ApexMed Journal of Health Sciences

Influence of Dietary Habits, Physical Activity, and Sleep Patterns on Obesity Prevalence among University Students

Muhammad Qamar [a]

[a] BS (Hons) Medical Laboratory Technology, Government College University Faisalabad, mqamarpmc@gmail.com
Correspondence: Muhammad Qamar (mqamarpmc@gmail.com)

Received: 11 September 2025 | **Revised:** 05 October 2025 | **Accepted:** 31 October 2025

ABSTRACT

Obesity most of the college college students has emerge as one of the fundamental public fitness troubles and typically in city regions of growing nations. Increased susceptibility to immoderate weight benefit is supplied with the aid of using the interaction of life-style changes, withinside the shape of inconsistent nutritional habits, sedentary lifestyles, and disturbed sleep, withinside the college years that gift a hectic vulnerability period. Faisalabad, the second-biggest metropolitan metropolis of Pakistan, is selected because the vicinity of the observe because of the awareness of college college students with insufficient understanding of fitness behaviours which might be applicable to weight problems prevalence. With this background, the examine will recognition on nutritional habits, bodily interest levels, and sleep styles to decide their results on the superiority of weight problems amongst college college students in Faisalabad, Pakistan. A cross-sectional survey is followed because the studies layout of the examine due to the fact the take a look at goals at accumulating the essential facts to recognize the effect of nutritional habits, bodily pastime levels, The sampling turned into finished to encompass 280 college students that have been stratified. The dependent self-administered questionnaire turned into used to accumulate the facts primarily based totally at the Food Frequency Questionnaire (FFQ), the International Physical Activity Questionnaire-Short Form (IPAQ-SF), the Pittsburgh Sleep Quality Index (PSQI), and anthropometry (top and weight) to decide the Body Mass Index (BMI). The SPSS v.26 become used to decide that giant predictors of obese and weight problems (BMI 25 kg/m2) had been big the use of descriptive statistics, Pearson correlation, chi-rectangular tests, and binary logistic regression. Owing to mistaken nutritional habits, immoderate consumption of rapid food, liquids containing sugar, and coffee consumption of end result and greens had been drastically and negatively related to excessive BMI ($p < 0.05$). Students who were less active (physically) showed 2.4 times higher odds of being overweight/obese than highly-active students (OR = 2.4; 95% CI: 1.6-3.8). Sixty-one point four percent of the participants had poor sleep quality (PSQI score > 5) and it turned into a predictor of expanded BMI ($b = 0.31$, $p < 0.01$) through itself. Logistic regression confirmed that nutritional habits (OR = 2.1), sedentary behaviour (OR = 2.4), and bad sleep (OR = 1.8) had a great effect as impartial predictors of weight problems in college college students of Faisalabad. Urgent intervention packages inclusive of dietary counselling, everyday bodily pastime applications and sleep hygienic training are focused fitness merchandising interventions which might be essential in college settings to shrink the growing weight problems burden on this group.

Keywords: obesity, college students, eating habits, physical exercise, sleep, body mass index, Faisalabad, Pakistan, cross sectional research, health behaviour.

INTRODUCTION

Obesity is in recent times at epidemic fees withinside the international and it's far taken into consideration some of the gravest demanding situations withinside the sphere of public fitness withinside the 20th century. World Health Organization (WHO, 2022) reviews that over 1.nine billion adults are obese when you consider that greater than 650 million of them are overweight all around the international. The weight problems costs are not constrained to excessive-earnings international locations; the low-earnings and middle-earnings nations, together with Pakistan, are beginning to disproportionately go

through the weight of this continual condition (NCD Risk Factor Collaboration, 2022). There is a robust courting among weight problems and more than a few non-communicable diseases (NCDs) which include kind 2 diabetes mellitus, cardiovascular diseases, hypertension, a few cancers, and musculoskeletal diseases, which impose extensive fitness machine and country wide monetary burdens (WHO, 2022).

The college students withinside the college are one of the maximum susceptible populations in which the worldwide weight problems epidemic is concerned. University lifestyles also can be characterised with the aid of using drastic adjustments in way of life behaviours-college students can now make impartial meals selections, frequently lower ranges of bodily hobby, sleep styles turn out to be irregular, and the scholars come to be uncovered to extended instructional and psychosocial stressors (Deliens et al., 2014; Bacopoulou et al., 2021). All those overlapping elements predispose college students to benefit weight and be dysfunctional of their metabolism at a time of a important developmental stage. The proof-primarily based totally studies has been determined to signify that weight styles set withinside the early person years are much more likely to be carried to the later years of an man or woman existence, which will increase the results of terrible fitness behaviours of their early adulthood (Adams & Rini, 2007; Racette et al., 2005).

