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A Cross-Sectional Study of Smoking Prevalence and Body Mass Index Differences in Aljanad University for Science and Technology Students, Taiz City, Yemen

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Abstract

Introduction: Smoking is one of the leading causes of morbidity and mortality worldwide and has been linked to changes in body weight. However, the relationship between smoking and Body Mass Index (BMI) among university students in Yemen remains insufficiently explored. This study aimed to assess the relationship between smoking habits and BMI among students at Aljanad University for Science and Technology in Taiz City, Yemen, and to identify the factors influencing this association, including physical activity and dietary habits.
Methods: A cross-sectional study was conducted among randomly selected students (from three faculties. Data were collected using a structured questionnaire covering sociodemographic characteristics, smoking patterns, diet, and physical activity. Anthropometric measurements were obtained to calculate BMI, and statistical analysis was performed using SPSS version 21.
Results: The study included 200 students (128 males and 72 females). Fifty-nine percent of the participants were smokers, with a higher prevalence among males and students of the Faculty of Engineering and Information Technology. Mean±SD BMI values for smokers (20.5±1.0) and non-smokers (20.1± 0.9) were within the normal range, while ex-smokers showed slightly lower BMI (18.2± 2.0). No significant relationship was found between smoking duration and BMI (P=0.350). The associations of physical activity and dietary habits with BMI were stronger than that of smoking status.
Conclusion: Smoking was prevalent among students but showed no direct effect on BMI. Other lifestyle factors, particularly physical activity and dietary habits, played a significant role in determining body weight. Targeted health education programs, gender-sensitive smoking cessation initiatives, promotion of physical activity, and integration of nutritional counseling into university health services are recommended to improve overall student well-being.

Keywords: Smoking, Body Mass Index (BMI), Dietary Habits

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دراسة مقطعية حول انتشار التدخين واختلافات مؤشر كتلة الجسم بين طلاب جامعة الجند للعلوم والتكنولوجيا، مدينة تعز- اليمن

أيمن عبدالجبار راوح[1]، إسراء الجماعي[2]، شيماء الكبادي[2] ، أشجان المعمري[2] ، مرام الصنوي[2] ، بسمة المخلافي[2] ، نهى الأغبري[2] ، دعاء غلاب[2] ، هديل حسن[2]

ملخص الدراسة

المقدمة: يُعد التدخين أحد أبرز الأسباب المؤدية إلى الإصابة بالأمراض والوفيات على مستوى العالم، وقد ارتبط بحدوث تغيرات في وزن الجسم. ومع ذلك، لا تزال العلاقة بين التدخين ومؤشر كتلة الجسم (BMI) بين طلاب الجامعات في اليمن غير مدروسة بشكل كافٍ .هدفت هذه الدراسة إلى تقييم العلاقة بين عادات التدخين ومؤشر كتلة الجسم بين طلاب جامعة الجند للعلوم والتكنولوجيا في مدينة تعز – اليمن، بالإضافة إلى تحديد العوامل التي تؤثر في هذه العلاقة، بما في ذلك النشاط البدني والعادات الغذائية.

المنهجية: أُجريت دراسة مقطعية على عينة عشوائية من ثلاث كليات مختلفة. جُمعت البيانات باستخدام استبيان منظم تضمن الخصائص الديموغرافية، وأنماط التدخين، والعادات الغذائية، ومستوى النشاط البدني. كما تم أخذ القياسات الأنثروبومترية لحساب مؤشر كتلة الجسم، وأُجري التحليل الإحصائي باستخدام برنامج SPSS الإصدار 21.

النتائج: شملت الدراسة 200 طالب (128 ذكراً و72 أنثى). أظهرت النتائج أن 59٪ من المشاركين كانوا من المدخنين، مع انتشار أعلى بين الذكور وطلاب كلية الهندسة وتقنية المعلومات. كان المتوسط والانحراف المعياري لمؤشر كتلة الجسم للمدخنين 1.0 ±20.5 ولغير المدخنين 0.9 ±20.1 أي ضمن النطاق الطبيعي، في حين أظهر المدخنون السابقون متوسطًا أقل قليلاً (2.0 ±18.2). لم تُلاحظ علاقة ذات دلالة إحصائية بين مدة التدخين ومؤشر كتلة الجسم (P= 0.350) كما تبين أن النشاط البدني والعادات الغذائية يرتبطان بمؤشر كتلة الجسم بدرجة أكبر من حالة التدخين.

