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Article

Changes in Body Composition Among University Students During Exam Preparation: The Role of Dietary Habits and Physical Activity

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Abstract: Bad dietary habits and sedentary lifestyles alter body composition, increasing disease risk. We conducted a prospective, comparative, longitudinal observational study among nursing students (n=72, 79.2% female, mean age 21.94 years) from Complutense University of Madrid. Data were collected at two periods: before exams (January 2024) and during exams (May 2024). Body composition was assessed via bioimpedance (Beurer BF 1000), dietary habits through modified Kidmed survey, and physical activity using IPAQ. During exam preparation, fat mass significantly increased (25.43% to 28.79%, p=0.016), muscle mass significantly decreased (39.70% to 36.20%, p<0.001), and visceral fat rose notably (2.34 to 3.52, p<0.001). Students exhibiting poor dietary quality increased (54.2% to 80.0%, p<0.001), vigorous physical activity dramatically decreased (84.7% to 11.1%, p<0.001), and sedentary time increased significantly (408.24 to 543.61 minutes/day, p<0.001). Our findings suggest dietary deterioration and reduced physical activity during exams adversely affect students' body composition.

Keywords: body composition; dietary habits; physical activity; stress; bioimpedance; students; university students; exams

1. Introduction

Thanks to healthy dietary habits, individuals are able to maintain a healthy lifestyle. These habits are closely linked to how we select, process, and consume food, as it must provide the essential nutrients required by our bodies to perform vital functions effectively [1,2]. Achieving a healthy diet depends on several factors, such as food processing methods, timing of meals, and the presence of stress and anxiety. Following a healthy eating pattern can help prevent various diseases, including hypertension, cancer, anemia, obesity, and osteoporosis [3].

From childhood, young individuals develop a set of habits that evolve throughout their lives based on lifestyle choices, which are influenced by culture, customs, and beliefs. These influences shape food preferences and behaviors, which may either support or undermine healthy practices [4,5]. Currently, the population increasingly consumes fast food—highly processed items rich in sugars and fats—and exhibits a more sedentary lifestyle, as most free time is spent engaging with screens, video

games, and smartphones. This sedentary behavior has detrimental consequences for both physical and social well-being. Therefore, healthy eating must be accompanied by regular physical activity, performed daily to avoid physical inactivity and sedentarism[6].

Physical activity plays a crucial role in maintaining overall health. As the amount of physical exercise increases, the respiratory system improves, enhancing pulmonary capacity and reducing the likelihood of respiratory illnesses. Exercise also supports mental well-being, helping reduce stress and anxiety. Thus, engaging in physical activity is particularly important during exam periods, as it enhances concentration levels[7–9].

Stress is the body's short-term response to threatening situations. Its onset often disrupts eating habits and physical activity. Stress manifests in two forms: organic and psychological. The latter includes academic stress, which is the focus of this study. Academic stress is defined as a physiological, emotional, cognitive, and behavioral activation in response to academic stimuli and demands[10]. University students are particularly at risk of adopting unhealthy lifestyles[4,11], as they regularly face numerous examinations that induce stress. This stress often stems from competitiveness, goal-setting (e.g., early employment, gaining entry to a desired academic program, managing multiple subjects), or unmet goals that lead to frustration. Academic overload also contributes, as students not only study but must attend internships, seminars, and complete coursework, further intensifying stress. Such accumulated stress can have long-term negative effects.

Body composition refers to the primary components that make up the human body: bone, water, muscle, fat, and visceral tissue. Visceral fat exceeding 12% indicates abdominal fat infiltration, a serious nutritional concern that increases the risk of cardiovascular and metabolic diseases if uncorrected. These components are assessed using bioimpedance analysis, which sends an electrical current through the body (from hand to hand or foot to foot). The time required for the current to travel across the body allows estimation of the amount and percentage of each component[10]. Poor diet and sedentary behavior can significantly disrupt body composition.

As previously described, students experience heightened stress during exam periods. This stress often results in poor lifestyle choices, including unhealthy eating (either excess or insufficient intake of unhealthy foods) and reduced physical activity (due to time constraints). These behavioral changes can negatively affect body composition and increase disease risk.

The aim of this study was to demonstrate how the stress and anxiety experienced by students during exam periods affect their body composition due to poor dietary choices and decreased physical activity. The findings may support the implementation of targeted interventions and raise awareness among young individuals about the importance of maintaining healthy lifestyle habits.

The main objective was to evaluate body composition among university students in relation to their dietary intake and physical activity levels before and during the exam period.

The hypothesis was that students' body composition deteriorates during the exam period.

2. Materials and Methods

2.1. Study Design and Population

This study was designed as a prospective, observational, comparative, and longitudinal investigation. The target population consisted of second-year undergraduate nursing students enrolled at the University Complutense of Madrid. Students were recruited through convenience sampling.

This study was approved by the Ethics and Research Committee of Puerta de Hierro University Hospital (ACT 244/23). Access to the study files was password-protected and restricted to the responsible researchers in accordance with current data protection regulations (BOE-A-2018, Regulation 2016). The study was also approved and registered at ClinicalTrials.gov with the identifier: NCT06717620.

2.1.1. Inclusion Criteria

- Age ≥ 18 years
- Current enrollment in the second year of the nursing program

- Willingness to participate in both evaluation periods.

2.1.2. Exclusion Criteria

- The presence of any physical limitation that prevented bioimpedance measurement.
- Ongoing use of pharmacological treatments that could influence body composition.
- The inability to complete the second assessment (e.g., absence on the exam day).

2.2. Intervention

Participants were assessed at two time points: (1) prior to the start of the exam preparation period (January 2024), and (2) during the exam period, immediately following completion of a major exam (May 2024).