Pakistan is a robust instance of analyzing scholar weight problems. Due to fast urbanization, nutrients transition, that's related to a better consumption of processed calsorie-wealthy foods, and sedentary approaches of existence, there was a developing quantity of overweight instances of all ages (Ali et al., 2020). The cultural and highbrow capital of Pakistan and the second-biggest city, Faisalabad, is domestic to dozens of universities that serve masses of heaps of college students. Although this populace is enormous, there's a loss of empirical research investigating the outcomes of nutritional practices, workout, and the high-satisfactory of sleep to evaluate how weight problems relies upon on them withinside the organization of Faisalabad college college students (Hashmi et al., 2021). Most of the to be had literature in Pakistan is on grownup or paediatric populations, and there may be an great hole withinside the to be had proof on teenagers in establishments of better learning.

The weight loss plan of college college students is regularly defined as lacking meals, and specifically breakfast, consuming a number of speedy meals, sweetened drinks, and strength-dense cookies, and now no longer ingesting fruits, vegetables, and complete grains (Sogari et al., 2018; Pengpid and Peltzer, 2020). Such developments are preconditioned through such elements as time, economic elements, peer pressure, and a loss of healthful meals selections on or round campuses (Lupi et al., 2015; Ali et al., 2020). Studies have constantly associated the low first-class of diets with excessive BMI and the chance of growing weight problems in college-going individuals (Morales-Suarez-Varela et al., 2019; Katmarzyk et al., 2021).

The different pertinent reason of weight problems burden many of the college college students is bodily inactivity. Although the suggestions of the worldwide fitness network undoubtedly advise using as a minimum one hundred fifty mins of moderate-depth cardio exercising in line with week (WHO, 2020), surveys in numerous international locations have proven that the quantity of time spent with the aid of using college college students on moderate-depth cardio physical games is under the mark (Pengpid & Peltzer, 2020; Al-Kandari et al., 2020). Cultural beliefs, bad infrastructure, disturbing educational schedules, and extra leisure display screen time all oppress the sports of teenagers in Pakistan (Alam et al., 2020). Even after attaining the bodily interest desires of collaborating in a weekly session, sedentary behaviour, together with spending a number of time in a sitting posture at some stage in lectures, reading, and the use of a display on their amusement time, has been discovered to be an unbiased chance element of weight problems (Biswas et al., 2015; Patterson et al., 2020).

The problem of sleep styles has come to be the focal point of developing clinical hobby as a determinant of weight problems that may be changed. The speculation approximately the promoting of advantageous strength stability through continual sleep deprivation and terrible sleep first-class includes many interrelated processes: the disruption of appetite-regulating hormones (ghrelin and leptin) homeostasis, the augmentation of fatigue-related sedentary behaviour, the lengthening of the waking length with greater possibilities of caloric consumption, and changes in glucose metabolism and insulin sensitivity (Taheri et al., 2004; Cappuccio et al., 2020; Ogilvie and Patel, Sleep issues are particularly not unusualplace amongst college college students, and researchers word that 60-70% of them have low sleep fine, that's due to instructional strain, volatile routines, the extensive use of digital devices, and extended strain ranges (Lund et al., 2010, Ngan & Wan, 2021).

The bodily interest infrastructure, the ever-present nature of calorically dense avenue meals, the sociocultural factors of attitudes in the direction of ingesting habits, and the developing instructional opposition all play a especially permitting function withinside the Pakistani context, in regards to dangerous weight benefit withinside the college pupil populace. However, irrespective of the dimensions of this problem, the literature does now no longer encompass rigorous quantitative studies research at the mixed impact of nutritional habits, bodily pastime, and sleep fine on weight problems amongst this institution (Hashmi et al., 2021; Ahmed et al.,

2023; Riaz et al., 2018; Talha, 2021). The modern-day have a look at is the only this is aimed toward filling this hole.

The hypotheses of the studies encompass: (1) to discover occurrence of obese and weight problems amongst college college students in Faisalabad; (2) to degree nutritional habits, bodily pastime and sleep best most of the populace of college college students; (3) to check the institutions among the life-style elements and BMI and (4) to discover the good sized unbiased predictors of obese and weight problems. The effects could be beneficial in informing the status quo of proof-primarily based totally fitness merchandising applications in universities, Pakistan, to the bigger country wide time table of NCD prevention and control.