الاستنتاج: على الرغم من انتشار التدخين بين الطلاب، إلا أنه لم يُظهر تأثيرًا مباشرًا على مؤشر كتلة الجسم. وتشير النتائج إلى أن العوامل المتعلقة بنمط الحياة، وخاصة النشاط البدني والتغذية، لها تأثير أكبر في تحديد وزن الجسم. توصي الدراسة بتنفيذ برامج توعية صحية موجهة، ومبادرات للإقلاع عن التدخين تراعي الفروق بين الجنسين، وتشجيع ممارسة النشاط البدني، ودمج الإرشاد الغذائي ضمن خدمات الرعاية الصحية الجامعية، بما يسهم في تعزيز الصحة العامة للطلاب.

كلمات مفتاحية: التدخين ، مؤشر كتلة الجسم ، العادات الغذائية

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Introduction

Smoking is one of the leading causes of morbidity and mortality worldwide [1,2]. The co-occurrence of smoking has substantial consequences for health. Tobacco smoking involves drawing into the mouth, and usually the lungs, smoke from burning tobacco [3].

Body Mass Index (BMI) is a measure of human body fat based on height and weight. A person's weight is calculated in kilograms or pounds divided by the square of height in meters or inch. BMI is calculated by dividing a person's weight in kilograms by the square of their height in meters. [4]. BMI is a popular and reliable anthropometric tool to measure obesity, and assess an individual's nutritional and health status that applies to both adult men and women [5]. It is also liable risk indicator for various diseases that can develop due to a higher percentage of body fat. At present, it is extensively used in many fields because of its simplicity in measurement and its availability [6]. BMI can be used by all people, both amateur trainers, as well as professionals, scientists, and researchers [7]. It is the best available anthropometric estimate of body fatness for public health purposes as it is related to both physical and psychological health, such as overall mortality, chronic somatic illnesses, psychiatric disorders, etc. [8,9].

Numerous studies show that nicotine acutely increases energy expenditure [10]. and could can reduce appetite, which likely explains why smokers tend to have lower body weight than do nonsmokers and why smoking cessation is frequently followed by weight gain [11,12]. The link between smoking and body weight is evident as early as adolescence. Adolescents, especially girls, report starting to smoke and continuing with the habit for purposes of weight control and weight loss [13]. Young adults who are trying to lose weight are 40% more likely to smoke cigarettes [14]. The idea that cigarette smoking is helpful in controlling body weight has been part of popular culture for many years. It is not surprise that smoking cessation is often coupled with an increase in weight [15]. The literature confirms that, although not universal, most people will experience a weight gain of between 4-5 kg following cessation [16,17], while only a small percentage of quitters (13%) experience a weight gain of 11 kg [16,18]. Nevertheless, the onset of significant, or greater than anticipated, weight gain can significantly impair the likelihood of smoking cessation success. As a result, it is important to understand the factors that surround weight gain in association with smoking cessation to apply "anticipatory guidance" and simple counselling in forestalling the development of this common cessation side effect [19].

Smoking initiation may be triggered by weight concern and previous attempts to lose weight and smoking initiation was more frequent in females who were overweight, who reported trying to lose weight, or who described themselves as overweight than in females, [20]. Moreover, the inverse relationship between smoking and relative body weight becomes stronger with age, [21] which can be explained by a longer duration of smoking [22,23].

Although numerous studies have examined the relationship between smoking and BMI, much of the existing literature has focused primarily on the superficial association between smoking and weight status. There remains a limited understanding of the bidirectional impact effects of smoking cessation on weight gain, particularly in relation to gender differences, age groups, and psychological factors. Furthermore, the long-term implications of post-cessation weight gain on the success of smoking cessation programs have not been thoroughly investigated.

This research seeks to address these gaps by providing a more nuanced analysis of the smoking-BMI relationship and its broader health implications, thereby contributing to the development of more effective public health interventions. Therefore, the current study aims to clarify the nature of the smoking-BMI relationship among students at Aljanad University and identify factors influencing this association. The aim of this work is to assess the relationship between smoking habits and BMI among students at Aljanad University in Taiz city, Yemen, with a particular focus on the effect of smoking and smoking cessation on body weight, and to identify the key factors influencing this relationship.

Methods

Study Design

A cross-sectional study was conducted incorporating both descriptive and analytical components. The data collection period extended from October 2024 to January 2025.

