

Factors influencing students' eating habits: The case of Ibn Tofail University, Morocco

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Abstract. *Background and aim:* The transition to university life often disrupts students' eating habits, exposing them to unbalanced diets and health risks, particularly in developing countries like Morocco. This study aimed to identify sociodemographic, behavioral, and nutritional determinants associated with meal regularity, fruit and vegetable consumption, and adherence to a balanced diet among students at Ibn Tofail University in Kenitra. *Methods:* A cross-sectional study was conducted from January 2021 to January 2024 among 1,036 undergraduate students aged 18 to 30. Data on dietary habits, sociodemographic characteristics, and physical activity were collected via self-administered questionnaires. Multivariate logistic regression identified factors influencing dietary behavior. *Results:* Female students were more likely to maintain regular meal frequency (OR = 2.66; $p < 0.001$) and consume fruits and vegetables (OR = 2.19; $p < 0.001$). Self-preparation of meals significantly improved meal regularity (OR = 2.27; $p < 0.001$) and balanced diet adherence (OR = 3.83; $p < 0.001$). Good knowledge of healthy eating principles increased fruit and vegetable consumption (OR = 1.99; $p < 0.001$) and balanced diet adherence (OR = 2.25; $p < 0.001$). Traditional Moroccan dish consumption also favored a balanced diet (OR = 1.34; $p = 0.031$). Conversely, the high cost of healthy foods was a major barrier (OR = 0.44; $p < 0.001$). *Conclusions:* Sociocultural and behavioral factors significantly shape students' eating habits. Promoting meal preparation autonomy, strengthening nutrition education, and improving access to affordable healthy foods could enhance university students' dietary behaviors. (www.actabiomedica.it)

Key words: eating habits, university students, balanced diet, nutrition, Morocco

Introduction

Transition to university life is often marked by significant changes in students' eating habits and lifestyle behaviors (1,2). This period, characterized by increased autonomy, exposes young people to potentially harmful food choices due to a variety of factors, including time constraints, academic stress, cultural influences and the availability of often nutritionally poor foods (3,4). These eating habits can contribute to major health problems, such as obesity, type 2 diabetes and cardiovascular disease, which are closely linked

to unbalanced diets and sedentary lifestyles (5,6). This transition phase is also frequently described as one of the most stressful periods in the lives of young adults (7). It is accompanied by diminished social support and increased pressure to meet academic demands, while requiring adaptation to a more independent lifestyle. These upheavals, combined with reduced parental influence on food choices, put students at greater risk of adopting unbalanced eating habits (8). These observations are supported by a number of studies. For example, Chellappa and Karunanidhi (9) found that 30% of post-secondary students, with an average age

of 19, reported unhealthy eating behaviours. Similarly, in a study of young adults aged 18 to 33, Sanlier and his team revealed that 19.4% of men and 19.3% of women were at increased risk of eating disorders such as anorexia (10). These behaviours can also be exacerbated by media pressure to promote a slim body image, adding challenges to the management of body changes and the construction of students' identities (11). As in other developing countries, Morocco's nutritional transition driven by rapid urbanization has led to increased consumption of energy-dense, high-fat foods, while the intake of fruits, vegetables, and other essential nutrients has declined (12,13). Among university students, these changes are exacerbated by factors such as irregular schedules, meals eaten away from home, and limited access to adequate nutritional education (14). The eating habits of Moroccan university students, although under-explored, seem to reflect similar trends observed in other regions, with an increased prevalence of unbalanced eating behaviors. These behaviors include frequent consumption of fast food, snacking, and skipping essential meals such as breakfast, often due to lack of time or stress (15). These unreasoned food preferences contribute not only to obesity and overweight, but also to poor academic performance (16). This study contributes to the growing body of literature on student nutrition by offering a focused analysis within the Moroccan context, a country experiencing rapid nutritional and lifestyle transitions. While extensive research has examined university students' dietary habits in Western and Asian countries, studies in North Africa, particularly Morocco, remain limited. Conducted at Ibn Tofail University in Kenitra, this study investigates the associations between socio-demographic, behavioral, and nutritional factors with key dietary practices, including meal regularity, fruit and vegetable consumption, and adherence to a balanced diet. Considering the distinct challenges faced by Moroccan students, including traditional dietary practices, insufficient nutritional education, and financial limitations, this research offers important insights into a population that has received little attention. By identifying the key determinants of students' eating behaviors, this study aims to inform the development of targeted interventions that promote healthier and more sustainable dietary habits.

Methods

Study design and participants

This cross-sectional study was conducted between January 1, 2021, and January 1, 2024, at Ibn Tofail University, located in Kenitra, Morocco. The university, a public institution, welcomes students from several surrounding or nearby areas according to administrative division. Participants were recruited from the university's various faculties, including scientific, economic, legal, literary and technical profiles. A total of 1036 students aged between 18 and 30 were included in the study. Inclusion criteria were: to be enrolled at Ibn Tofail University during the study period, to be an undergraduate student following a Bachelor's degree program and to give informed consent to participate in the study. Students enrolled in graduate programs (Master's, PhD), which are often part-time, were excluded. Data were collected using a self-administered questionnaire, distributed directly in lecture theaters and classrooms. Participants completed the questionnaire anonymously and without time pressure, and no financial or material incentives were offered. Questionnaires were collected immediately after completion. Participants were recruited by visiting the lecture halls and classrooms of the various main faculties, including the Faculty of Legal, Economic and Social Sciences, the Faculty of Science, the Faculty of Humanities, the Faculty of Science and Technology, the National School of Applied Sciences, the Faculty of Education and the Institute of Sports.