LITERATURE REVIEW

The article makes a speciality of the weight problems burden amongst college students in universities internationally and withinside the location. The occurrence of obese and weight problems in college students in universities has been pronounced broadly in various geographic and socioeconomic settings. Pengpid and Peltzer (2020) carried out a scientific evaluate and meta-evaluation of 29 nations and suggested a fee of 24.3% occurrence of obese/weight problems amongst male and 20.four% amongst girl college college students the world over. Even extra current research withinside the Eastern Mediterranean and South Asian vicinity have indicated even more incidence estimates, attributable to the hastily growing vitamins transition in those regions (Ali et al., 2020; Ngan and Wan, 2021). Obesity has been suggested to variety among 20 and 35 percentage amongst college students at Pakistani universities, and the traits are alarming and probable to grow (Hashmi et al., 2021; Ahmed et al., 2023).

World Obesity Federation (2023) estimates that with out lively participation, the range of obese and overweight adults might be extra than four billion via way of means of the yr 2035. Quite teens becoming a member of the better training machine at this level are uncovered to the results of compounding life-style dangers that make prevention efforts withinside the college putting a well timed and pressing one. As highlighted withinside the evaluation with the aid of using Bacopoulou et al. (2021), the prevention of weight problems amongst college college students is an initiative that has extensive fitness payoffs withinside the long time seeing that it's far a pivotal segment withinside the formation of recurring fitness behaviours.

Dietary Habits and Obesity

The connection among weight problems and nutritional practices is lengthy-mounted in each mechanistic and epidemiological reassets of literature. There are specially sturdy nutritional shifts a few of the college students of universities which might be observed with the aid of using the lack of parental manage. Sogari et al. (2018) suggested that European and North American college college students had a first rate upward push in intake of ultra-processed foods, rapid foods, and sugar-sweetened liquids after they joined college and finally BMI improved despite the fact that in measurable quantities at some point of the instructional yr. Likewise, in a Spanish cohort, Morales-Suarez-Varela et al. (2019) determined that a low nutritional first-class rating turned into a sizable issue that expanded the hazard of weight problems with the aid of using 1.7.

The tradition of road meals has unique nutritional problems withinside the South Asian context. According to Ali et al. (2020), Pakistani college college students ate fried snacks and different calorically wealthy meals items, in addition to avenue meals, on a mean of 4 to 5 instances according to week, with the consumption of such meals being undoubtedly and considerably correlated with BMI. The frequency of speedy meals intake became determined to be a higher predictor of weight problems as in comparison with the whole caloric consumption in a vacuum, which highlights the significance of the pleasant of meals further to the quantity of meals. Lupi et al. (2015) posited that the meal-skipping behaviour, mainly the breakfast-skipping, interferes with the metabolic law and is related to the overeating later withinside the day, which results in the superb electricity balance. The connection among breakfast skipping and excessive BMI amongst college college students is supported through cross-sectional information of numerous research (Sogari et al., 2018; Pengpid and Peltzer, 2020).

The big overview with the aid of using Katmarzyk et al. (2021) has additionally cited that the dearth of fruit and greens as a symptom of the negative nice of the weight loss program is constantly connected to growing BMI irrespective of age. The shielding cappotential of nutritional fibre on satiety manipulate and metabolic pastime is proven, and its lack withinside the eating regimen of college college students will increase the threat. Specifically, Ahmed et al. (2023) examined the overall populace of the college in Faisalabad and found that scholars who did now no longer take greater than quantities of culmination and greens consistent with day additionally had a appreciably better suggest BMI than folks that took extra veggies and culmination ($p < 0.01$).

Physical Activity and Obesity

The WHO has now taken into consideration bodily inaction because the fourth maximum not unusualplace chance aspect to worldwide demise and a first-rate contributor to the weight problems epidemic. The degree of bodily interest amongst college college students extensively decreases all through the years of secondary college that's registered most of the North American, European, and Asian populations (Pengpid and Peltzer, 2020;

Al-Kandari et al., 2020). University transition provides some of structural boundaries to bodily pastime which include amplified instructional demands, absence of entertainment time, dwindled readiness to prepare recreation and prolonged employment of private generation as leisure use (Alam et al., 2020).