At each time point, the following data were collected:

Anthropometric and body composition measurements: Body weight (kg), height (cm), fat mass (%), muscle mass (kg), and visceral fat (score) were assessed using a validated bioimpedance device (Beurer BF 1000). Participants were instructed to remove footwear and metallic items and to follow standard pre-measurement conditions (e.g., fasting state, avoidance of intense physical activity 12 hours prior).

Dietary habits: Evaluated using a modified version of the Kidmed questionnaire, which assesses adherence to the Mediterranean diet. The questionnaire includes positive and negative dietary items with a scoring system that classifies diet quality into low (≥ 3 points), medium (4–7 points), or optimal (≥ 8 points).

Physical activity: Measured using the short form of the International Physical Activity Questionnaire (IPAQ-SF). Participants reported the frequency and duration of vigorous, moderate, and walking activities over the past 7 days. Total physical activity was calculated in MET-minutes/week and categorized as low, moderate, or high following standard IPAQ classification criteria (Figure 1).

Additional data on lifestyle behaviors (e.g., caffeine consumption, tobacco use, intake of cola or energy drinks) were also gathered via a structured survey.

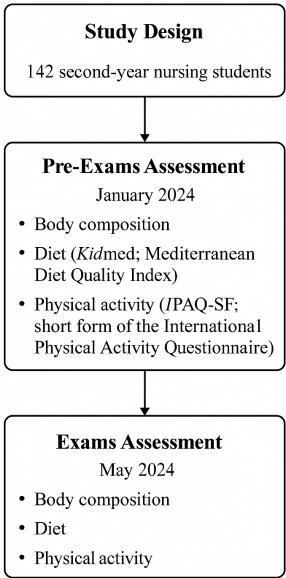


Figure 1. Flowchart of the study design. The study involved 142 second-year nursing students who underwent two assessments: one before the exam period (January 2024) and another during the exam period (May 2024). Each assessment included measurements of body composition (via bioimpedance), dietary habits (Kidmed questionnaire), and physical activity levels (IPAQ-SF).

2.3. Statistical Analysis

Descriptive statistics were used to summarize sociodemographic and clinical characteristics. Continuous variables were expressed as means and standard deviations, and categorical variables

as absolute frequencies and percentages. Paired-sample t-tests were used for normally distributed continuous variables, while Wilcoxon signed-rank tests were applied to non-normally distributed data. Chi-square tests assessed differences in categorical variables. The statistical significance threshold was set at $p<0.05$. All analyses were performed using IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, NY, USA).

3. Results

3.1. General Characteristics of the Population

In the first phase of data collection, conducted in January 2024 (non-exam period), 142 students who met the inclusion criteria participated in the study. Most participants were female (78.9%), with a mean age of 22.54 years. The mean body weight was 63.32 kg, with a mean BMI of 23.04. Regarding body composition, 42.3% of the students were categorized as having very high body fat, and 50.7% were within the normal muscle mass range.

Diet quality was classified as medium in 48.6% of participants and optimal in another 48.6%. Physical activity was high in 80.3% of the sample during this period (Table 1).

Table 1. Demographic and clinical variables in the initial data collection phase before exam preparation.

n=142		
Age mean (SD)		22.54 (7.38)
Gender n(%)	Man	30.00 (21.10)
	Woman	112 (78.90)
Weight mean (SD)		63.32 (10.79)
Height mean (SD)		165.89 (7.94)
BMI mean (SD)		23.04 (3.31)
Fat mass mean (SD)		26.07 (8.37)
Body fat range n(%)	Low	18.00 (12.70)
	Moderate	22.00 (15.50)
	High	42.00 (29.60)
	Very high	60.00 (42.30)
Muscular Mass mean (SD)		38.96 (5.37)
Body muscular range n (%)	Low	28.00 (19.70)
	Moderate	72.00 (50.70)
	High	42.00 (29.60)
Smoking habit n(%)	Yes	28.00 (19.70)
	No	114.00 (80.30)
Caffeine intake n(%)	Yes	93.00 (65.50)
	No	49.00 (34.50)
Daily cups of coffee consumption n(%)	Yes	1.59 (0.76)
Cola drink consumption n(%)	Yes	38.00 (26.80)
	No	104.00 (73.20)
Energy drink consumption n(%)	Yes	19.00 (13.40)
	No	123.00 (86.60)
Fruit or juice consumption n(%)	Yes	118.00 (83.10)
	No	24.00 (16.90)
Intake of a second piece of fruit n(%)	Yes	69.00 (48.60)
	No	73.00 (51.40)
Daily intake of fresh or cooked vegetables (once per day) n(%)	Yes	115.00 (81.00)
	n=142	
	No	27.00 (19.00)
Intake of fresh or cooked vegetables more than once daily n(%)	Yes	73.00 (51.40)
	No	69.00 (48.60)
Intake of fish 2–3 times per week n(%)	Yes	84.00 (59.20)
	No	58.00 (40.80)

Table 1. Cont.