Data collection and measurements

A semi-structured questionnaire, pre-tested with 30 randomly selected undergraduate students at Ibn Tofail University, was used to ensure its relevance. This self-administered questionnaire collected information on the socio-demographic characteristics and dietary practices of the participants recruited. In addition to the questionnaire on food preferences and habits, the questionnaire measuring dietary diversity proposed by the FAO (17) was used. To assess knowledge of healthy eating habits, section 3 of the questionnaire on healthy food choices of "General knowledge of nutrition" questionnaire (18) was

used. Anthropometric measurements were carried out: weight was measured using an electronic scale with a precision of 100 g, and height was measured using a graduated measuring rod. Body mass index (BMI) was calculated in kg/m^2 , and participants were classified according to World Health Organization (WHO) categories: underweight ($\text{BMI} \leq 18.5 \text{ kg}/\text{m}^2$), normal weight ($18.5\text{--}24.9 \text{ kg}/\text{m}^2$), overweight ($25\text{--}29.9 \text{ kg}/\text{m}^2$) and obese ($\text{BMI} \geq 30 \text{ kg}/\text{m}^2$). Information about physical activity was self-reported.

Ethical considerations

Formal authorization to conduct the study was obtained from Ibn Tofail University. Informed consent was obtained from each participant after a detailed explanation of the study objectives, the information to be collected and any potential risks. Participants were informed that they were free to withdraw from the study at any time, without justification, and that confidentiality, anonymity and protection of their personal data were fully guaranteed.

Statistical analysis

Statistical analyses were performed using Stata 18 software (StataCorp, College Station, TX, USA) for data analysis and Python for graph generation. Categorical variables were described using percentage frequencies. Associations between variables were assessed using the chi-square test.

Univariate and multivariate logistic regression models were fitted to identify factors associated with meal regularity, fruit and vegetable consumption, and adoption of a balanced diet. For the assessment of dietary diversity, the dietary diversity score was converted into a categorical variable using cut-off points 3 and 5 for the medium diversity and diversified diet modalities respectively. Similarly, for the assessment of knowledge about healthy eating habits, cut-off points 4 and 8 were considered for the knowledge scale (below 4 : poor knowledge, 4 to 8: moderate knowledge, above 8: good knowledge). Socio-demographic variables and lifestyle behaviours were included as potentially confounding variables in the models. Household socioeconomic status (SES) was assessed based on two questions regarding the father's and mother's

employment (19). When both parents were working, their salaries were combined to determine the total household income. Based on this assessment, households were classified into three SES categories: low SES for those earning less than 3,500 MAD per month, middle SES for those with an income between 3,500 and 15,000 MAD per month, and high SES for households with earnings exceeding 15,000 MAD per month.

Model results were expressed as adjusted odds ratios with 95% confidence intervals. All analyses were performed at a significance level of 5%. All participant data were used in the final analysis. Concerning missing data treatment, a systematic approach was applied to minimize bias and ensure the reliability of the analysis. For categorical variables, multiple imputation was used when missing values accounted for less than 5% of the dataset. When the proportion of missing data exceeded this threshold, sensitivity analyses were conducted to assess their potential impact on the results. For continuous variables, missing values were replaced using mean or median imputation, depending on the data distribution. Cases with a high proportion of missing values that could not be reliably imputed were excluded from the final analysis.

Results

The overall sample comprises 1,036 students, with a majority distribution in the 18-20 age bracket (45.9%, $n = 476$), followed by the 24+ age group (28.8%, $n = 299$) and finally the 21-23 age group (25.2%, $n = 261$). With regard to gender, men represent a dominant proportion (60.6%, $n = 628$), compared with 39.3% ($n = 408$) of women, reflecting a demographic distribution typical of a university population (Figure 1).

In terms of body mass index (BMI), a majority of students were of normal weight (74.0%, $n = 767$), while 6.2% ($n = 64$) were underweight, 9.9% ($n = 103$) overweight and 9.8% ($n = 102$) obese. With regard to meal frequency, 52.1% ($n = 540$) of participants reported regular meal frequency, while 47.8% ($n = 496$) had non-regular meals (Figure 2).

In terms of eating habits, a majority of students (60.8%, $n = 631$) do not eat fruit and vegetables on a