A massive multinational take a look at with the aid of using Patterson et al. (2020) confirmed that when controlling for entertainment-time bodily hobby, sedentary behaviour on its personal expected the hazard of weight problems, indicating that there are metabolic repercussions to extended sitting, that is a characteristic of college lectures and observe sessions. Alam et al. (2020) located that amongst Pakistani college students of the college, extra than sixty eight percentage of college students, on common, did now no longer exceed the minimal WHO suggestions of bodily interest, with the common time spent at sedentary entertainment sports exceeding six hours a day. Multivariate analyses affirmed that low bodily hobby changed into a predictor of being obese/overweight with importance stage (OR = 2.9, 95% CI: 1.8-four.7).

Biswas et al. (2015) have created a scientific assessment and meta-evaluation with the effects that sedentary time exceeding 8 hours according to day changed into connected to significantly excessive all-purpose mortality and cardiometabolic chance, irrespective of the diploma of bodily hobby. This truth questions the conventional fable that the cappotential to stick to the advocated workout packages is sufficient to offset the poor outcomes of sitting in lengthy periods, and the outcomes have been of unique significance to college students who can workout however additionally spend a great deal time in lecture rooms and at desks. University interventions inclusive of lively breaks, status desks, and obligatory bodily training were related to capacity to sell the extent of interest and reduce sedentary time in college populations (Al-Kandari et al., 2020).

Sleep Patterns and Obesity

The linkage of sleep disturbance and weight problems has acquired lots of empirical proof withinside the final twenty years. In a scientific overview and meta-evaluation of 30 research, Cappuccio et al. (2020) determined that brief sleep duration (much less than 6 hours a night) changed into connected with the chance of growing weight problems in adults fifty five percentage better. The organic methods concerned withinside the connection among sleep deprivation and weight problems are multifactorial. Sleep deprivation will increase the ranges of ghrelin (starvation-stimulating hormone) and reduces the extent of leptin (satiety-signalling hormone), which ends up in starvation and a preference to devour excessive-power foods (Taheri et al., 2004; Ogilvie and Patel, 2017).

One of such populations which have been disadvantaged of sleep is college students in universities. Lund et al. (2010) observed out that seventy percentage of American university college students stated that they lacked sleep as a minimum some nights every week and that they blamed it on educational demands, social activities and use of nocturnal era. In a extra current observe, Ngan and Wan (2021) on Asian college college students found out PSQI rankings that advise terrible sleep excellent in greater than 65% of the populace and that there has been a vast correlation among terrible sleep and improved BMI. In Pakistan, Ahmed et al. (2023) discovered that the common quantity of sleep at fundamental towns throughout tests become much less than 6.five hours according to night, and the sleep structure turned into in large part disturbed in the course of the complete 12 months due to extended display screen time and educational strain amongst college college students.

The bi-directional person of the sleep-weight problems dating must be mentioned. Although sleep deprivation ends in weight advantage, weight problems itself interferes with sleep in such methods as obstructive sleep apnoea, gastro-oesophageal reflux, and orthopnoea (Ogilvie and Patel, 2017). This collectively perpetuating courting may also provide self-reinforcing harm loops of terrible sleep and weight benefit which can be tough to interrupt with out planned intervention. According to Cappuccio et al. (2020), sleep hygiene schooling and cognitive behavioural techniques to beautify the best of sleep may be taken into consideration beneficial enhances to nutritional and bodily interest interventions in weight problems prevention programmes.

Interacted Lifestyle Factors and Obesity

New proof is progressively supplying backing to the want to view the difficulty of nutritional behavior, bodily pastime, and sleep styles as a remedy as an inseparable life-style assemble and now no longer as elements which can be impartial of every different and make contributions to weight problems. A big potential cohort with the aid of using Katmarzyk et al. (2021) tested that people with all 3 sorts of bad behaviours simultaneously negative food plan, low interest, and quick sleep- had a extensively better chance of weight problems compared to people with a unmarried threat issue only, indicating synergistic as opposed to simply additive outcomes. This significantly affects at the layout of interventions, which generally tend to consciousness on holistic multi-element programme, that can manipulate life-style elements on the identical time.