Study setting

The study was conducted at Aljanad University for Science and Technology Campus in Taiz, Yemen. The participants included the Faculty of medical sciences, the Faculty of Engineering and Information Technology (IT), and the Faculty of Administrative Sciences.

Sampling

The sample size was determined using Fischer's Formula ($n= z^2pq/d^2$) [24]. A total of 200 students were randomly selected from the aforementioned faculties at Aljanad University Taiz. Participants' ages ranged from 17 to 28 years.

Data collection method

Data were collected using structured, self-administered questionnaires. These questionnaires captured information on sociodemographic characteristics, medical history, smoking habits, chronic illnesses, psychological factors, dietary habits, and physical activity levels. Each respondent was assigned a unique identification code to ensure confidentiality and accurate data management.

Anthropometric measurements

The weight and height of the students were measured and the values used to calculate the BMI. The procedure for height measurement has been clarified in accordance with WHO protocols. Height and weight were measured using a standardized stadiometer and digital scale, respectively. Participants were measured without shoes and in light clothing to ensure accuracy. Evaluation of the nutrition status using BMI was based on the WHO criteria and computed by dividing the weight (kg) by the square of the

height (m). BMI (kg/m^2) of the students was classified as follows: underweight (< 18.5); normal (18.5-24.9); overweight (25.0-29.9) and obese (> 30.0) [25].

Data analysis

All data were coded and analyzed using SPSS version 21. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize the data. The Chi-square test and Independent Samples t-test were applied to assess associations between smoking status and BMI. A p-value < 0.05 was considered statistically significant.

Results

1. Prevalence of Smoking Among University Students

1.1. Distribution of Groups by Smoking status

The study included 128 males and 72 females, 59% of them were smokers, with the Faculty of Engineering and IT reported the highest percentage (37.3%), followed by the Faculty of Medical Sciences (31.3%), and Administrative Sciences (31.3%). Non-smokers represented 34.5%, and ex-smokers made up 6.5% of the sample as illustrated in Table (1) and Figure (1).

Table 1: Distribution of Students by Smoking Status

Groups	Faculty of Medical Sciences		Faculty of Engineering & IT		Faculty of Administrative Sciences		Total	
	No.	%	No.	%	No.	%	No.	%
Smokers	37	31.3	44	37.3	37	31.3	118	59.0
Non-Smokers	31	45.0	28	40.5	10	14.5	69	34.5
Ex-Smokers	6	46.1	4	30.8	3	23.1	13	6.5
Total	**74**	**37.0**	**76**	**38.0**	**50**	**25.0**	**200**	**100**

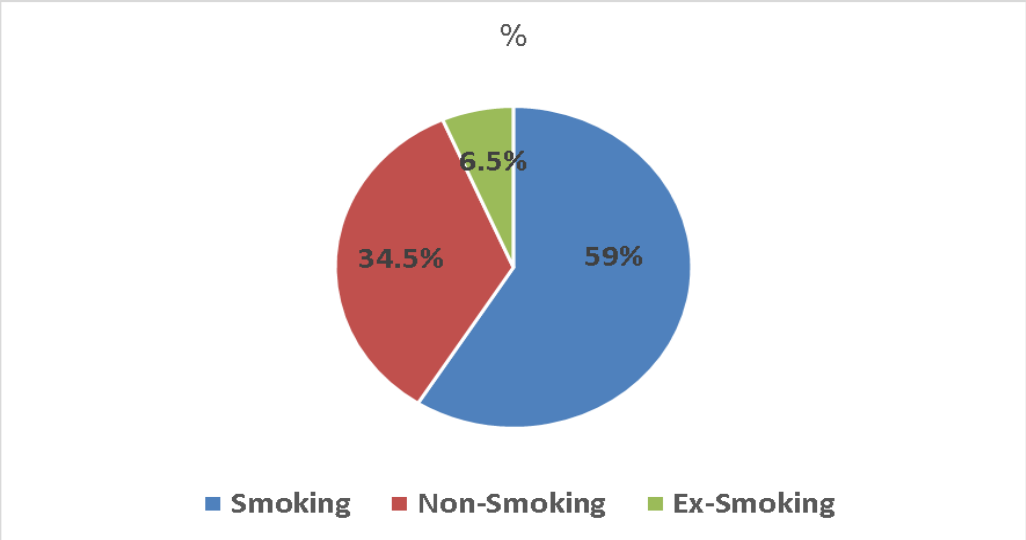

Fig. 1: Distribution of Groups by Smoking Status

1.2. Distribution of Smoking status in Relation to Sex of Samples:

Males were predominantly represented among smokers (72%) and ex-smokers (61.5%), whereas non-smokers were more evenly distributed between males (51%) and females (49%) as illustrated in Table (2) and Figure (2).

