed as mean ± standard error (SE).

3. Results and Discussion

3.1 Body Mass Index of Teachers

The study investigated obesity and overweight prevalence among female teachers from various educational institutions in Gilgit Pakistan, highlighting its rising public health threat as a significant issue in various countries (GBD, 2015). The distribution of BMI among female teachers in girl's schools and colleges is presented in Fig. 1. The majority of female teachers were either obese or overweight, with only a small number of teachers had a normal weight. Precisely, 62 respondents (56%) were classified as obese, 28 respondents (25%) as overweight, and only 17 respondents (19%) had a normal BMI. According to the previous reports, 38% of the global population are currently either overweight or obese (Lobstein et al., 2023). Moreover, WHO also reported that 11% of men and 15% of women have obesity due to the lake of physical activities. The South Asian women are more likely to be overweight and obese than men, which increases their risk of non-communicable diseases and pregnancy-related complications (Amin et al., 2015). Globally, prevalence of obesity and overweight is 72.7% among primary and secondary female teachers over 35 years old (George et al., 2021). Similar trends have been observed among school teachers in other countries, with obesity rates of 4.3% in Malaysia (Zulkepli et al., 2019), 70% in India (Monica et al., 2018), and 85% in Cape Town, South Africa (Laurence et al., 2016). The obesity rates were higher in the women 9.0% as compared to the men 1.9% in Uganda and 4.8% in men and 17.3% in women in Ghana (Abarc-Gomez et al., 2017). A national survey in Saudi Arabia found that the prevalence of obesity and overweight among women was 13.9% and 23.4%, respectively (Moradi-Lakeh et al., 2016).

3.2 Marital Status

The marital status of female teachers in girls' schools and colleges is shown in Fig. 2. It was observed that 89 respondents (83%) were married, while 18 respondents (17%) were unmarried. It was observed that the women aged 35-49 years were more prone to overweight and obesity than those of younger aged women between 15-24 years in Nepal. In addition, obesity and overweight was witnessed higher in married couple and widowed/divorced than those of non-married women (Rana et al., 2021).

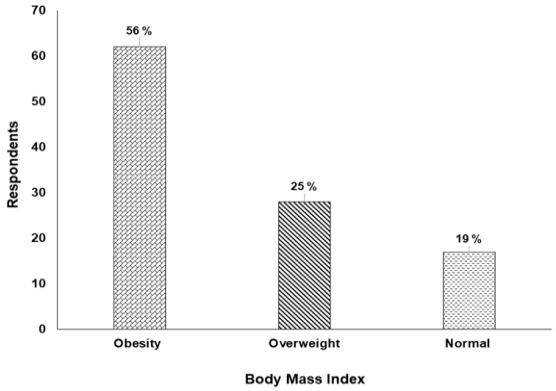

Fig. 1 Body mass index of female teachers in different girl colleges and schools in Gilgit city.

3.3 Anthropometric Measurements

The anthropometric measurements, family history and physical activity data gathered from the participants are presented in Table 1. Out of 53 participants, 28 (52.8%) reported a family history of obesity, and 15 (28.3%) reported a family history of being overweight. These figures were not significantly different from those of participants who did not report a family history of obesity *($p>0.06$)*. Previously, comparative study was conducted on gender bases in Gilgit City. Their findings revealed that obesity is more prevalent among housewives compared to men's (Hussain et al., 2017). Living in the urban areas with higher income is directly related to the higher risk of obesity and overweight for the

females (Lartey et al., 2019). The higher in obesity and overweight among female teachers might be lack of physical activity and higher consumption of energy dense foods.

Table. 1 Anthropometric measurement, family history, and physical activity of female teachers in different schools and colleges of Gilgit city.