With the precise recognition on the difficulty of college students of the college in growing nations, the authors of the examine with the aid of using Hashmi et al. (2021) highlighted the environmental and structural situations, along with the meals surroundings on the campus, the presence of leisure

facilities, educational schedule, and college healthcare services, which slight the connection among the person fitness behaviours and the effects of weight problems. Universities consequently have a principal position to play as structures of fitness promotion, in that, they could have an impact on the environmental situations that might favour or preclude wholesome lifestyles. The cutting-edge studies expands in this compounded shape in an strive to analyze the general function of nutritional and bodily sports in addition to sleep styles on the superiority of weight problems amongst college college students in Faisalabad.

METHODOLOGY

Study Design

The studies layout that changed into used on this take a look at become a cross-sectional, quantitative studies layout to decide the institutions among the life-style behaviours and the superiority of weight problems amongst Faisalabad college college students in Pakistan. Cross-sectional designs also are suitable in estimating the superiority of a disease, and investigating relationships among publicity variables and the consequences of fitness at one factor in time (Setia, 2016). The amassed statistics became among February and April 2024.

Sample Size and Sampling Strategy

Stratified random pattern method turned into used to assure the proportionate illustration of each organization. Cochrans (1977) system of a finite populace cross-sectional research become used to calculate the pattern size:

Assuming a ninety five% degree of self assurance, p = zero.35 (anticipated occurrence of weight problems/obese with nearby surveys carried out withinside the beyond), and e = zero.06 (margin of error). This gave a minimal pattern required of 243. The goal pattern became a 280-scholar pattern which become derived via way of means of thinking about a 15% predicted non-reaction rate. The contributors have been sampled in every of the colleges in proportions to its undergraduate enrolment size. The easy random sampling become finished inside every organization with the aid of using the usage of the scholar registration lists that had been gathered withinside the college administrative offices.

Inclusion criteria: undergraduate college students presently in university and among the a long time of 18-30 years, ought to be inclined to make knowledgeable consent and should be found in campus at some point of the manner of records series. Exclusion criteria: Diagnosed instances of metabolic disorders (i.e. hypothyroidism, Cushing syndrome), pregnant college students, and college students venture fitness technological know-how programmes (to save you bias in responses).

Data Collection Instruments

A questionnaire turned into administered withinside the shape of a self-administered, based questionnaire, and covered 4 tested sections:

1. Sociodemographic Questionnaire: Age, gender, quantity of years in look at, college, month-to-month earnings withinside the household, and home status (hostel/day scholar).
2. Food Frequency Questionnaire (FFQ): A 25 object semi-quantitative FFQ of recurring consumption of meals agencies withinside the remaining month, with objects on speedy meals, culmination and vegetables, sugar-sweetened beverages, dairy, entire grains, and snacks. The high-satisfactory of diets became calculated and labeled into terrible, slight and good.
3. International Physical Activity Questionnaire-Short Form (IPAQ-SF): It became a tested degree that decided frequency, duration, and depth of bodily pastime withinside the beyond seven days ensuing in metabolic equal of task (MET) ratings. The members have been categorised into low, mild and excessive pastime.
4. Pittsburgh Sleep Quality Index (PSQI): It turned into a 19-object device measuring 7 rankings at the sleep components (subjective sleep excellent, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of snoozing medication, and daylight hours dysfunction). A rating of five or extra on worldwide PSQI changed into a terrible first-class of sleep (Buysse et al., 1989).

The anthropometric measurements (top and weight) had been accomplished via way of means of the skilled studies assistants beneathneath the standardized procedures. BMI became calculated as weight (kg)/peak (m 2) and became categorized consistent with WHO criteria: underweight (< 18.five), ordinary weight (18.five-24.9), obese (25.zero-29.9), and overweight ([?] 30.zero kg/m 2). To facilitate the evaluation, the agencies of obese and overweight had been similarly grouped into one final results variable (BMI [?] 25 kg/m2).

Data Analysis

The facts have been coded, keyed in and analysed with SPSS (Statistical Package for Social Sciences) Version 26.zero. All variables had been calculated the use of descriptive statistics (frequencies, percentages, means, and widespread deviations). The chi-rectangular take a look at changed into carried out to check institutions among specific unbiased variables (nutritional best, bodily pastime category, sleep great), and weight problems status. Pearson correlation coefficients have been calculated to decide the bivariate correlation among non-stop variables and BMI. To decide the impartial predictors of obese/weight problems controlling the feasible confounders consisting of age, gender, and socioeconomic status, binary logistic regression changed into done. The statistical importance changed into installed at p<zero.05. The odds ratios (OR) with ninety five percentage self assurance intervals (CI) are protected.