Table 2: Distribution of Smoking Status in Relation to Sex

Group	Male (n=128)		Female (n=72)	
	No.	%	No.	%
Smokers	85	72.0	33	28.0
Non-Smokers	35	51.0	34	49.0
Ex-Smokers	8	61.5	5	38.5

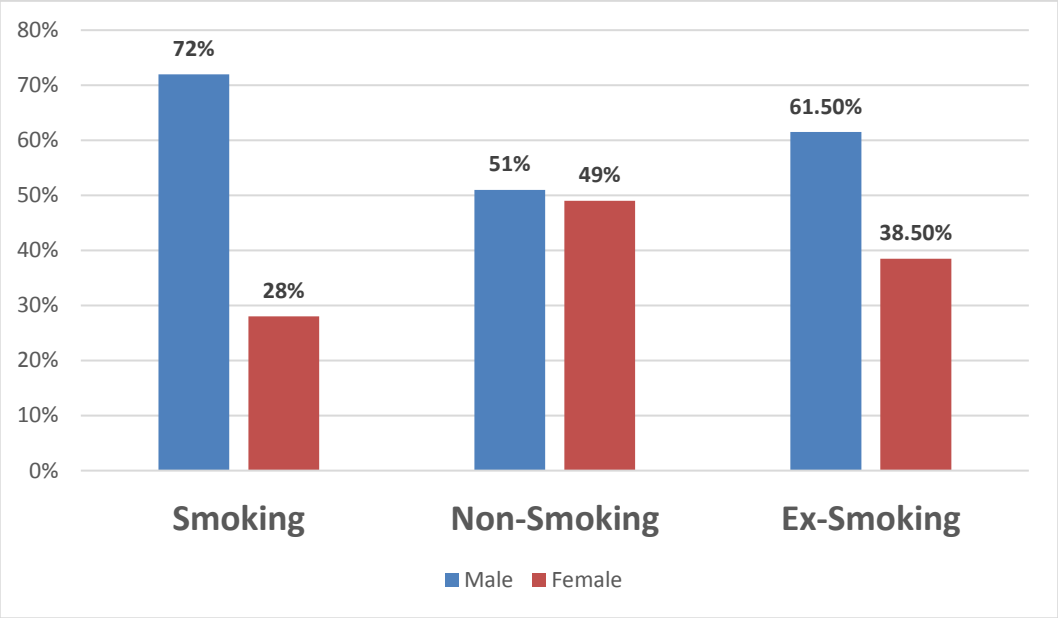

Fig. 2: Distribution of Smoking Status in Relation to Sex of Samples

2. Relationship Between Smoking Status and BMI

The data revealed that all groups had average BMIs within the normal range except for ex-smokers, who had a mean±SD BMI of 18.2±2.0 categorized as underweight. Smokers and non-smokers had BMIs of 20.5± 1.0 and 20.1± 0.9 respectively as seen in Table (3).

Table 3: Relationship between Smoking Status and BMI

Group	Mean BMI ± SD	Classification
Smokers	20.5 ± 1.0	Normal
Non-Smokers	20.1 ± 0.9	Normal
Ex-Smokers	18.2 ± 2.0	Underweight

3. Relationship Between Smoking Duration and BMI

BMI was normally classified across different smoking durations (Table 4).

Table 4: Relationship between smoking duration and BMI

Smoking Duration (Years)	Mean of BMI ± SD	Classification
Less than 1 year	20.5 ± 2.0	Normal
1-3 years	21 ± 1.0	Normal
More than 3 years	20 ± 3.0	Normal

4. Comparison of BMI Classification among Groups

The BMI distribution showed that the highest percentage of participants in all groups were within the normal range with statistically insignificant difference as displayed in Table (5).