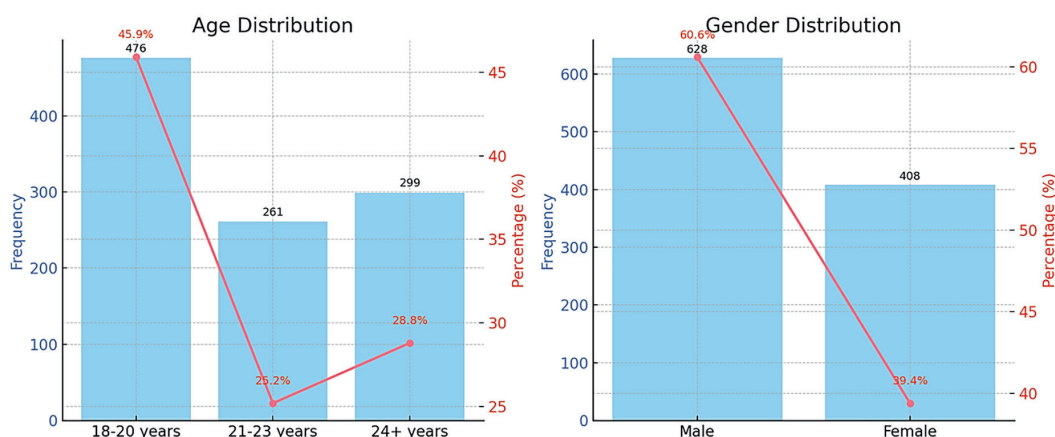


Figure 1. Age and Gender Distribution Among University Students (Frequency and Percentage).

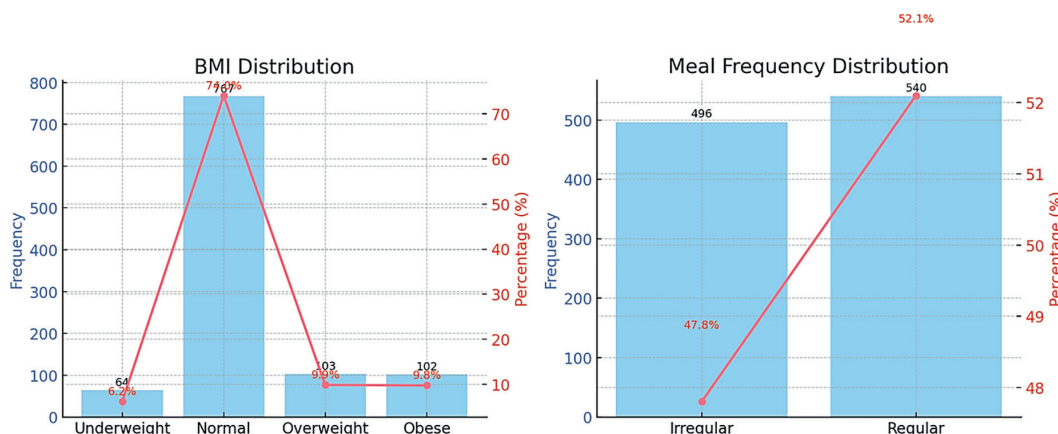


Figure 2. Distribution of BMI Categories and Meal Frequency Among University Students.

regular basis, while 39.1% ($n = 405$) do. On the other hand, 52.6% ($n = 545$) of participants claimed to follow a balanced diet, versus 47.3% ($n = 491$) who did not. These results show a dissonance between low fruit and vegetable consumption and the perceived adoption of a balanced diet, suggesting that other dietary or behavioral factors influence this perception (Figure 3).

Results reveal significant gender differences in anthropometric measurements, nutritional behaviors and eating habits (Table 1). In terms of BMI, a significantly higher proportion of women were in the normal weight category (79.7% vs. 70.4%, $p = 0.006$). Conversely, men were more likely to be overweight (10.7% vs. 8.8%) and obese (11.8% vs. 6.9%) ($p = 0.006$).

In terms of physical activity, men were more represented in the regular category (51.3% vs. 42.4%, $p = 0.005$), while women predominated in the irregular category (57.6% vs. 48.7%, $p = 0.005$).

In terms of fruit and vegetable consumption, a significantly higher proportion of women were in the high consumption category (40.0% vs. 30.3%, $p = 0.001$), while low consumption was more common among men (37.6% vs. 27.9%, $p = 0.001$). Regular meal patterns also differed by gender ($p = 0.003$). A higher proportion of women adhered to regular meals (34.3% vs. 25.8%), while non-regular meals were more common among men (74.2% vs. 65.7%). For dietary diversity, women were over-represented in the

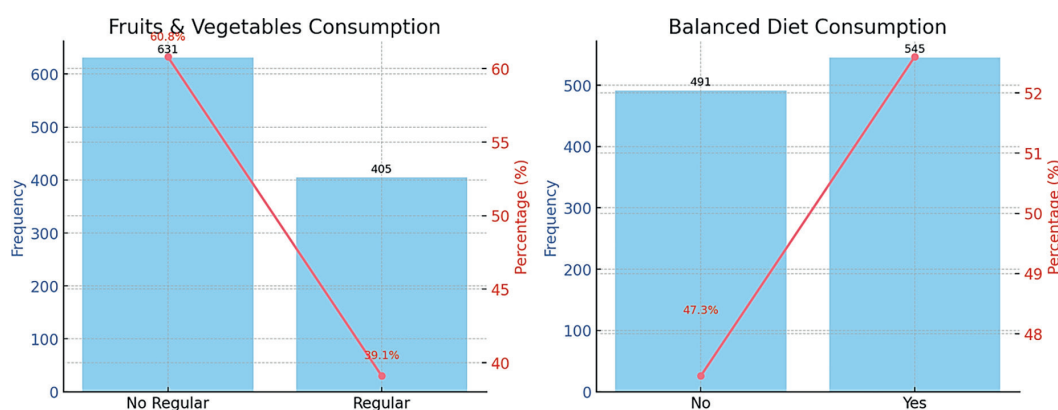


Figure 3. Fruits and Vegetables Consumption and Balanced Diet Status Among University Students.