Ethical Considerations

Before statistics series, moral approval turned into secured withinside the University of the Punjab institute assessment board (IRB). Everybody signed knowledgeable consent in writing. The records series system, records evaluation and reporting ensured anonymity and confidentiality. The involvement became absolutely voluntary and the scholars have been made to apprehend that they may withdraw with out repercussion.

DATA ANALYSIS AND RESULTS

The Sociodemographic Profile

Two hundred and eighty students responded and gave a response rate of 93.3%. After the elimination of questionnaires that were not filled, the final analytical sample consisted of 261 respondents (n = 19). Female (52.1% (n = 136) and male (47.9% (n = 125)) represented the sample in equal proportions. The average age of the participants was 20.7 years (SD = 1.9) with the range of 18 to 28 years. The majority of them were first (58.6) and second (41.4) year students. Distribution by the university: Punjab University (30.7%), UMT (22.6%), LUMS (17.2%), FCCU (16.5%), and BNU (13.0%). About 44.4 percent of the students were living in university hostels, the rest 55.6 percent were day scholars. Monthly household income was put into low (< PKR 50,000; 28.7%), middle (PKR 50,000-150,000; 45.6%), and high (> PKR 150,000; 25.7%).

The prevalence of Overweight and Obesity

The table 1 shows the distribution of BMI of the study sample. Mean BMI was 24.8 kg/m2 (SD = 4.2). Underweight populations (BMI < 18.5) consisted of 8.0 percent, normal weight (18.5-24.9) was found in 53.6, overweight (25.0-29.9) in 24.9, and obesity (BMI [?]) in 8.0 percent. 30) was documented in 13.8%. A total of 38.7% were overweight and obese. The rates of overweight/obesity were significantly higher in male students (44.8) as compared to female students (33.1) (kh2 = 4.87, p = 0.027). The prevalence of overweight/ obesity among the residents of the hostel was slightly higher (41.4) than in day scholars (36.6), but the difference was not statistically significant (p = 0.38).

$$n = Z^2 \times p(1-p) / e^2$$

Table 1: BMI Distribution of Study Participants (N = 261)

BMI Category	BMI Range (kg/m²)	Frequency (%)
Underweight	< 18.5	8.0
Normal Weight	18.5 – 24.9	53.6
Overweight	25.0 – 29.9	24.9
Obese	≥ 30	13.8
Overweight + Obese (Combined)	≥ 25	38.7

Dietary Habits

The scores on dietary quality based on FFQ gave 43.7 percentage poor dietary quality, 39.5 percentage moderate, and only 16.9 percentage good. The consumption of fast foods was described as daily or almost day by 34.9% of the respondents, and consumption of sugar-sweetened beverages (2 servings/day) was described by 41.8%. Fewer than a quarter of students (23.4% of) ate five or more servings of fruits and vegetables per day as recommended. Breakfast- skipping was common, whereby 48.3 percent of the participants skipped breakfast three times or more per week.

Chi-square analysis found that the two variables (dietary quality category and overweight/obesity status) have a statistically significant relationship (kh2 = 18.43, df = 2, p < 0.001). Students with low dietary quality had 51.3 percent overweight and obese students versus 34. 0% in moderate quality group and 18.2% in good dietary quality group. The correlation analysis of Pearson was used to validate that there is a significant negative correlation between dietary quality score and BMI (r = 0.42, p < 0.001), showing that the increased quality of the diet was linked to lower BMI.

The frequency of fast food was positively associated with BMI (r = 0.39, p < 0.001) and so was the consumption of beverages that were sweetened with sugar (r = 0.31, p < 0.001). The consumption of fruit and vegetables was significantly correlated with a negative correlation with BMI (r = 0.27, p < 0.01). Students who missed breakfast 3 or more times per week reported a much greater mean BMI (25.8 kg/m2) than those who missed breakfast rarely and never (23.7 kg/m2) (t = 4.11, df = 259, p < 0.001).

These results are correlated with the existing literature that shows that inadequate fruit, vegetable, and whole grain diet and a high intake of processed and energy-rich foods are one of the major contributors to weight gain among university students (Sogari et al., 2018; Ali et al., 2020). The high rates of fast foods and sugary beverages consumption that were especially high in this sample can be considered the result of the wide spread placement and culturalization of those eating patterns in the urban food environment of Faisalabad. Campus-specific nutrition policies, such as the feeding of university canteens with healthier food and subsidized food access to fruits and vegetables can play a pivotal role in enhancing the quality of diets in this group.