		n=142
Visits to fast food restaurants (≥ 1 time per week) n(%)	Yes	44.00 (31.00)
	No	98.00 (69.00)
Legume intake more than once weekly n(%)	Yes	127.00 (89.40)
	No	15.00 (10.60)
Pasta or rice intake ≥ 5 times per week	Yes	55.00 (38.70)
	No	87.00 (61.30)
Cereal or cereal-derived product consumption at breakfast n(%)	Yes	106.00 (74.60)
	No	36.00 (25.40)
Nut intake 2 to 3 times weekly n(%)	Yes	81.00 (57.00)
	No	61.00 (43.00)
Olive oil consumption n(%)	Yes	150.00 (98.60)
	No	2.00 (1.40)
Habitually skips breakfast n(%)	Yes	19.00 (13.40)
	No	123.00 (86.60)
Breakfast includes a dairy product n(%)	Yes	115.00 (81.00)
	No	27.00 (19.00)
Breakfast includes industrial pastries n(%)	Yes	28.00 (19.70)
	No	114.00 (80.30)
Intake of at least 2 yogurts daily n(%)	Yes	66.00 (46.50)
	No	76.00 (53.50)
Intake of sweets several times per day n(%)	Yes	10.00 (7.00)
	No	132.00 (93.00)
Nutritional score n(%)	Low quality	4.00 (2.80)
	Moderate quality	69.00 (48.60)
	High quality	69.00 (48.60)
Days of vigorous physical activity, mean (SD)		3.14 (1.40)
Minutes of vigorous physical activity, mean (SD)		253.49 (172.65)
Days of moderate physical activity, mean (SD)		2.91 (1.60)
Minutes of moderate physical activity, mean (SD)		189.79 (158.96)
At least 10 consecutive minutes of walking in the past 7 days, mean (SD)		6.32 (1.31)
Minutes of walking per day, mean (SD)		492 (404.31)
Daily sitting time, mean (SD)		394.51 (147.61)
Exercise score n(%)	Low	7.00 (4.90)
	Moderate	21.00 (14.80)
	High	114.00 (80.30)

3.2. Comparative Results Between Pre-Exam and Exam Periods

In the second phase of the study, conducted in May 2024 (on the day of the nutrition exam), 72 students completed both data collection stages and were included in the comparative analysis (Figure 2). Of these, 79.2% were female, with a mean age of 21.94 years. (Table 2)

3.2.1. Significant Changes Between the Two Phases

- Fat mass increased from a mean of 25.43% pre-exams to 28.79% during the exam period (p=0.016).
- Muscle mass decreased from 39.70 kg to 36.20 kg (p<0.001)(Figure 2).
- Visceral fat rose from a mean of 2.34 to 3.52 (p<0.001).
- The percentage of students with very high body fat increased from 38.9% to 63.9%, and those with high muscle mass decreased from 36.1% to 8.3%.

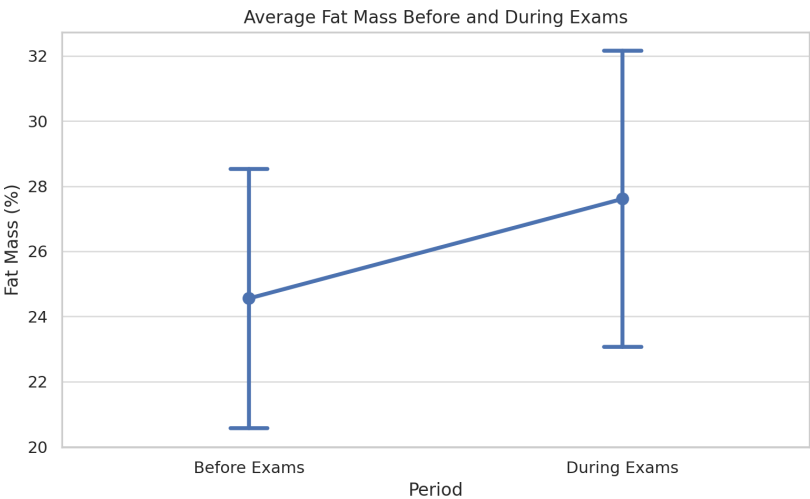


Figure 2. Mean fat mass before and during the exam period with standard deviation error bars. The plot shows a clear increase in average fat mass during exams, indicating a general deterioration in body composition.

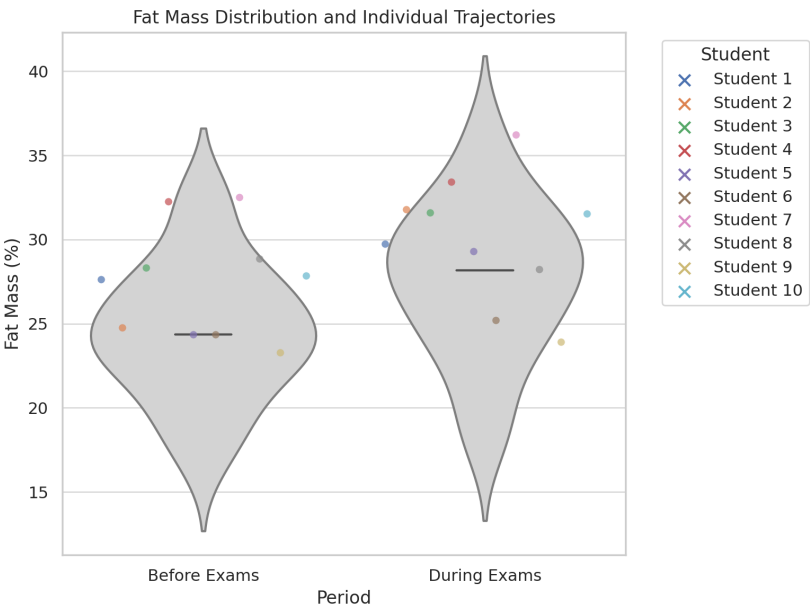


Figure 3. Violin and box plot of fat mass distribution before and during exams, including individual trajectories for a subset of 10 students. The figure highlights both the shift in distribution and the within-subject variability associated with academic stress.