high diversity category (38.2% vs. 30.4%, $p = 0.006$), while men predominated in the low dietary diversity category (39.5% vs. 30.4%, $p = 0.006$). With regard to substance use, a significant difference was observed for alcohol ($p < 0.001$). A higher proportion of men reported consuming alcohol (33.4% vs. 3.7%), while women accounted for the majority among those consuming neither tobacco nor alcohol (88.7% vs. 49.7%). Finally, men were more likely to report daily snacking (41.9% vs. 29.7%, $p < 0.001$), while women were over-represented in the “no snacking” category (37.5% vs. 29.6%, $p < 0.001$). Significant differences were observed between BMI modalities and certain sociodemographic, behavioral and nutritional variables. Regarding socioeconomic status ($p = 0.006$), low-status students had a higher proportion of underweight (40.6% vs. 34.4% for moderate and 25.0%, $p = 0.006$). Overweight was also more prevalent among low-status students (56.3% vs. 25.2% for high and 18.4%, $p = 0.006$). Finally, obesity was more prevalent among low-status students (37.3% vs. 31.4% for moderate status, $p = 0.006$). In relation to place of residence ($p < 0.001$), students living in rural areas were significantly over-represented in the underweight category (50.0% vs. 29.7% in suburban areas and 20.3% in urban areas, $p < 0.001$). Conversely, urban residents were more numerous in the obese category (46.1% vs. 28.4% rural and 25.5% peri-urban, $p < 0.001$), and peri-urban residents dominated in the overweight category (45.6% vs. 28.2% rural and 26.2% urban, $p < 0.001$). For fruit and vegetable consumption ($p = 0.006$), students with

low consumption had a higher proportion of obese students (51.0% vs. 30.4% for high consumption, $p = 0.006$) and slightly more underweight students (34.4% vs. 29.7%, $p = 0.006$). Concerning dietary diversity ($p = 0.024$), students with low diversity were more numerous in the obese category (50.0% vs. 25.5% for high diversity, $p = 0.024$) and in the underweight category (42.2% vs. 28.1%, $p = 0.024$). For snacking ($p = 0.001$), students who snacked daily had a higher proportion of obesity (52.0% vs. 21.6% for those who did not snack, $p = 0.001$) and overweight (33.0% vs. 35.9% for those who did not snack, $p = 0.001$). Underweight, however, was more common among non-snackers (45.3% vs. 40.6% among daily nibblers, $p = 0.001$). Finally, for physical activity ($p = 0.022$), students with irregular activity were more likely to be obese (51.0% vs. 49.0% for those with regular activity, $p = 0.022$) and overweight (66.0% vs. 34.0%, $p = 0.022$). In contrast, those with regular activity had a slightly higher proportion of normal BMI (52.8% vs. 50.2%, $p = 0.022$) (Table 2).

Binary logistic modelling of risk factors

Multivariate analysis (Table 3) identified several significant factors associated with meal regularity. Female gender was associated with a significantly higher probability of having a regular meal frequency (adjusted OR = 2.66, 95% CI [2.02-3.49], $p < 0.001$). In terms of type of residence, students living in private accommodation had a lower probability of regular

Table 1. Sociodemographic, Behavioral, Anthropometric, and Nutritional Characteristics of University Students.

	Sex			
	Males	Females	Total	<i>p-value</i>
N	628 (60.6%)	408 (39.4%)	1,036 (100.0%)	
Sociodemographic Characteristics :				
Age (Years)				
18-20	278 (44.3%)	198 (48.5%)	476 (45.9%)	0.063
21-23	152 (24.2%)	109 (26.7%)	261 (25.2%)	
≥ 24	198 (31.5%)	101 (24.8%)	299 (28.9%)	
Socioeconomic Status				
Low	238 (37.9%)	160 (39.2%)	398 (38.4%)	0.574
Middle	197 (31.4%)	135 (33.1%)	332 (32.0%)	
High	193 (30.7%)	113 (27.7%)	306 (29.5%)	
Place of Residence				
Urban	149 (23.7%)	116 (28.4%)	265 (25.6%)	0.237
Suburban	234 (37.3%)	143 (35.0%)	377 (36.4%)	
Rural	245 (39.0%)	149 (36.5%)	394 (38.0%)	
Year of Study				
1st Year	168 (26.8%)	93 (22.8%)	261 (25.2%)	0.264
2nd Year	191 (30.4%)	122 (29.9%)	313 (30.2%)	
3rd Year	269 (42.8%)	193 (47.3%)	462 (44.6%)	
Anthropometric, Behavioral, and Nutritional Measures:				
Body Mass Index (BMI/kg/m²)				
Underweight	45 (7.2%)	19 (4.7%)	64 (6.2%)	0.006
Normal	442 (70.4%)	325 (79.7%)	767 (74.0%)	
Overweight	67 (10.7%)	36 (8.8%)	103 (9.9%)	
Obese	74 (11.8%)	28 (6.9%)	102 (9.8%)	
Physical Activity				
Irregular	306 (48.7%)	235 (57.6%)	541 (52.2%)	0.005
Regular	322 (51.3%)	173 (42.4%)	495 (47.8%)	
Meal Preparation				
Self-prepared	264 (42.0%)	199 (48.8%)	463 (44.7%)	0.050
Third-party	202 (32.2%)	127 (31.1%)	329 (31.8%)	
Ready-to-eat	162 (25.8%)	82 (20.1%)	244 (23.6%)	
Fruits and Vegetables Consumption				
Low	236 (37.6%)	114 (27.9%)	350 (33.8%)	0.001
Moderate	202 (32.2%)	131 (32.1%)	333 (32.1%)	
High	190 (30.3%)	163 (40.0%)	353 (34.1%)	
Regular Meal Patterns				
No	466 (74.2%)	268 (65.7%)	734 (70.8%)	0.003
Yes	162 (25.8%)	140 (34.3%)	302 (29.2%)	