Nutritional indicators		BMI			Total	*p-Values*
		Normal	**Overweight**	**Obesity**		
Obesity in Family	Yes	10 (18.9%)	15 (28.3%)	28 (52.8%)	53 (100.0%)	0.067
	No	9 (16.7%)	12 (22.2%)	33 (61.1%)	54 (100.0%)	
Muac	Low (≤ 25.4 cm)	1 (25.0%)	2 (50.0%)	1 (25.0%)	4 (100.0%)	0.022
	Normal (25.4 to < 30.1 cm)	14 (28.6%)	13 (26.5%)	22 (44.9%)	49 (100.0%)	
	High (> 31.1 cm)	4 (7.4%)	12 (22.2%)	38 (70.4%)	54 (100.0%)	
Waist Circumference	Normal (>80 cm)	8 (38.1%)	4 (19.0%)	9 (42.9%)	21 (100.0%)	0.024
	High Level 1 (80-88 cm)	7 (18.9%)	12 (32.4%)	18 (48.6%)	37 (100.0%)	
	High Level 2 (<88 cm)	4 (8.2%)	11 (22.4%)	34 (69.4%)	49 (100.0%)	
Life Stage Groups	Young Adults	3 (20.0%	7 (46.7%)	5 (33.3%)	15 (100.0%)	0.097
	1st Adulthood	15 (20.5%)	14 (19.2%)	44 (60.3%)	73 (100.0%)	
	2nd Adulthood	1 (5.3%)	6 (31.6%)	12 (63.2%)	19 (100.0%)	
Physical Activity	Sedentary Lifestyle	16 (15.7%)	27 (26.5%)	59 (57.8%)	102 (100.0%)	0.032
	Low Active Lifestyle	3 (60.0%)	0 (0.0%)	2 (40.0%)	5 (100.0%)	

3.4 MUAC and Waist Circumference

MUAC and waist circumference are important indicators of central and overall adiposity and are strongly associated with metabolic and cardiovascular risks. In the current study, the MUAC (mid-upper arm circumference) values were significantly higher for participants classified as obese. A total of 38 respondents (70.4%) in obese category had higher MUAC values compared to 12 respondents (22.2%) in the overweight category and 4 respondents (7.4%) in the normal category *(p<0.02)*. Additionally, waist circumference values were significantly higher among the obese respondents. Specifically, it was noted that 34 (69.4%) of the obese respondents had a high (level 2) waste circumference than those of 11 (22.4%) in the overweight category and 4 (8.2%) in the normal category *(p<0.02)*. There was no significance difference among life stage groups *(p>0.09)*. Physical activity levels among the teachers of girls schools and colleges were also notable. Most teachers fell into either the sedentary or low active lifestyle categories. Specifically, 59 (57.8%) of respondents who were classified as obese led a sedentary life style, followed by 27 respondents (26.5%) in the overweight category, and 16 respondents (15.7%) in the normal category (p>0.01). Earlier studies reported that respondents who consumed fried foods more than five times a week had a 3.6 times higher risk of increased waist circumference compared to those who consumed fried foods less than once a week (Ghaith and Ibrahim, 2020). Higher BMI and waist circumference values were positively correlated with greater intake of red and processed meat (Khodayari et al., 2022).

Table.2 Dietary intake of different food groups among female teachers in different schools and colleges at Gilgit city.