3.2.2. Significant Changes Observed in Dietary Habits

- Students consuming a second piece of fruit daily decreased from 52.8% to 33.3% (p=0.018).
- Fast food consumption increased from 48.6% to 52.8% (p=0.024).
- The proportion of students skipping breakfast rose from 13.9% to 51.4% (p<0.001).
- Consumption of pastries for breakfast increased from 23.6% to 45.8% (p=0.005).
- Daily candy consumption increased from 6.9% to 29.2% (p=0.001).
- Optimal diet quality decreased from 45.8% to 20.0% (p<0.001), with a drop in mean Kidmed score from 7.55 to 5.45 points (p<0.001). (Figure 4)

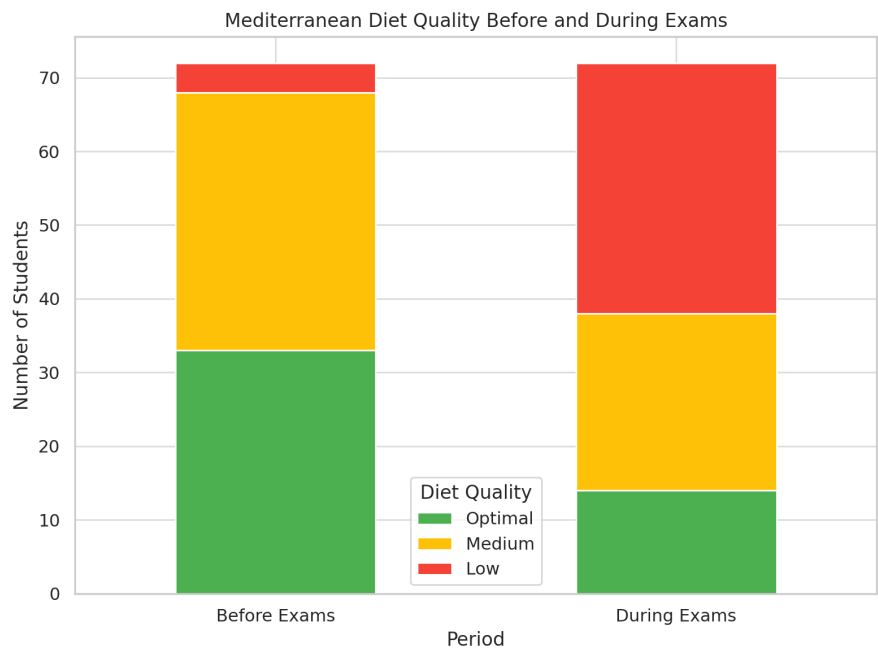


Figure 4. Stacked bar chart showing the distribution of Mediterranean diet quality among students before and during the exam period. The figure illustrates a marked decline in diet quality during exams, with a substantial increase in the number of students classified as having low adherence to the Mediterranean diet.

3.2.3. Significant Changes Observed y Physical Activity

- Days of vigorous physical activity decreased from 3.10 to 0.72 days/week ($p<0.001$).
- Vigorous activity time dropped from 229.02 to 30.69 minutes/week ($p<0.001$).
- The proportion of students with low physical activity rose from 4.2% to 59.7% ($p<0.001$), while those with high physical activity dropped from 84.7% to 11.1%.
- Mean sitting time increased from 408.24 to 543.61 minutes/day ($p<0.001$) (Figure 5).

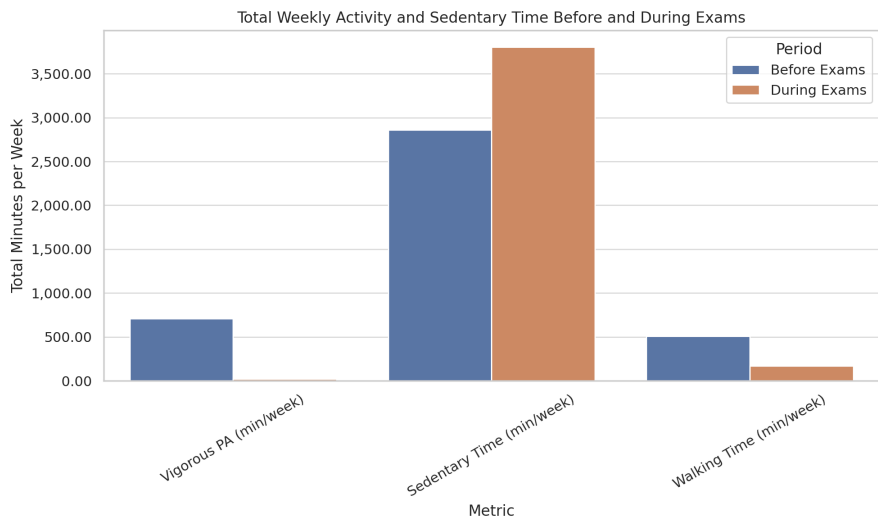


Figure 5. Total weekly minutes of vigorous physical activity, sedentary time, and walking before and during the exam period. The figure illustrates a significant decline in physical activity and walking, alongside a marked increase in sedentary behavior during exams. Data are based on calculated totals from self-reported frequency and duration.

Table 2. Demographic and clinical variables in the second data collection phase, before and during exam preparation, with comparative analysis of results.