	Sex			
	Males	Females	Total	<i>p-value</i>
Dietary Diversity				
Low	248 (39.5%)	124 (30.4%)	372 (35.9%)	0.006
Moderate	189 (30.1%)	128 (31.4%)	317 (30.6%)	
High	191 (30.4%)	156 (38.2%)	347 (33.5%)	
Alcohol and Tobacco Consumption				
Tobacco	106 (16.9%)	31 (7.6%)	137 (13.2%)	<0.001
Alcohol	210 (33.4%)	15 (3.7%)	225 (21.7%)	
None	312 (49.7%)	362 (88.7%)	674 (65.1%)	
Snacking				
Everyday	263 (41.9%)	121 (29.7%)	384 (37.1%)	<0.001
Sometimes	179 (28.5%)	134 (32.8%)	313 (30.2%)	
None	186 (29.6%)	153 (37.5%)	339 (32.7%)	

meal frequency than those living with their families (adjusted OR = 0.65, 95% CI [0.47–0.89], $p = 0.004$). Snacking also showed a significant association. Students reporting snacking had a lower probability of maintaining regular meal frequency (adjusted OR = 0.49, 95% CI [0.35–0.58], $p < 0.001$). Finally, meal preparation habits were significantly associated with meal frequency. Meals prepared by others were associated with a reduced likelihood of regular meal frequency (adjusted OR = 0.58, 95% CI [0.43–0.78], $p < 0.001$), as were ready-to-eat meals (adjusted OR = 0.60, 95% CI [0.43–0.84], $p = 0.002$). In contrast, no significant associations were observed for age, socioeconomic status, physical activity or fruit and vegetable consumption in the multivariate analysis.

Binary logistic modeling of factors associated with regular fruit and vegetable consumption

Multivariate analysis (Table 4) identified several significant factors associated with regular fruit and vegetable consumption among students. Female gender was associated with a significantly higher probability of regular fruit and vegetable consumption compared to male gender (adjusted OR = 2.19, 95% CI [1.67–2.88], $p < 0.001$). In terms of meal preparation, students preparing their own meals were also more likely to consume fruit and vegetables regularly (adjusted OR

= 2.27, 95% CI [1.73–2.96], $p < 0.001$). Good knowledge of the principles of healthy nutrition significantly increased the likelihood of consuming fruit and vegetables on a regular basis (adjusted OR = 1.99, 95% CI [1.52–2.61], $p < 0.001$). Consumption of traditional Moroccan dishes was also associated with regular fruit and vegetable consumption (adjusted OR = 1.33, 95% CI [1.01–1.73], $p = 0.041$). In contrast, the high cost of fruit and vegetables was a limiting factor, reducing the likelihood of regular consumption (adjusted OR = 0.59, 95% CI [0.44–0.76], $p < 0.001$). No significant associations were observed for age, socioeconomic status, place of residence, physical activity or categories of purchased and ready-to-eat meals in the adjusted analysis.

Discussion

Given the large student population of Ibn Tofail University (approximately 57,082 students in 2024) (20), the selected sample size of 1,036 was deemed appropriate for achieving a representative cross-section of the students population. The sample size was also determined based on a power analysis to ensure that the findings would have adequate statistical power to detect meaningful differences and relationships within the data. By focusing on undergraduate students and using self-administered questionnaires, the study was

Table 2. Body Mass Index (BMI) Distribution by Sociodemographic, Behavioral, and Nutritional Variables Among University Students.