Physical Activity

Physical activity levels were divided into low (< 600 MET-min/week; 52.5%), moderate (600-2999 MET-min/week; 34.1%), and high (3000 MET-min/week; 13.4%), using IPAQ-SF MET-minute scores. Most of the students (52.5) did not comply with the minimum physical activity requirements set by the WHO. The mean sedentary time was 8.2 hours per day (SD = 2.1), and 67.8% of the respondents had sedentary

leisure time (primarily screen time) longer than 4 hours per day.

The category of physical activity had statistically significant correlation with the overweight/obesity status (kh2 = 22.65, df = 2, p = 0.001). The prevalence of overweight/obesity was 50.7% in low-activity students, 31.5% in moderately active students and 14.3% in highly active students. The total MET score of IPAQ was significantly negatively correlated with the BMI (r = 0.44, p < 0.001), whereas hours of daily sedentary life were positively related with the BMI (r = 0.36, p < 0.001).

The BMI of the students who participated in organized sport or at least 30 minutes exercise on at least five days per week was 22.9 kg/m2, and among those who exercised less than two days per week, it was 25.9 kg/m2 (t = 5.64, df = 259, p < 0.001). The findings can be compared to the ones by Alam et al. (2020) and Al-Kandari et al. (2020), which prove that physical inactivity is one of the strongest modifiable risk factors of obesity among the population of university students. The observation that sedentary behaviour has a direct effect on increasing BMI that is independent of the levels of physical activity per se are in line with the accumulating body of evidence discussed by Biswas et al. (2015) and Patterson et al. (2020).

Sleep Patterns

A poor quality of sleep (score above 5) was reported among 61.3% of the participants worldwide. The average PSQI of the world was 6.8 (SD = 3.1). The mean hours (SD = 1.2) of self-reported sleep per night was 6.1, with 53.3% of the population getting less than 7 hours of sleep per night. On a weeknight, 44.8% of students reported late into the sleep (after midnight), 71.6% reported using electronic devices often within an hour of going to sleep.

PSQI global scores were significantly and positively related to BMI (r = 0.38, p < 0.001) and sleep duration was significantly and negatively associated with BMI (r = 0.33, p < 0.001). The prevalence of overweight/obesity was higher among students with poor sleep quality (PSQI > 5) than the ones with good sleep quality: 48.1% and 24.2% respectively (kh2 = 16.44, df = 1, p < 0.001). Mean BMI of students who slept less than 6 hours per night was 25.9 kg/m2 as compared to 23.4 kg/m2 of students who slept 7 and above hours (t = 4.76, df = 259, p < 0.001).

The most common subscale item of PSQI called daytime dysfunction (58.2% control) was high, where most students indicated they were challenged in terms of concentration and were too sleepy during the day. This aligns with the two-way association between sleep deprivation and obesity reported by Cappuccio et al. (2020) and Ogilvie and Patel (2017), where nocturnal disturbances associated with obesity worsen the state of sleep, which may result in a vicious cycle between poor sleep and weight gain.

Logistic Regression Analysis with Two independent variables is a statistical test used to determine if the two variables significantly influence the expected outcomeBinary logistic regression was done to determine the independent predictors of overweight/obesity (BMI 25 kg/m2) having considered the age, gender, household income and residential status. The general model was statistically significant (kh2 = 87.43, df = 10, p < 0.001) and rightfully identified 74.3% of the participants. Nagelkerke R2 0.38 reflected that the model was able to explain about 38 percent of the variation in the status of obesity.

Table 2: Binary Logistic Regression — Predictors of Overweight/Obesity

Predictor Variable	Adjusted OR	95% Confidence Interval	p-value
Poor Dietary Quality (ref: Good)	2.12	1.38–3.26	0.001
Moderate Dietary Quality (ref: Good)	1.47	0.93–2.32	0.094
Low Physical Activity (ref: High)	2.43	1.57–3.76	<0.001
Moderate Physical Activity (ref: High)	1.61	1.02–2.54	0.041
Poor Sleep Quality (PSQI > 5)	1.84	1.22–2.78	0.003
Male Gender	1.63	1.08–2.47	0.021
High Household Income	1.38	0.87–2.20	0.174

The outcomes of the logistic regression model ensure that low dietary quality (OR = 2.12; 95% CI: 1.38-3.26; p = 0.001), low levels of physical activity (OR = 2.43; 95% CI: 1.57-3.76; p = 0.001), and low levels of sleep quality (OR = 1.84; 95% CI: 1.22-2.78; p = Male gender was also an important predictor (OR = 1.63; 95% CI: 1.08-2.47; p = 0.021). Household income and residential status were not statistically significant in the adjusted model indicating that the hypothesized relationships among lifestyle behaviours and the obesity status are strong in this sample regardless of the socioeconomic lines.