Table 5: Comparison of BMI Classification among Groups

Group	Under Weight		Normal		Over Weight		Obese		*P*
	No.	%	No.	%	No.	%	No.	%	
Smokers	46	39.0	53	45.0	11	9.0	8	7.0	
Non Smokers	29	42.0	33	48.0	3	4.0	4	6.0	**0.350**
Ex-Smokers	5	38.5	8	61.5	0	0.0	0	0.0	

5. Factors Influencing Smoking Status - BMI Relationship

The distribution of BMI across smoking status groups according to physical activity level and dietary habits is presented in Table (6). Among smokers, individuals with low physical activity constituted the largest proportion across BMI categories, with higher frequencies observed in the underweight (39.7%) and normal weight (45.4%) groups. Smokers reported high levels of physical activity were predominantly classified as having normal BMI (66.6%), with minimal representation in the overweight and obese categories. Regarding dietary habits, smokers adhering to a healthy diet were mainly within the normal BMI category (57.0%), whereas those reported unhealthy dietary patterns showed higher proportions of overweight (10.6%) and obesity (7.7%).

Among non-smokers, low physical activity was similarly found with higher proportions in underweight (41.6%) and normal weight (45.8%) groups. In contrast, all non-smokers reported high physical activity were classified as having normal BMI (100%). Participants following healthy dietary habits were more frequently found in the normal BMI category (62.5%).

In the ex-smoker group, most participants were categorized as underweight or normal weight across all levels of physical activity, with no cases of overweight or obesity observed. Ex-smokers with high physical activity or healthy dietary habits were exclusively within the normal BMI category. Physical activity level and dietary pattern were not significantly associated with BMI categories across smoking status groups (all $P > 0.05$).

Table 6: Factors Influencing the Relationship between Smoking Status and BMI

Factor / BMI		Underweight No. (%)	Normal No. (%)	Overweight No. (%)	Obese No. (%)	Group	*P-value*
Physical Activity	Low	35 (39.7)	40 (45.4)	7 (8.0)	6 (6.8)		
	Moderate	11 (52.3)	8 (38.0)	1 (4.7)	1 (4.7)		0.212
	High	0 (0.0)	6 (66.6)	2 (22.2)	1 (4.5)	Smokers	
Diet	Healthy	6 (42.8)	8 (57.0)	0 (0.0)	0 (0.0)		
	Unhealthy	40 (38.4)	45 (43.2)	11 (10.6)	8 (7.7)		0.369
Physical Activity	Low	20 (41.6)	22 (45.8)	2 (4.1)	4 (8.3)		
	Moderate	9 (45.0)	10 (50.0)	1 (5.0)	0 (0.0)		
	High	0 (0.0)	1 (100)	0 (0.0)	0 (0.0)	Non-smokers	0.588
Diet	Healthy	3 (37.5)	5 (62.5)	0 (0.0)	0 (0.0)		
	Unhealthy	26 (42.6)	28 (46.0)	3 (5.0)	4 (6.5)		0.731
Physical Activity	Low	4 (44.4)	5 (55.5)	0 (0.0)	0 (0.0)		
	Moderate	1 (33.3)	2 (66.6)	0 (0.0)	0 (0.0)		
	High	1 (33.3)	1 (100)	0 (0.0)	0 (0.0)	Ex-smokers	0.570
Diet	Healthy	1 (50.0)	1 (50.0)	0 (0.0)	0 (0.0)		
	Unhealthy	4 (36.3)	7 (63.6)	0 (0.0)	0 (0.0)		0.630

Discussion

This section interprets the main findings of the present study in light of existing literature, focusing on smoking prevalence and its association with BMI among university students. The results are compared with previous studies to identify consistencies and discrepancies, while considering relevant demographic and lifestyle factors. The present findings are consistent with those reported by Haddad and Malak [26], who demonstrated that smoking prevalence among university students tends to increase with academic progression and is strongly influenced by social factors. They emphasized the significant role of the university environment and peer pressure in shaping smoking behaviors. Similarly, Eryilmaz-Eren *et al.* [27] reported that the majority of their study participants were males (75.6%) and university graduates (85.7%). In line with these observations, males constituted the larger proportion of both current smokers (72%) and ex-smokers (61.5%) in the present study. This pattern is also supported by Akbartabartoori *et al*. [28], who noted that males are more likely to smoke than females due to prevailing social and cultural norms. Furthermore, Haddad and Malak [26] highlighted a pronounced gender disparity in smoking prevalence among university students, further corroborating the current findings.