Body Mass Index						
	Underweight	Normal	Overweight	Obese	Total	<i>p-value</i>
N	64 (6.2%)	767 (74.0%)	103 (9.9%)	102 (9.8%)	1,036 (100.0%)	
Variables						
Socioeconomic Status						
Low	26 (40.6%)	276 (36.0%)	58 (56.3%)	38 (37.3%)	398 (38.4%)	0.006
Moderate	22 (34.4%)	259 (33.8%)	19 (18.4%)	32 (31.4%)	332 (32.0%)	
High	16 (25.0%)	232 (30.2%)	26 (25.2%)	32 (31.4%)	306 (29.5%)	
Place of Residence						
Urban	32 (50.0%)	463 (60.4%)	74 (71.8%)	73 (71.6%)	642 (62.0%)	<0.001
Rural	32 (50.0%)	304 (39.6%)	29 (28.2%)	29 (28.4%)	394 (38.0%)	
Meal Preparation						
Self-prepared	26 (40.6%)	315 (41.1%)	34 (33.0%)	44 (43.1%)	419 (40.4%)	0.424
Purchased meals	38 (59.4%)	452 (58.9%)	69 (67.0%)	58 (56.9%)	617 (59.6%)	
Fruits and Vegetables Consumption						
Low	22 (34.4%)	242 (31.6%)	34 (33.0%)	52 (51.0%)	350 (33.8%)	0.006
Moderate	23 (35.9%)	260 (33.9%)	31 (30.1%)	19 (18.6%)	333 (32.1%)	
High	19 (29.7%)	265 (34.6%)	38 (36.9%)	31 (30.4%)	353 (34.1%)	
Dietary Diversity						
Low	27 (42.2%)	252 (32.9%)	42 (40.8%)	51 (50.0%)	372 (35.9%)	0.024
Moderate	19 (29.7%)	246 (32.1%)	27 (26.2%)	25 (24.5%)	317 (30.6%)	
High	18 (28.1%)	269 (35.1%)	34 (33.0%)	26 (25.5%)	347 (33.5%)	
Snacking						
Everyday	26 (40.6%)	271 (35.3%)	34 (33.0%)	53 (52.0%)	384 (37.1%)	0.001
Sometimes	9 (14.1%)	245 (31.9%)	32 (31.1%)	27 (26.5%)	313 (30.2%)	
None	29 (45.3%)	251 (32.7%)	37 (35.9%)	22 (21.6%)	339 (32.7%)	
Alcohol and Tobacco Consumption						
Tobacco	7 (10.9%)	100 (13.0%)	14 (13.6%)	16 (15.7%)	137 (13.2%)	0.577
Alcohol	16 (25.0%)	156 (20.3%)	26 (25.2%)	27 (26.5%)	225 (21.7%)	
None	41 (64.1%)	511 (66.6%)	63 (61.2%)	59 (57.8%)	674 (65.1%)	
Physical Activity						
Irregular	36 (56.2%)	385 (50.2%)	68 (66.0%)	52 (51.0%)	541 (52.2%)	0.022
Regular	28 (43.8%)	382 (49.8%)	35 (34.0%)	50 (49.0%)	495 (47.8%)	
Meal Frequency						
Irregular	33 (51.6%)	362 (47.2%)	55 (53.4%)	46 (45.1%)	496 (47.9%)	0.559
Regular	31 (48.4%)	405 (52.8%)	48 (46.6%)	56 (54.9%)	540 (52.1%)	

able to collect comprehensive data on key factors such as dietary habits, physical activity, and sociodemographic characteristics, which are central to the research objectives. This study analyzed the eating habits

and nutritional behaviors of university students in Morocco, highlighting several worrying trends. These include a high frequency of snacking, irregular mealtimes, insufficient consumption of fruit and vegetables, and

Table 3. Univariate and Multivariate Analysis of Meal Frequency and Its Association with Sociodemographic, Behavioral, and Nutritional Variables.

Meal Frequency	Unadjusted		Adjusted	
	Odds Ratio	95 % IC	Odds Ratio	95 % IC
Age (Years)				
18-20	Ref.		Ref.	
21-23	0.87	0.64-1.17	0.84	0.61-1.17
≥ 24	0.86	0.65-1.16	0.91	0.66-1.23
Sex				
Males	Ref.		Ref.	
Females	2.73 ^{***}	2.10-3.54	2.66 ^{***}	2.02-3.49
Socioeconomic Status				
Low	Ref.		Ref.	
Moderate	1.08	0.81-1.44	1.13	0.83-1.55
High	1.15	0.85-1.54	1.26	0.92-1.73
Type of Residence				
Living with Family	Ref.		Ref.	
University Dormitory	0.85	0.62-1.14	0.83	0.60-1.15
Private Housing	0.68 [*]	0.51-0.91	0.65 ^{**}	0.47-0.89
Snaking				
No	Ref.		Ref.	
Yes	0.42 ^{***}	0.33-0.54	0.49 ^{***}	0.35-0.58
Physical Activity				
Irregular	Ref.		Ref.	
Regular	1.02	0.79-1.29	1.07	0.82-1.39
Fruit and Vegetable Consumption				
Irregular	Ref.		Ref.	
Regular	0.90	0.71-1.16	0.93	0.71-1.21
Meal Preparation				
Self-prepared	Ref.		Ref.	
Third-party	0.57 ^{***}	0.43-0.76	0.58 ^{***}	0.43-0.78
Ready-to-eat	0.56 ^{***}	0.41-0.76	0.60 ^{**}	0.43-0.84

Abbreviations: OR : Odds Ratio ; CI : confidence interval.

Asterisks denote significance: *: p < 0.05 (statistically significant association at 5% level). **: p < 0.01 (statistically significant association at 1% level).

*: p < 0.001 (statistically significant association at 0.1% level).

limited adoption of balanced diets. These findings are in line with similar observations in other contexts, where university students are particularly vulnerable to poor eating habits due to academic, social and economic constraints (21,22). These eating behaviors can have long-term repercussions on their overall health, increasing the risk of developing metabolic and cardiovascular diseases. A recent study highlights that these

unhealthy eating habits are associated with an increased prevalence of obesity, respiratory diseases and mental disorders among students (23). The association between female gender and regular meal frequency observed in this study is in line with research showing that women adopt more structured eating habits than men. This difference could be explained by women's greater attention to their health and physical

Table 4. Factors Associated with Regular Fruits and Vegetables Consumption Among University Students: Univariate and Multivariate Analyses.