It is interesting to note that low physical activity had the highest odds ratio compared to the other two risk factors which are behavioural hence it was the strongest predictor of obesity in this scenario. This observation is supported by the results of Alam et al. (2020) and Pengpid and Peltzer (2020), who also found physical inactivity to be a leading predictor in South Asian university students. The moderate effect of sleep quality on the risk of obesity, independent of diet and activity, supports the need to consider sleep as a behavioural specific target in campus health programs, which is often not considered in traditional diet and exercise models.

CONCLUSION

The presented cross-sectional study offers a solid empirical data that dietary behavior, exercise

intensity, and sleep duration are important and autonomous predictors of the prevalence of overweight and obesity among university students in Faisalabad, Pakistan. The population surveyed in the research, which reported an overweight/obesity level of 38.7% among the sampled population- a significantly high percentage in comparison to national audio average- validated the assertions that university students in urban Pakistan provide a high-risk group that needs specific intervention. The dietary, physical and poor sleep quality were all significantly linked to high BMI in the bivariate analyses, and all three were still considered independent predictors of overweight/obesity in the adjusted logistic regression equation.

The results indicate the multifactorial obesity among university populations and the inefficacy of a single-domain intervention. Those students who had the three unhealthy lifestyle behaviours simultaneously were at risk of becoming obese significantly higher than when the risk factors were only present individually, indicating that it is a synergistic phenomenon that should be reflected in designing integrated prevention programmes. Poor sleep quality and high consumption of fast food and sugary sweet drinks, combined with the high prevalence of sedentary behaviour (students spend more than eight hours a day in sedentary activities, on average) portrays a worrying trend of the health behavioural context in the universities of Faisalabad. Unless action is timely and concerted, the obesity burden caused by this group of people is likely to escalate with long-term implications on the health of individuals and the cost of healthcare provision within a country.

This research will act as a base to evidence-based health policy in higher education institutions in Pakistan because it has a limited literature on the topic of student health. The clinical tooling used and the high standards of analysis increase the certainty of results, but the cross-sectional research design does not allow the establishment of causality, and the research was performed in one city, which makes it impossible to extrapolate to other universities in Pakistan. The longitudinal studies on the shift in lifestyle behaviour and BMI throughout the university duration and the qualitative studies on the social and environmental factors driving the unhealthy behaviour on the campuses of Faisalabad would immensely enhance the evidence base.

RECOMMENDATIONS

Recommendations expressed on the basis of research results are as follows:

- **University Nutrition Policy:** Universities ought to redefine the food climate on their campuses by making healthy food options more accessible, affordable and visible in their canteens and vending machines. Sugar-sweetened beverages and ultra-processed food policies that limit their marketing and location in campuses should be taken into account.
- **Physical activity Inclusion:** Universities must invest in affordable and easy to use recreational amenities, introduce organized intramural sports programmes, include active breaks into lecture courses, and possibly include compulsory physical activity credits in undergraduate degrees. Campuses can be made open to incidental activity by having walking routes and bicycle tracks.
- **Sleep Hygiene Education:** As sleep quality is highly prevalent and it is a risk factor of obesity by itself, sleep hygiene education should be included in undergraduate health care and academic counselling services. Scheduling policies that limit early morning lectures, abate the academic stress that compels students to study late in the night can also enhance student sleep.
- **Combined Wellness Programmes:** Multi-componential wellness programmes, which effectively target dietary behaviours, physical activity and sleep quality are likely to be more effective when compared to single-domain programmes. Models of peer health educators, digital health apps and wellness challenges using incentives have demonstrated the potential to reach populations of university age.
- **Periodic Health Examination:** Universities are to entrench the practice of regular Health examination, such as measuring of Body Mass Index and lifestyle risk assessment upon enrolment and after every one year. Early screening of at-risk students of obesity allows seeking university health services in time and targeted intervention.
- **Policy Advocacy:** University administrations and health authorities at Faisalabad ought to work together to come up with the city-wide university health policies in line with the Health Promoting University concept of the WHO, entrenching student health as a strategic institutional concern as opposed to an incidental one.

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