Food groups	Serving size	BMI			Total	*p-Value*
		Normal	Overweight	Obesity		
Cereal/Legumes/ Pulses	>11	5 (10.4%)	14 (29.2%)	29 (60.4%)	48 (100.0%)	0.116
	6-11	13 (22.4%)	13 (22.4%)	32 (55.2%)	58 (100.0%)	
	<5	1 (100.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)	
Fruits	>5	2 (66.7%)	1 (33.3%)	0 (0.0%)	3 (100.0%)	0.002
	2-4	15 (40.5%)	18 (48.6%)	4 (10.8%)	37 (100.0%)	
	<1	2 (3.0%)	8 (11.9%)	57 (85.1%)	67 (100.0%)	
Vegetables	>5	6 (60.0%)	1 (10.0%)	3 (30.0%)	10 (100.0%)	0.004
	2-4	8 (20.0%)	22 (55.0%)	10 (25.0%)	40 (100.0%)	
	<1	5 (8.8%)	4 (7.0%)	48 (84.2%)	57 (100.0%)	
Meat/seafood/Poultry	>5	11 (13.4%)	12 (14.6%)	59 (72.0%)	82 (100.0%)	0.013
	2-4	8 (47.1%)	9 (52.9%)	0 (0.0%)	17 (100.0%)	
	<1	0 (0.0%)	6 (75.0%)	2 (25.0%)	8 (100.0%)	
Milk and Dairy Products	>5	5 (25.0%)	6 (30.0%)	9 (45.0%)	20 (100.0%)	0.146
	2-4	2 (7.4%)	4 (14.8%)	21 (77.8%)	27 (100.0%)	
	<1	12 (20.0%)	17 (28.3%)	31 (51.7%)	60 (100.0%)	
Fats and Oils	>5	7 (14.3%)	1 (2.0%)	41 (83.7%)	49 (100.0%)	0.001
	2-4	5 (11.1%)	22 (48.9%)	18 (40.0%)	45 (100.0%)	
	<1	7 (53.8%)	4 (30.8%)	2 (15.4%)	13 (100.0%)	
Fast/Junk foods	>5	8 (14.3%)	1 (1.8%)	47 (83.9%)	56 (100.0%)	0.002
	2-4	3 (7.5%)	25 (62.5%)	12 (30.0%)	40 (100.0%)	
	<1	8 (72.7%)	1 (9.1%)	2 (18.2%)	11 (100.0%)	

3.5 Measurements of Dietary Intakes

The dietary intake of various food groups among female teachers in different girls' schools and colleges is presented in Table 2. These food groups serving size are designed according to the recommendations of food guide pyramid, WHO. In this study, there was no significant difference in the consumption of cereals, legumes, and pulses. Fruit intake was significantly lower, with less than one serving per day in the obese category 57 respondents (85.1%) compared to the overweight 8 respondents (11.9%) and normal 2 respondents (3.9%) categories *(p>0.002).* A similar trend was observed for vegetable intake, which was significantly less than one serving per day in the obese category 48 respondents (84.2%) compared to the overweight 4 respondents (7.0%) and normal 5 respondents (8.8%) categories *(p>0.004).* The intake of red meat and poultry was significantly higher in the obese category, with 59 respondents (72.0%) consuming three to five serving per day compared to the overweight 12 respondents (14.6%) and 11 respondents (13.4%) in normal individuals *(p>0.013).* There was no significant difference in the consumption of milk and dairy products across categories. Similarly, the intake of fats and oils was significantly higher than 5 servings per day in the obese category 41 respondents (83.7) than those of overweight and normal individuals *(p>0.001).* Likewise, the serving size of fast and junk foods was also significantly higher in the obese category 47 respondents (83.9%) compared to the overweight and normal respondents *(p>0.02).* Overall, it was noticed that the serving sizes of meat, fats/oils, and fast/junk foods were significantly higher among obese

respondents with less intake of vegetables and fruits. The current study findings align with a meta-analysis and systematic review by Rouhani et al. (2014) which found a positive association between obesity prevalence and the consumption of red and processed meats. Additionally, it was observed a significant association between red meat intake and age groups, with younger adults consuming more red meat than older individuals (Lashari et al., 2019). The higher ratio of obesity in the South Asian countries and lower-middle-income countries (LMICs) might be due to the shifting of traditional nutritious diet to high calories with poor nutrients in diets (Ford et al., 2017). This shift may fluctuate the balance intake of all food groups recommended by the WHO food guide pyramid and can increase the consumption of high sugars, saturated fats, processed foods and sweet beverages, thus contributing to weight gain (Mishra et al., 2019). Research on functional food ingredients such as mint, ginger, aloe vera, and phenolic-rich oats highlights the role of nutrient-dense, antioxidant-rich foods in improving metabolic health and reducing oxidative stress, which are closely linked to obesity risk (Syed et al., 2022; Zia-ur-Rehman et al., 2025; Ali et al., 2025; Manzoor et al., 2023). In the current study, female teachers reported that during lunchtime, they typically consumed processed and oily foods such as samosas, rolls, fries, biryani and various sweets. Particularly, government-employed female teachers, who received satisfactory can afford more expensive foods. Teachers often experience substantial workload demands alongside domestic responsibilities, particularly for women, limiting time for meal preparation and favoring convenient, energy-dense foods (Venn & Strazdins, 2017). In addition, school food environments and surrounding vendors may disproportionately offer fast foods and snacks, while fresh fruits and vegetables are less accessible during the workday (Story et al., 2008).