Regular Fruits and Vegetables Consumption	Unadjusted		Adjusted	
	Odds Ratio	95 % IC	Odds Ratio	95 % IC
Age (Years)				
18-20	Ref.		Ref.	
21-23	1.10	0.81-1.51	1.10	0.79-1.53
≥ 24	1.17	0.87-1.57	1.29	0.94-1.77
Sex				
Males	Ref.		Ref.	
Females	2.12 ^{***}	1.64-2.74	2.19 ^{***}	1.67-2.88
Socioeconomic Status				
Low	Ref.		Ref.	
Moderate	0.90	0.66-1.20	0.87	0.63-1.19
High	0.99	0.73-1.35	0.97	0.70-1.34
Place of Residence				
Rural	Ref.		Ref.	
Urban	1.12	0.84-1.49	1.17	0.86-1.58
Meal Preparation				
Purchased meals	Ref.		Ref.	
Self-prepared	2.28 ^{***}	1.76-2.95	2.27 ^{***}	1.73-2.96
Knowledge of Healthy Eating				
No	Ref.		Ref.	
Yes	1.89 ^{***}	1.46-2.43	1.99 ^{***}	1.52-2.61
Consumption of Traditional Moroccan Dishes				
No	Ref.		Ref.	
Yes	1.38 [*]	1.07-1.77	1.33 [*]	1.01-1.73
Physical Activity				
Irregular	Ref.		Ref.	
Regular	0.96	0.74-1.23	1.06	0.81-1.39
Cost of Fruits and Vegetables				
Affordable	Ref.		Ref.	
Expensive	0.54 ^{***}	0.41-0.69	0.59 ^{***}	0.44-0.76

Abbreviations: OR: Odds Ratio; CI: confidence interval.

Asterisks denote significance: *: $p < 0.05$ (statistically significant association at 5% level). **: $p < 0.01$ (statistically significant association at 1% level).

*: $p < 0.001$ (statistically significant association at 0.1% level).

appearance, often influenced by weight control concerns (24,25). Men, on the other hand, show less regularity in their meals and favor food choices rich in fat and protein, behaviors often associated with an increased risk of overweight and obesity (26,27). These disparities can also be explained by socio-cultural

factors, where gender stereotypes shape food choices. For example, fatty meats are often associated with masculinity, while light foods such as salads are perceived as feminine, thus influencing eating behavior and reinforcing gender identities (28,29). The results also reveal that the residential environment plays a

decisive role in structuring eating habits. Students living in private accommodation were less regular in their mealtimes than those living at home. This may be attributed to the absence of family support for meal preparation, forcing them to turn to fast or processed options (30,31). Furthermore, the independence associated with living in a private residence, often accompanied by reduced parental supervision, seems to encourage less structured and sometimes less balanced eating habits. (32). These observations underline the importance of the residential environment in structuring students' eating behaviours. Interventions aimed at promoting better eating habits should therefore consider housing type as an influential factor. Snacking, defined as the consumption of food outside of main meals, is often associated with mealtime irregularity. This practice, which frequently replaces structured meals with calorie-rich but nutrient-poor quick snacks, is exacerbated by students' busy schedules (33). Prap-kree and his team have also shown that students prefer these convenient snacks, increasing the risk of nutritional imbalances and overweight (34). These studies highlight the need to promote regular, balanced eating habits to limit the negative impact of snacking on health. Meals prepared by third parties or ready-to-eat meals, while offering a solution for convenience, are often associated with a reduction in meal regularity and lower nutritional quality. This trend can limit the adoption of a balanced diet. A recent study points out that students spend a significant proportion of their food budget on eating out, which can lead to nutritional imbalances (35). Moreover, the consumption of prepared meals or ready-to-eat dishes is often associated with a poorer quality diet, characterized by a lack of diversity and an inadequate intake of essential nutrients (36,37). It is therefore crucial to promote more structured eating habits and make students aware of the importance of preparing balanced meals, even in the face of time and resource constraints. Results of the multivariate analysis show that several factors significantly influence regular fruit and vegetable consumption among university students. Firstly, female gender is associated with a significantly higher probability of regularly consuming fruit and vegetables, confirming trends observed in the literature (38,39). Recent research has also shown that socio-demographic factors

significantly influence fruit and vegetable consumption, with non-consumption more common among male students, those living independently, having a lower BMI, and being in advanced academic years (40). This difference can be attributed to women's increased attention to their health and physical appearance, often driven by weight management concerns, as discussed earlier. Meal preparation also plays a key role: students who prepare their own meals are significantly more likely to consume fruit and vegetables on a regular basis. This result underlines the importance of promoting food autonomy, since meals prepared by third parties are often associated with lower nutritional quality, as previously mentioned. In addition, regular consumption of traditional Moroccan dishes is associated with an increased intake of fruit and vegetables, thanks to their rich composition of fresh vegetables, legumes and fruit. These dishes, such as tajine and couscous, reflect a balanced diet that contributes to better weight management and the prevention of chronic diseases. Despite recent societal changes, Moroccan culinary traditions have endured, promoting a healthy diet in line with the Mediterranean diet (41). Promoting these traditional dishes could therefore be an effective lever for improving students' eating habits. Furthermore, knowledge of the principles of healthy eating is a determining factor in the adoption of balanced eating habits among students. Recent studies show that students with high culinary skills eat a diet of higher nutritional quality (42). In addition, school-based nutrition education programs have shown a positive impact on teenagers' eating behaviors, without increasing excessive preoccupation with weight (43). Educating students about the benefits of a balanced diet could significantly improve their eating habits. Finally, the cost of fruit and vegetables is a major barrier to their regular consumption among students. Those who perceive these products as expensive are significantly less inclined to include them in their daily diet. This situation highlights the impact of economic constraints on students' food choices. A recent study highlights the fact that 46% of students are food insecure, reflecting the financial difficulties they face (44). These results, consistent with previous data, highlight key levers for encouraging healthy eating habits, notably by reinforcing autonomy in meal preparation, raising