In addition, Kwamanga *et al*. [29] reported that cigarette smoking prevalence was highest among obese individuals (51% in men and 43% in women) and lowest among those with

a BMI ranging from 25 to 30 kg/m² (35% in men and 33% in women). They also observed that female current smokers had significantly higher mean waist circumference (WC) and waist-to-hip ratio (WHR), along with lower hip circumference (HC), compared with non-smokers (P<0.001). In males, however, only HC was significantly lower among current smokers than non-smokers (P<0.001). Comparable demographic characteristics were reported by Eryilmaz-Eren *et al.* [27], who similarly documented a predominance of male participants (75.6%).

Conversely, the present findings differ from those reported by George *et al*. [30], who found an overall smoking prevalence of 37.6%, with light, moderate, and heavy smokers accounting for 36.1%, 40.8%, and 23.1% of smokers, respectively. In their study, the mean age of smoking initiation was 17.6 years, with no significant differences between sexes, and no statistically significant differences in BMI were detected between smokers and non-smokers. Although smoking prevalence did not differ markedly by sex, heavy smoking was more common among males.

The current results are in agreement with those of Piirtola *et al.* [31], who demonstrated that ex-smokers tend to gain weight following smoking cessation, whereas current smokers often maintain lower body weight due to the appetite-suppressing and metabolism-enhancing effects of nicotine. These findings are further supported by Miyata *et al.* [32] and Jo *et al.* [33], who showed that nicotine suppresses appetite through modulation of hypothalamic neurotransmitters. Moreover, Audrain-McGovern and Benowitz [34] emphasized the multifactorial mechanisms through which smoking influences body weight, including behavioral substitution of smoking for eating. In contrast, Akbartabartoori *et al.* [28] reported that among 9,047 respondents, current smokers had significantly lower mean BMI, whereas ex-smokers exhibited higher BMI values compared with non-smokers. After adjusting for confounding factors such as social class, physical activity, age, and alcohol intake, current smokers remained leaner than both non-smokers and ex-smokers (P=0.001). Similarly, Ul-Haq *et al.* [35] found that current smokers were less likely to be overweight, while long-term smokers and ex-smokers had an increased likelihood of overweight status, with age-specific interactions observed. Furthermore, Alshaarawy *et al.* [36] reported significant gender-related associations between smoking status and BMI, showing that males had higher probabilities of normal or at-risk BMI categories and a lower likelihood of obesity compared with females. Comparable trends were observed among casual and compulsive smokers. Additionally, Fang *et al*. [37] suggested that the effect of smoking on body weight is more closely related to smoking intensity rather than duration. The influence of genetic and environmental factors was also underscored by Piirtola *et al.* [31]. Moreover, Clair *et al.* [38] identified a dose-dependent positive association between daily cigarette consumption and waist circumference, indicating increased central adiposity despite lower overall BMI. Collectively, these findings support the present

result showing no statistically significant differences in BMI distribution across smoking status groups (P=0.35), suggesting that smoking alone is not a decisive determinant of BMI. Akbartabartoori *et al.* [28], who reported higher BMI among ex-smokers compared with non-smokers even after adjusting for potential confounders. The apparent association between smoking and central fat accumulation in the present study may reflect fat redistribution or muscle mass reduction, potentially influenced by hormonal alterations or unmeasured confounders such as physical activity level, dietary intake, alcohol consumption, and psychological stress. The present data further underscore the critical role of physical activity and dietary habits in BMI regulation. Students who engaged in higher levels of physical activity maintained healthier body weights regardless of smoking status, while healthier dietary patterns were associated with more favorable BMI outcomes.

Conclusion

Smoking was found to be relatively prevalent, particularly among male students and those enrolled in the Faculty of Engineering and Information Technology. Overall, smoking showed no apparent direct association with BMI, except among ex-smokers, who tended to have lower BMI values. Furthermore, smoking duration was not related with BMI changes, indicating that factors such as dietary habits and physical activity may play a more substantial role in influencing body weight among university students.

Targeted health education programs should be implemented to address the high prevalence of smoking among university students, particularly in the Faculties of Engineering and Information Technology, with content tailored to faculty-specific contexts and delivered through effective academic and digital platforms. Gender-sensitive preventive strategies are also recommended to address the higher smoking rates among male students while sustaining protective behaviors among female students. Universities should promote physical activity by enhancing access to sports facilities and encouraging active lifestyles, given the observed association between physical activity and healthier BMI levels. Additionally, integrating nutritional counseling into student health services is essential to support healthier dietary behaviors, especially among smokers and ex-smokers. Finally, comprehensive smoking cessation programs that include nutritional and psychological support are recommended to ensure a healthy transition after quitting and to mitigate potential adverse effects on BMI.

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