Table. 3 Body composition of female teachers in different schools and colleges of Gilgit city.

Body Composition	Height (cm)	Weight (kg)	Body fat (%)	Body water (%)	Muscle mass (%)	Bone mass (Kg)	AMR (cal.)
Mean	163.1	70.10	36.57	45.50	33.80	6.23	1684.17
S.EM	6.27	1.09	0.57	0.45	0.46	0.10	15.68

It was noticed that the higher income is directly associated with greater purchasing power and thus increased the consumption of processed and fast/junks foods leads to higher ratio of obesity (Al-Kibria et al., 2019; Tanwi et al., 2019). Furthermore, religious, social, and cultural factors often restrict outdoor physical activity for women, which may contribute to increased trend of obesity (Kanter and Caballero et al., 2012). Previous studies have linked obesity among Asian women to inaccurate beliefs about diet, such as associating ghee consumption with physical strength, as well as poor lifestyle practices, including imbalanced diets, sedentary behavior, and reduced physical activity (Mishra et al., 2019). Social and cultural issues often limit physical activity among South Asian women, including traditional beliefs that associate obesity with good health, as well as concerns about security and the cultural acceptability of outdoor exercise (Jayawardena et al., 2014).

3.6 Body Composition assessment

The body composition measurements in the teachers at different schools and colleges were presented in Table 3. The mean value for female teacher's height was 163 cm and weight was 70.1 kg. The weight according to the height is too high as compared to the recommend weight presented in the height chart which is 50 to 60 kg. The average body fat of female teachers in schools and

colleges were considerably high which was 36%, whereas body water was 45.5 % and bone mass 6.23% which were considered lower compared to the standards. It was noticed that the body composition parameters were not consistent and varied compared with standard.

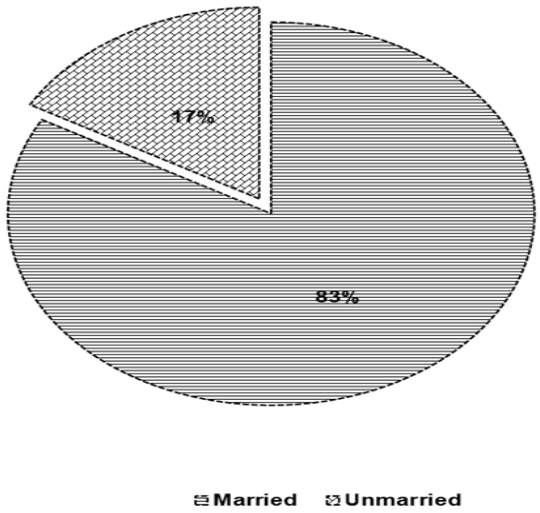

Fig. 2. Marital status of female teachers in different girl colleges and schools in Gilgit city.

4. Conclusion

The present study demonstrates a high prevalence of obesity and overweight among female teacher's schools and colleges in Gilgit city, particularly among those aged 35 years and above. The findings indicate that sedentary lifestyle, low level of physical activity, and unhealthy eating patterns are major contributing factors to excess body weight. Elevated values of BMI, waist circumference, and mid-upper arm circumference further confirm the increased risk of obesity among this population. The current study suggested that the health related departments should take some serious steps in the schools and colleges to promote awareness sessions regarding the importance of physical activity and health food choices.

The cross-sectional design of the current study limits the capacity to establish causal associations between lifestyle factors and obesity. Moreover, the study only focuses on the female teachers in school and colleges of Gilgit city, which limits the generalizability of the findings to other populations.

Conflict of interest

The authors declare no conflict of interest.

Data availability

Data will be made available on request.