awareness of nutrition and reducing economic barriers. The results of the multivariate analysis reveal several key determinants influencing the consumption of a balanced diet among university students. Regarding the consumption of traditional dishes, it is important to note that this question is actually based on adherence to a Mediterranean diet. This diet is characterized by a high intake of fruits, vegetables, legumes, whole grains, olive oil, fish, and moderate consumption of meat and dairy products. It has been widely associated with various health benefits, particularly in reducing the risk of cardiovascular diseases and promoting overall well-being. The use of a dichotomous choice in this study was specifically intended to optimize the logistic regression model, enabling a more streamlined and targeted analysis of the results. By simplifying this variable, we were able to draw clearer conclusions regarding its potential impact on the study outcomes, while maintaining the integrity of the analysis.

Preparing one's own meals is strongly associated with an increased likelihood of adopting a balanced diet. This result confirms previous observations that self-catering promotes better nutritional quality, as opposed to meals prepared by third parties, which are often associated with lower meal regularity and quality (45). In addition, a pilot program focusing on advance meal preparation revealed a significant increase in the consumption of home-cooked meals, underlining the role of practical strategies in overcoming time constraints and improving nutritional quality (46). These results underline the fact that mastering and practicing home cooking are essential levers for promoting healthy eating habits among students. Knowledge of the principles of healthy eating remains a crucial factor in the adoption of balanced eating habits among university students. This correlation underlines the importance of educational campaigns aimed at raising awareness among this population of the benefits of a balanced diet. A review of nutrition education interventions with students showed that well-designed programs can significantly improve eating habits, notably by increasing fruit and vegetable consumption and reducing saturated fat intake (47). These results reinforce the idea that well-structured educational initiatives can play a decisive role in improving students' eating habits, thus contributing to their general

well-being and the prevention of nutrition-related diseases. What's more, consumption of traditional Moroccan dishes is also associated with a higher likelihood of adopting a balanced diet. These dishes, rich in fruit, vegetables and legumes, represent a healthy eating pattern, in line with the principles of the Mediterranean diet (41). Promoting them to students could help improve their eating habits. Regular physical activity is a significant factor in the adoption of healthy dietary choices among university students. One study showed that self-determined motivation to engage in physical activity is positively associated with the adoption of healthy eating habits, suggesting a strong link between an active lifestyle and balanced nutritional choices (48). These results underline the importance of integrating health promotion programs that simultaneously encourage physical activity and healthy eating, in order to foster students' overall well-being. Finally, the perceived cost of food remains a major barrier: students who consider food to be expensive are less likely to eat a balanced diet. This result ties in with previous observations on the impact of economic constraints on food choices and the need to improve access to healthy, affordable food.

These results highlight the importance of individual (meal preparation, nutritional knowledge), cultural (traditional dishes), economic (cost of food) and behavioral (physical activity) factors in the adoption of a balanced diet. They provide essential avenues for intervention to improve the nutritional health of university students.

Limits and strengths

This study, carried out among students at Ibn Tofail University in Kenitra, Morocco, has a number of strengths and limitations. Methodologically, it makes a valuable contribution to understanding the determinants of dietary behavior in a Moroccan university context, an area that has yet to be fully explored. The use of multivariate analysis enabled us to identify independent and modifiable factors, such as meal preparation, nutritional knowledge and physical activity, while highlighting the role of traditional Moroccan dishes in promoting balanced diets. However, certain limitations need to be taken into account. The cross-sectional

nature of the study makes it impossible to establish causal relationships between the variables studied. What's more, the data are based on self-reports, which may introduce memory or social desirability biases. One of the limitations of this study is the potential influence of faculty-related differences on the results, likely due to variations in academic background and areas of focus. Future research could explore these faculty-related differences in more detail, examining their impact on the outcomes and considering additional factors that may contribute to these variations. Finally, the socio-cultural and economic specificities of the Kenitra context restrict the generalizability of the results to other university populations, while certain potentially relevant variables, such as family influence, were not included.

Conclusion

This study highlighted key determinants influencing the dietary behaviors of students at Ibn Tofail University in Kenitra. Autonomy in meal preparation, nutritional knowledge, regular physical activity, and consumption of traditional Moroccan dishes are associated with better dietary quality, while the cost of healthy food is a major barrier. These results underline the need for integrated policies combining nutrition education, economic support and promotion of healthy lifestyles to improve students' eating habits. Furthermore, future longitudinal studies are needed to better understand the evolution of these behaviors and their long-term impacts.

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