		Before (n=72)	After (n=72)	p
Age mean (SD)		21.94 (5.52)	21.94 (5.52)	
Gender n(%)	Man	15.00 (20.80)	15.00 (20.80)	
	Woman	57.00 (79.20)	57.00 (79.20)	
Weight mean (SD)		64.14 (10.52)	65.63 (11.96)	0.489
Height mean (SD)		165.83 (8.30)	165.83 (8.30)	1
BMI mean (SD)		23.32 (3.45)	24.10 (3.86)	0.355
Fat mass mean (SD)		25.43 (8.20)	28.79 (8.35)	0.016
Body fat range n(%)	Low	18.00 (12.70)	6.00 (8.30)	0.028
	Moderate	22.00 (15.50)	6.00 (8.30)	
	High	25.00 (29.60)	14.00 (19.40)	
	Very high	28.00 (38.90)	46.00 (63.90)	
Muscular Mass mean (SD)		38.96 (5.37)	39.70 (5.35)	
Body muscular range n (%)	Low	11.00 (15.30)	35.00 (48.60)	<0.001
	Moderate	35.00 (48.60)	31.00 (43.10)	
	High	26.00 (36.10)	6.00 (8.30)	
Smoking habit n(%)	Yes	11.00 (15.30)	11.00 (15.30)	1
	No	61.00 (84.70)	61.00 (84.70)	
Caffeine intake n(%)	Yes	42.00 (58.30)	45.00 (63.40)	0.536
	No	30.00 (41.70)	26.00 (36.60)	
Daily cups of coffee consumption n(%)		1.60 (0.82)	1.60 (0.82)	1
Cola drink consumption n(%)	Yes	18.00 (25.00)	22 (30.60)	0.456
	No	54.00 (75.00)	50.00 (69.40)	
Energy drink consumption n(%)	Yes	8.00 (11.10)	11.00 (15.30)	0.460
	No	64.00 (88.90)	61.00 (84.70)	
Fruit or juice consumption n(%)	Yes	61.00 (84.70)	59.00 (81.90)	0.655
	No	11.00 (15.30)	13.00 (18.10)	
Intake of a second piece of fruit n(%)	Yes	38.00 (52.80)	24.00 (33.30)	0.018
	No	34.00 (47.20)	48.00 (66.70)	
Daily intake of fresh or cooked vegetables (once per day) n(%)	Yes	57.00 (79.20)	49.00 (68.10)	0.130
	No	15.00 (20.80)	23.00 (31.90)	
Intake of fresh or cooked vegetables more than once daily n(%)	Yes	31.00 (43.10)	31.00 (43.10)	1
	No	41.00 (56.90)	41.00 (56.90)	
Intake of fish 2–3 times per week n(%)	Yes	38.00 (52.80)	35.00 (48.60)	0.617
	No	34.00 (47.20)	37.00 (51.40)	
Visits to fast food restaurants (≥ 1 time per week) n(%)	Yes	35.00 (48.60)	38.00 (52.80)	0.024
	No	37.00 (51.40)	34.00 (47.20)	
Legume intake more than once weekly n(%)	Yes	61.00 (84.70)	57.00 (79.20)	0.386
	No	11.00 (15.30)	15.00 (20.80)	
Pasta or rice intake ≥ 5 times per week	Yes	29.00 (40.30)	23.00 (31.90)	0.298
	No	43.00 (59.70)	49.00 (68.10)	
Cereal or cereal-derived product consumption at breakfast n(%)	Yes	52.00 (72.20)	53.00 (73.60)	0.851
	No	20.00 (27.80)	19.00 (26.40)	
Nut intake 2 to 3 times weekly n(%)	Yes	39.00 (54.20)	39.00 (54.20)	1
	No	33.00 (45.80)	33.00 (45.80)	
Olive oil consumption n(%)	Yes	71.00 (98.60)	68.00 (94.40)	0.172
	No	1.00 (1.40)	4.00 (5.60)	
Habitually skips breakfast n(%)	Yes	10.00 (13.90)	37.00 (51.40)	<0.001
	No	62.00 (86.10)	35.00 (48.60)	
Breakfast includes a dairy product n(%)	Yes	58.00 (80.60)	53.00 (73.60)	0.322
	No	14.00 (19.40)	19.00 (26.40)	
Breakfast includes industrial pastries n(%)	Yes	17.00 (23.60)	33.00 (45.80)	0.005
	No	55.00 (76.40)	39.00 (54.20)	
Intake of at least 2 yogurts daily n(%)	Yes	42.00 (58.30)	40.00 (55.60)	0.736
	No	30.00 (41.70)	32.00 (44.40)	
Intake of sweets several times per day n(%)	Yes	5.00 (6.90)	21.00 (29.20)	0.001
	No	67.00 (93.10)	51.00 (70.80)	
Nutritional score n(%)	Low quality	3.00 (4.20)	17.00 (24.30)	<0.001
	Moderate quality	36.00 (50.00)	39.00 (55.70)	
	High quality	33.00 (45.80)	14.00 (20.00)	
Overall dietary score n(%)		7.55 (1.97)	5.45 (2.14)	<0.001
Days of vigorous physical activity, mean (SD)		3.10 (1.41)	0.72 (1.07)	<0.001
Minutes of vigorous physical activity, mean (SD)		229.02 (169.71)	30.69 (60.25)	<0.001
Days of moderate physical activity, mean (SD)		2.83 (1.63)	1.15 (1.64)	<0.001
Minutes of moderate physical activity, mean (SD)		196.17 (165.59)	57.50 (125.03)	<0.001
At least 10 consecutive minutes of walking in the past 7 days, mean (SD)		6.41 (1.11)	3.79 (2.23)	<0.001
Minutes of walking per day, mean (SD)		506.55 (391.85)	168.83 (174.90)	<0.001
Daily sitting time minutes, mean (SD)		408.24 (154.28)	543.61 (237.48)	<0.001
Exercise score n(%)	Low	3.00 (4.20)	43.00 (59.70)	<0.001
	Moderate	8.00 (11.10)	21.00 (29.20)	
	High	61.00 (84.70)	8.00 (11.10)	

3.3. Impact of Diet Quality on Body Composition

Students with poor diet quality showed worse body composition parameters, with higher fat mass (30.10%), higher visceral fat (4.14), and lower muscle mass (35.16 kg) compared to those with optimal dietary habits (Table 3) (Figure 6).