Reference

Abarca-Gómez, L., Abdeen, Z. A., Hamid, Z. A., Abu-Rmeileh, N. M., Acosta-Cazares, B., Acuin, C., Adams, R. J., Aekplakorn, W., Afsana, K., Aguilar-Salinas, C. A., Agyemang, C., Ahmadvand, A., Ahrens, W., Ajlouni, K., Al-Hazzaa, H. M., Al-Othman, A. R., Al-Raddadi, R., Al Buhairan, F., Al Dhukair, S., ... & Ezzati, M. (2017). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. The Lancet, 390(10113), 2627–2642. https://doi.org/10.1016/S0140-6736(17)32129-3.

Abdul-Rasoul, M. M. (2012). Obesity in children and adolescents in Gulf countries: Facts and solutions. Advances in Measures of Obesity Among Urban Married Women in India, 3, 293–302.

Ali, F., Imran, Z., Ali, A., Ahmed, M., Iqbal, A., Nazeer, A., Rahman, A., & Mariussi, M. (2025). A novel concept study on key factors affecting student performance using machine learning algorithms. Journal of Food and Agricultural Technology Research, 4(1), 38–51.

Al-Kibria, G. M., Swasey, K., Hasan, M. Z., Sharmeen, A., & Day, B. (2019). Prevalence and factors associated with underweight, overweight and obesity among women of reproductive age in India. Global Health Research and Policy, 4, 24. https://doi.org/10.1186/s41256-019-0117-z

Amin, F., Fatima, S. S., Islam, N., & Gilani,

A. H. (2015). Prevalence of obesity and overweight, its clinical markers and associated factors in a high risk South-Asian population. BMC Obesity, 2, 6. https://doi.org/10.1186/s40608-015-0044-6

Basit, A., Askari, S., Zafar, J., Riaz, M., Fawwad, A., & Members, N. D. S. P. (2021). NDSP 06: Prevalence and risk factors for obesity in urban and rural areas of Pakistan: A study from second National Diabetes Survey of Pakistan (NDSP), 2016–2017. Obesity Research & Clinical Practice, 15(1), 19–25. https://doi.org/10.1016/j.orcp.2020.11.005

Elerian, A. E., Ali, M. E., & Ali, N. (2016). Comparison between the effect of endurance and strengthening exercises on plasma lipoprotein in central obese female subjects. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 7(3), 1613–1622.

Ford, N. D., Patel, S. A., & Narayan, K. V. (2017). Obesity in low- and middle-income countries: Burden, drivers, and emerging challenges. Annual Review of Public Health, 38, 145–164. https://doi.org/10.1146/annurev-publhealth-031816-044604

Formiguera, X., & Cantón, A. (2004). Obesity: Epidemiology and clinical aspects. Best Practice & Research Clinical Gastroenterology, 18(6), 1125–1146. https://doi.org/10.1016/j.bpg.2004.06.030

Gahagan, S. (2011). Overweight and obesity. In R. M. Kliegman, B. F. Stanton, J. W. St. Geme, N. F. Schor, & R. E. Behrman (Eds.), Nelson textbook of pediatrics (19th ed., pp. 179–187). Saunders.

GBD 2015 Eastern Mediterranean Region Obesity Collaborators. (2018). Burden of obesity in the Eastern Mediterranean Region: Findings from the Global Burden of Disease 2015 study. International Journal of Public Health, 63(1), 165–176. https://doi.org/10.1007/s00038-017-1002-5

George, A. B. (2004). Medical consequences of obesity. The Journal of Clinical Endocrinology & Metabolism, 89(6), 2583–2589. https://doi.org/10.1210/jc.2004-0535

George, J. M., Mpogole, Z., Mgongo, M., & Ambikile, J. S. (2021). Prevalence and factors associated with overweight or obesity among primary and secondary school teachers in Moshi Municipality, Kilimanjaro, Tanzania. PLOS ONE, 16(9), e0256930. https://doi.org/10.1371/journal.pone.0256930

Ghaith, M. M., & Ibrahim, M. O. (2020). Dietary habits, eating practices and lifestyle pattern as predictors of increased waist circumference amongst University of Umm Al-Qura female students: A cross-sectional study (Obesity Associated Risk Factors). Medical Science, 24(101), 351–359.