Table 3. Relationship between diet quality and body composition.

	Fat	Visceral tissue	Muscle
Low-quality diet (SD)	30.10 (8.73)	4.14 (2.51)	35.16 (5.41)
Moderate-quality diet (SD)	29.60 (7.35)	3.57 (2.45)	35.71 (3.94)
High-quality diet (SD)	24.91 (10.29)	2.78 (1.96)	38.64 (5.16)

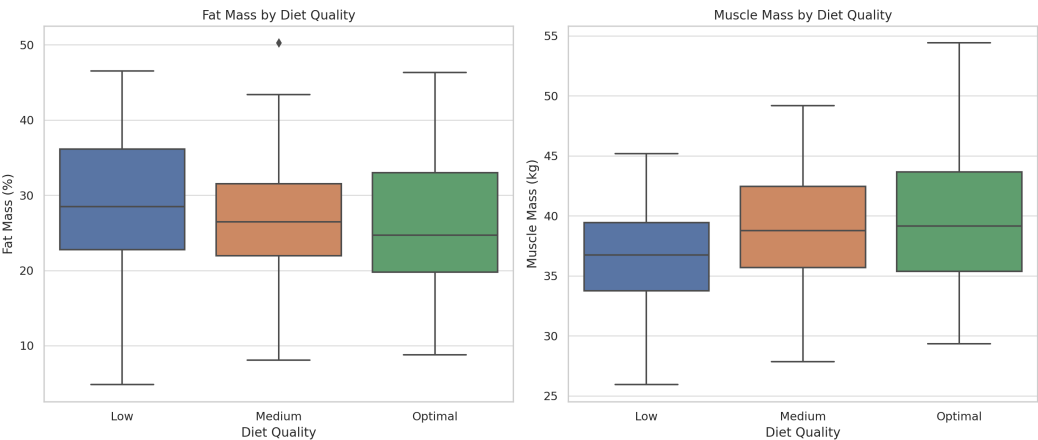


Figure 6. Distribution of fat mass and muscle mass according to diet quality. The boxplots illustrate that students with lower diet quality (as classified by the modified Kidmed score) tend to have higher fat mass and lower muscle mass, reinforcing the association between nutritional habits and body composition.

3.4. Impact of Physical Activity on Body Composition

Similarly, students with low levels of physical activity had higher fat mass (30.31%), higher visceral fat (3.90), and lower muscle mass (35.25 kg) compared to their more active peers (Table 4).

Table 4. Relationship between physical activity and body composition.

	Fat	Visceral tissue	Muscle
Low-physical activity (SD)	30.31 (7.72)	3.90 (2.67)	35.25 (4.51)
Moderate-physical activity (SD)	26.40 (8.34)	3.04 (1.77)	37.81 (4.15)
Vigorous-physical activity (SD)	26.95 (10.73)	2.75 (1.58)	37.33 (5.52)

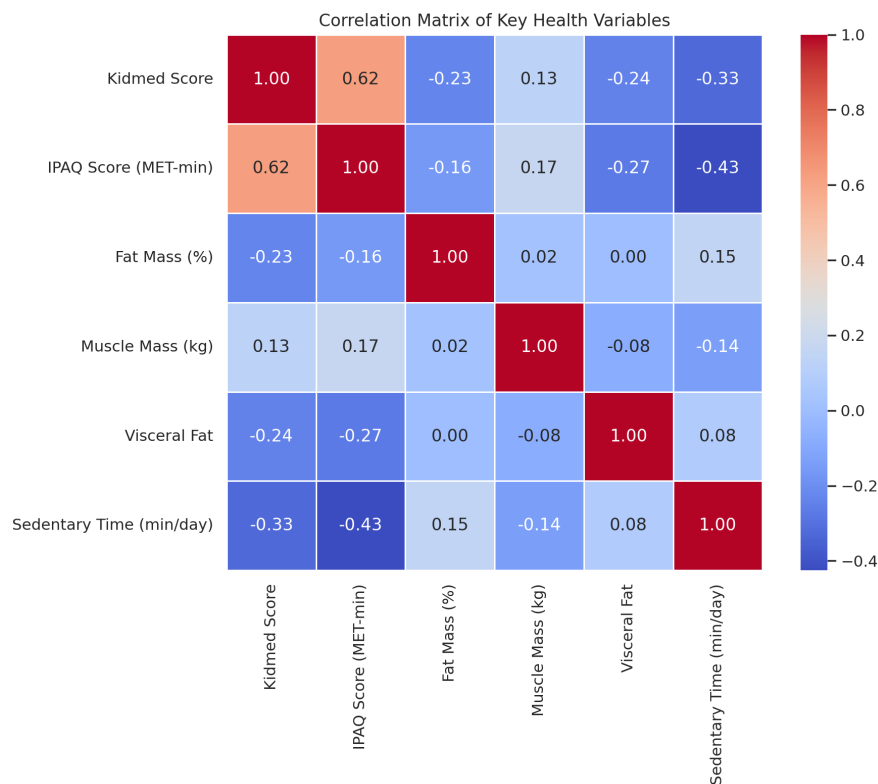


Figure 7. Correlation matrix of key variables related to lifestyle and body composition. The heatmap displays Pearson correlation coefficients among Kidmed score, IPAQ physical activity score (MET-min/week), fat mass, muscle mass, visceral fat, and sedentary time. Strong inverse correlations are observed between Kidmed or IPAQ scores and fat-related measures, highlighting the impact of healthy habits on body composition.

4. Discussion

The most relevant findings of this study clearly demonstrate the relationship between dietary habits, physical activity, and body composition among university students. The results show that students with poor diet quality and low physical activity levels exhibited increased fat mass, reduced muscle mass, and elevated visceral fat. In particular, the increase in visceral fat observed in students with unhealthy lifestyle habits is concerning, as sustained high levels are associated with a higher risk of developing metabolic disorders such as T2D and cardiovascular diseases, including hypertension and dyslipidemia. Furthermore, the instrument used to assess physical activity in this study, the short form of the International Physical Activity Questionnaire (IPAQ-SF), has been validated in international research and is considered suitable for population-level surveillance. As highlighted by Mantilla Toloza and Gómez-Conesa (2007), the short version is especially recommended for regional and national prevalence studies due to its adequate reliability ($r = 0.76$; 95% CI: 0.73–0.77) and its practical application across diverse populations. Although the IPAQ-SF does not provide as detailed information as its longer counterpart, it effectively captures essential domains of physical activity—such as walking, moderate and vigorous activity, and sedentary time—which are particularly relevant during periods of lifestyle disruption, such as university exam sessions. Therefore, its inclusion in this study was both methodologically justified and operationally feasible given the academic setting and time constraints of the participants [12].

Another important observation is that body weight and BMI did not differ significantly between the two assessment periods. This can be explained by the balance between increased fat mass and decreased muscle mass. Although body weight remained relatively stable, the underlying body composition worsened, emphasizing that weight and BMI alone are not sufficient indicators of health status. Assessing fat and muscle mass provides a more accurate picture of metabolic and nutritional health.

Previous literature supports the notion that academic stress during examination periods negatively impacts students’ lifestyles[13–15]. Increased academic demands often lead to disrupted routines, poorer eating habits[11,16], and a reduction in physical activity levels. Students may skip meals, consume ultra-processed foods, or neglect regular exercise due to time constraints or psychological stress, which, over time, can adversely affect body composition[17] and overall health.[1,6,18]

These findings highlight the need to include stress management strategies within academic environments, such as mindfulness techniques, relaxation exercises, and structured study plans that allow time for self-care. Moreover, educational initiatives focused on promoting healthy eating and regular physical activity should be integrated into university curricula to raise awareness among students about the long-term consequences of unhealthy behaviors.

Despite limitations such as the dropout rate between the two assessment points, the study offers evidence of the detrimental effects of stress-related lifestyle changes on body composition. Although the internal validity of this study is limited due to the homogeneous sample (students from a single university), the external validity is notable, as similar behaviors and stress patterns are likely to affect student populations in other academic settings.

Ultimately, the negative impact of poor habits during exam preparation affects a large portion of the student population. Addressing this issue requires institutional efforts to promote lifestyle interventions aimed at preserving both physical and mental health during high-stress academic periods.

5. Conclusions

Poor dietary habits and a sedentary lifestyle contribute to the deterioration of body composition. Among university students, both diet quality and physical activity levels decline significantly during exam preparation periods, leading to increased fat mass, decreased muscle mass, and elevated visceral fat. These findings underscore the importance of promoting healthy behaviors, particularly during periods of academic stress, to prevent long-term health risks (Figure 8).

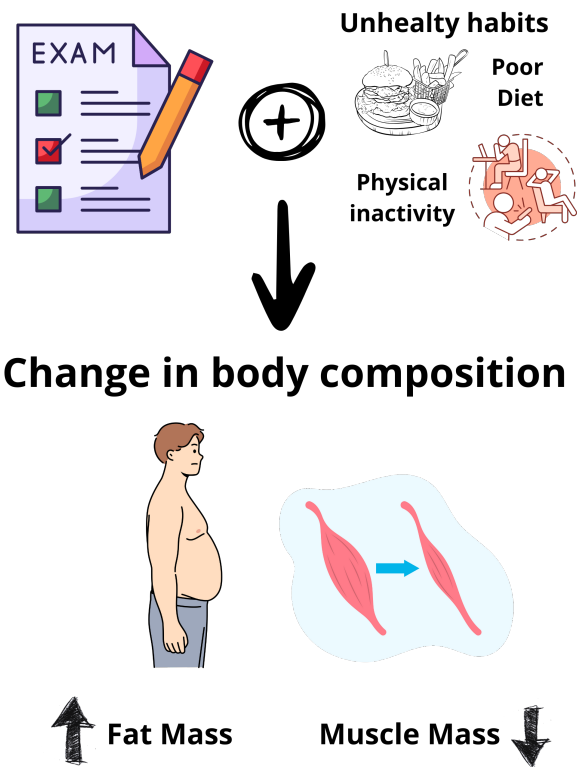


Figure 8. Conceptual summary of the impact of exam periods on student health. The infographic illustrates how academic stress leads to unhealthy habits, including poor diet and physical inactivity, which subsequently result in increased fat mass and decreased muscle mass, reflecting adverse changes in body composition.

6. Limitations

- Limited and homogeneous sample: All participants were second-year nursing students from a single institution (University Complutense of Madrid), which restricts the external validity and generalizability of the findings to other academic disciplines or university contexts.
- Participant attrition: Of the initial 142 students, only 72 completed both stages of the study. This loss may introduce selection bias, as students experiencing higher stress or more unhealthy behaviors may have been less likely to complete the follow-up.
- Lack of objective stress measurement: Although academic stress is hypothesized as a key factor influencing lifestyle changes, no validated tool (e.g., Perceived Stress Scale or Academic Stress Inventory) was used to assess it. This limits the ability to quantify its specific impact.
- Self-reported data: Both dietary habits (Kidmed) and physical activity (IPAQ) were assessed using self-administered questionnaires, which may be subject to social desirability bias and recall errors.
- Observational study design: The study's correlational and observational nature precludes causal inference. Therefore, it cannot be concluded with certainty that exam preparation or stress directly caused the observed changes in body composition.