Hussain, Z., Mahmood, S., Afzal, S., Ilyas, S., & Hussain, B. (2017). Assessment of nutritional status of patients suffering from appendicitis in Gilgit city, Pakistan. International Journal of Food Sciences and Nutrition, 6(4), 32–38.

Hussain, Z., Mehmood, S., Hussain, B., Khan, I., Rahman, I., & Qasim, S. (2017). Prevalence of obesity on gender base at Gilgit city, Pakistan. Advances in Obesity, Weight Management & Control, 6(2), 00149. https://doi.org/10.15406/aowmc.2017.06.00149

Hussein, H. M., Kamel, E., & Kamel, R. (2019). Association between pain intensity and obesity in patients with chronic non-specific low back pain. Bioscience Research, 16(4), 3579–3583.

Jayawardena, R., Byrne, N. M., Soares, M. J., Katulanda, P., & Hills, A. P. (2014). Body weight perception and weight loss practices among Sri Lankan adults. Obesity Research & Clinical Practice, 8(2), 192–200. https://doi.org/10.1016/j.orcp.2013.05.0

03

Kanter, R., & Caballero, B. (2012). Global gender disparities in obesity: A review. Advances in Nutrition, 3(4), 491–498. https://doi.org/10.3945/an.112.002063

Khodayari, S., Sadeghi, O., Safabakhsh, M., & Khosravi, A. (2022). Meat consumption and the risk of general and central obesity: The Shahedieh study. BMC Research Notes, 15, Article 339. https://doi.org/10.1186/s13104-022-06235-5

Kim, S. Y. (2016). The definition of obesity. Korean Journal of Family Medicine, 37(6), 309. https://doi.org/10.4082/kjfm.2016.37.6.309

Lartey, S. T., Magnussen, C. G., Si, L., Boateng, G. O., de Graaff, B., Biritwum, R. B., Minicuci, N., Kowal, P., & Blizzard, L. (2019). The role of intergenerational educational mobility and household wealth in adult obesity: Evidence from Wave 2 of the World Health Organization's Study on global AGEing and adult health. PLOS ONE, 14(1), e0208491. https://doi.org/10.1371/journal.pone.0208491

Lashari, M. H., Farooq, U., Anwar, Z., & Imtiaz, S. (2019). Prevalence of obesity, overweight and associated factors in female students of The Islamia University of Bahawalpur, Pakistan. Pure and Applied Biology, 8(2), 1718–1723. http://dx.doi.org/10.19045/bspab.2019.80118

Laurence, E. C., Volmink, J., & Levitt, N. S. (2016). Risk of cardiovascular disease among teachers in Cape Town: Findings of the South African PaCT pilot study. South African Medical Journal, 106(10), 996–1001. https://doi.org/10.7196/SAMJ.2016.v106i10.11032

Lobstein, T., Jackson-Leach, R., & Powis, J. (2023). World Obesity Atlas 2023. World Obesity Federation. https://www.worldobesity.org/resources/resource-library/world-obesity-atlas-2023

Syed, M., Butt, M. S., Arqam, U., Syed, A. & Manzoor, M. S. (2025). Study on quality attributes of mint extract in combination with animal and vegetable fat in ice-cream. Journal of Food and Agricultural Technology Research, 1(1).

Manzoor, M. S., Pasha, I., Younas, S., Zhu, M., Hussain, R., Arqam, U., Younis, N., and Chughtai, M. F. (2023). Phenolic acid profile of oat cultivars, and their suppressive effect on intracellular reactive oxygen species. International Food Research Journal, 30(1), 87–95.

Mishra, A., Jayawardena, R., & Anoop, S. (2019). Obesity in South Asia: Phenotype, morbidities, and mitigation. Current Obesity Reports, 8, 43–52. https://doi.org/10.1007/s13679-019-0329-z

Monica, S. J., John, S., & Madhanagopal, R. (2018). Risk of obesity among female school teachers and its associated health problems. Current Research in Nutrition and Food Science, 6(2), 482–489. https://dx.doi.org/10.12944/CRNFSJ.6.2.22