7. Future Research Directions

- Incorporate validated stress measurement tools: Future studies should assess perceived stress levels using validated scales (e.g., PSS), allowing for direct correlation between stress and changes in health-related behaviors and outcomes.
- Expand to other academic disciplines and institutions: Replicating the study across different fields of study and universities would enhance the generalizability and robustness of the findings.
- Intervention-based studies: Experimental or quasi-experimental designs could assess the effectiveness of specific interventions (e.g., brief educational sessions, mindfulness, or physical activity programs) implemented during exam periods to mitigate negative outcomes.
- Extended longitudinal follow-up: Investigating whether the changes in body composition are transient or sustained over time could provide insight into their potential long-term health implications.
- Objective measurement of diet and physical activity: The use of accelerometers, 24-hour dietary recalls, or nutritional biomarkers could improve the accuracy and reliability of lifestyle data collection.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used “Conceptualization, F.G. and N.M.; methodology, N.M. and I.O.; software, F.G.; validation, M.V., F.G. and M.P.; formal analysis, N.M.; investigation, N.M.; resources, M.V.; data curation, N.M.; writing—original draft preparation, N.M.; writing—review and editing, F.G.; visualization, F.G.; supervision, Z.G.; project administration, F.R.; funding acquisition, R.B. All authors have read and agreed to the published version of the manuscript.”, please turn to the [CRediT taxonomy](#) for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

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Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee Segovia—Arana Biomedical Research Institute of University Hospital Puerta de Hierro (protocol code ACT 15.18) in 19 October 2018. The study was also approved and registered at ClinicalTrials.gov with the identifier: NCT06717620.

Informed Consent Statement: All students who participated in the study signed an informed consent form after reading an information sheet that clearly explained the objectives, procedures, and conditions of the study.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

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Abbreviations

The following abbreviations are used in this manuscript:

- BMI Body mass index
- IPAQ International Physical Activity Questionnaire
- SD Standart desviation
- T2D Type 2 diabetes

Appendix A

Table A1. Modified Kidmed Questionnaire: Adherence to the Mediterranean Diet in Childhood.

Item	Adherence to the Mediterranean Diet	Points
1	I eat a dairy product for breakfast (milk, yogurt, etc.)	+1
2	I eat a cereal or cereal-based product for breakfast (e.g., bread)	+1
3	I skip breakfast	−1
4	I eat industrial pastries, cookies, or cakes for breakfast	−1
5	I consume one fruit or a natural juice every day	+1
6	I consume a second piece of fruit every day	+1
7	I eat fresh (e.g., salad) or cooked vegetables at least once a day	+1
8	I eat fresh or cooked vegetables more than once a day	+1
9	I eat 2 yogurts and/or 40 g of cheese daily	+1
10	I eat fish at least 2–3 times a week	+1
11	I go to a fast-food restaurant (e.g., burger place, pizzeria) or order food for delivery at least once a week	−1
12	I like legumes (chickpeas, lentils, etc.) and eat them 2–3 times a week	+1
13	I eat pasta or rice almost daily (5 or more times a week)	+1
14	Olive oil is used at home	+1
15	I frequently eat unsalted nuts (at least 2–3 times a week)	+1
16	I eat sweets, candies, or ice cream several times a day	−1
17	I snack daily between meals (e.g., chips, salty snacks, popcorn)	−1
18	I drink sugary beverages, packaged juices, and/or milkshakes every day	−1
19	I drink three or more glasses of water per day	+1

Table A2. Physical Activity Classification Based on IPAQ Short Form.

Level	Criteria
High	- Vigorous-intensity activity on at least 3 days, achieving a minimum of 1500 MET-min/week, or - 7 or more days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of 3000 MET-min/week
Moderate	- 3 or more days of vigorous-intensity activity of at least 20 minutes/day, or - 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes/day, or - 5 or more days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of 600 MET-min/week
Low	- Does not meet criteria for high or moderate physical activity levels

Table A3. Body Fat Classification by Age and Sex (percentages).

Age (years)	Low	Normal	High	Very High
Men				
10–14	<11%	11–16%	16.1–21%	>21%
15–19	<12%	12–17%	17.1–22%	>22%
20–29	<13%	13–18%	18.1–23%	>23%
30–39	<14%	14–19%	19.1–24%	>24%
40–49	<15%	15–20%	20.1–25%	>25%
50–59	<16%	16–21%	21.1–26%	>26%
60–69	<17%	17–22%	22.1–27%	>27%
70+	<18%	18–23%	23.1–28%	>28%
Women				
10–14	<16%	16–21%	21.1–26%	>26%
15–19	<17%	17–22%	22.1–27%	>27%
20–29	<18%	18–23%	23.1–28%	>28%
30–39	<19%	19–24%	24.1–29%	>29%
40–49	<20%	20–25%	25.1–30%	>30%
50–59	<21%	21–26%	26.1–31%	>31%
60–69	<22%	22–27%	27.1–32%	>32%
70+	<23%	23–28%	28.1–33%	>33%

Table A4. Muscle Mass Classification by Age and Sex (kg).

Age (years)	Low	Normal	High
Men			
10–14	<44	44–57	>57
15–19	<43	43–56	>56
20–29	<42	42–54	>54
30–39	<41	41–52	>52
40–49	<40	40–50	>50
50–59	<39	39–48	>48
60–69	<38	38–47	>47
70+	<37	37–46	>46
Women			
10–14	<36	36–43	>43
15–19	<35	35–41	>41
20–29	<34	34–39	>39
30–39	<33	33–38	>38
40–49	<31	31–36	>36
50–59	<29	29–34	>34
60–69	<28	28–33	>33
70+	<27	27–32	>32

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