Moradi-Lakeh, M., El Beheraoui, C., Tuffaha, M., Daoud, F., Al Saeedi, M., Basulaiman, M., Memish, Z. A., AlMazroa, M. A., Al Rabeeah, A. A., & Mokdad, A. H. (2016). The health of Saudi youths: Current challenges and future opportunities. BMC Family Practice, 17, Article 26. https://doi.org/10.1186/s12875-016-0425-z

Mosteller, R. D. (1987). Simplified calculation of body-surface area. The New England Journal of Medicine, 317(17), 1098. https://doi.org/10.1056/NEJM198710223171717

National Heart, Lung, and Blood Institute. (2003). The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7). JAMA, 289(19), 2560–2572.

https://doi.org/10.1001/jama.289.19.2560

Ogdon, D. P. (2004). Psychodiagnostics and personality assessment: A handbook (2nd ed.). Western Psychological Services.

Rana, K., Ghimire, P., Chimoriya, R., & Chimoriya, R. (2021). Trends in the prevalence of overweight and obesity and associated socioeconomic and household environmental factors among women in Nepal: Findings from Nepal demographic and health surveys. Obesities, 1(2), 113–135. https://doi.org/10.3390/obesities1020011

Rouhani, M. H., Salehi-Abargouei, A., Surkan, P. J., & Azadbakht, L. (2014). Is there a relationship between red or processed meat intake and obesity? A systematic review and meta-analysis of observational studies. Obesity Reviews, 15(9), 740–748. https://doi.org/10.1111/obr.12172

Sabar, J., & Akhtar, A. (2020). Prevalence of obesity among teachers of different universities of Punjab, Pakistan. Journal of Riphah College of Rehabilitation Sciences, 8(1), 47–50.

Sherina, M. S., & Ahmad, R. (2004). Childhood obesity: Contributing factors, consequences and intervention. Malaysian Journal of Nutrition, 10(1), 13–22.

Stahl, T., & Smedman, A. (2008). The WHO STEPS survey: A global effort to track noncommunicable diseases. Scandinavian Journal of Public Health, 36(6_suppl), 34–40. https://doi.org/10.1177/1403494808089719

Story, M., Kaphingst, K. M., Robinson-O'Brien, R., & Glanz, K. (2008). Creating healthy food and eating environments: Policy and environmental approaches. Annual Review of Public Health, 29, 253-272. https://doi.org/10.1146/annurev.publhealth.29.020907.090926

Tanwi, T. S., Chakrabarty, S., Hasanuzzaman, S., Saltmarsh, S., & Winn, S. (2019). Socioeconomic correlates of overweight and obesity among ever-married urban women in Bangladesh. BMC Public Health, 19, Article 842. https://doi.org/10.1186/s12889-019-7221-3

Venn, D., & Strazdins, L. (2017). Your money or your time? How both types of scarcity matter to physical activity and healthy eating? Social Science & Medicine, 172, 98-106. https://doi.org/10.1016/j.socscimed.2016.10.023

World Health Organization. (2014). Prevalence of non-communicable disease risk factors in the Republic of Moldova (STEPS 2013). WHO Regional Office for Europe.

World Health Organization. (2021, June 9). Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Younas, S., Murtaza, M. A., Manzoor, M. S., Arqam, U., Ali, Z., Hafiz, I., ... & Imran, M. (2024). Effect of probiotic incorporation on physicochemical attributes of yogurt during storage and influence on cholesterol assimilation. Journal of Food Science, 89(2), 1243-1251.

Zia-ur-Rehman, M., Kashif, M., Manzoor, M. S., Arqam, U., Tariq, F., Anwaar, M. U., Murtaza, A., Younas, S., Murtaza, M. A., & Ur Rehman, M. A. (2025). Effect of ginger (Zingiber officinale) and aloe vera (Aloe barbadensis Miller) extracts on physicochemical properties of grape juice under 4°C and 25°C. Journal of Food and Agricultural Technology Research, 4(1), 26–37.

Zulkepli, Z., Zakiah, N., Saat, M., Wafa, S. W., & Yahya, H. N. (2019). Relationship between physical activity level and cardiovascular risk factors among teachers. Asian Journal of Epidemiology, 12(1), 1–8. https://doi.org/10.3923/aje.2019.1.8

.