Assessment of dietary patterns, physical activity levels, and sedentary lifestyle in adolescents from an urban high school

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ABSTRACT

This quantitative cross-sectional study evaluated nutritional habits, physical activity levels, and sedentary behaviors in 62 students in 4th grade of secondary education (15.44 ± 0.62 years) from a public high school in Zaragoza, Spain. Results showed that students consumed an average of 1.98 ± 1.42 servings of fruit and 2.05 ± 1.61 servings of vegetables daily, with higher intake of meat (2.00 ± 1.24) than fish (1.00 ± 1.21). Gender differences were found ($p<0.05$): males consumed more meat while females ate more vegetables and practiced voluntary fasting more frequently. On average, students engaged in physical activity 3.15 ± 2.62 days per week, with males being significantly more active. Screen time was considerable (1.52 ± 0.88 hours TV; 2.73 ± 1.34 video games). Correlations revealed positive associations between physical activity and healthy food consumption ($r>0.39$), while sedentary behaviors were related to unhealthy foods ($r>0.43$). These findings suggest the need for specific interventions that promote healthy habits within the school environment.

KEYWORDS

1. INTRODUCTION

Physical activity (PA) and nutrition form the foundation of the main determinants of a person's health status. PA together with a healthy and balanced diet are the fundamental pillars in human development and growth (Hsu et al., 2019). PA practiced regularly and considering the different components that characterize it (volume, intensity, content to be developed, as well as frequency) has been shown to reduce morbidity and mortality in a wide spectrum of non-communicable diseases (Zhang & Liu, 2024). During adolescence, there is an exponential increase in height and weight, the influence of physical exercise and sedentary lifestyle (SD) has been extensively studied, having demonstrated multiple positive effects on body composition, muscle and bone development (Örjan et al., 2005; Smith et al., 2014), and even on adolescent mental health or self-esteem (Klos et al., 2020).

The evolution of society today has led to an increase in nutritional deficiencies and PA among children and adolescents globally (Guevara et al., 2020; Sahoo et al., 2015). The World Health Organization (WHO) has focused in recent years on advocating for the need for a balanced diet and regular PA throughout life, limiting the presence of diseases and health problems (WHO & FAO, 2003). In recent years, overweight and obesity have increased in both the global and Spanish populations, particularly among children and adolescents (Basterra-Gortari et al., 2017).

Healthy habits should be formed throughout life with a solid foundation in childhood that allows these habits to be maintained throughout life (Craigie et al., 2011). In this sense, nutritional and PA interventions are essential in schools and high schools to form good health habits. In the study of this situation, the differentiation between urban and rural contexts has been kept in mind (McCormack & Meendering, 2016). These contexts pose differentiated situations that must be adequately addressed, showing disparities in obesity rates between rural and urban children (Liu et al., 2008).

Sports and PA habits refer to the regular and planned practice of physical-sports activities by a person to improve their health and/or physical well-being. In this sense, there are 5 relevant factors for the practice of PA and sport: Sallis et al. (2000) argue that there are a total of five factors: biological/demographic, behavioral, psychological, social and cultural, and environmental.

Due to all this scientific evidence, a growing concern arose in society to preserve their health, which led official bodies to begin to develop guidelines for improving health through exercise and PA (Bull et al., 2020; Tremblay et al., 2011). In adolescents, the rate of compliance with these PA

guidelines gradually decreases from childhood to adolescence (Chaput et al., 2020). As for sedentary lifestyle (SB), the rates are even higher, with only 31% spending less than 2 hours a day in front of screens or less in the case of females with 14% (Abarca-Sos et al., 2016). Although the number and variety of sports offered are increasing for adolescents, many of them do not perform any type of PA, therefore failing to comply with the 3 hours of physical exercise recommended in the guidelines, which is the fundamental reason why the permanence of the subject of Physical Education (PE) in Spain is justified (Méndez Alonso et al., 2016).

Royal Decree 217/2022, of 29 March, which establishes the organisation and minimum teaching of Compulsory Secondary Education (ESO) establishes the compulsory nature of the subject of PE (BOE, 2022). The number of sessions of Secondary Education varies depending on the stage, being higher in the Primary stage than in ESO (3 sessions vs 2 sessions) and in the different autonomous communities. This reduction, together with the decrease in PA in their free time, leads to a decrease both in quality of life and in health improvement (Pérez-Pueyo et al., 2021). The PASOS study highlighted that only 36.7% comply with the WHO PA guidelines and the decrease in PA minutes per week between 8 and 16 years of age is 98.2 minutes less (Fundación Gasol., 2019).

Diet, the other fundamental pillar for optimal health and the prevention of the development of non-communicable diseases, especially cardiocirculatory and metabolic diseases (Lavie et al., 2018). In the case of adolescents, multiple studies have been carried out in different types of populations and economic levels, relating the influence of environments on the qualitative and quantitative composition of the diet (Palenzuela-Paniagua et al., 2014)). On a general level, subjects living in low-income economic environments demonstrate diets with lower caloric intakes and therefore with caloric deficits, but also on a qualitative level with a distribution of the different nutrients far from the medical criteria established by the different medical and dietary organizations (20-25 % fats, 45-60% carbohydrates and 10-15%) (European Food Society Authority, 2017) In addition, not only the energy balance or the proportion of nutrients must be assessed, but also the quality and biological value of these nutrients, since in many cases the proteins or fatty acids that are consumed do not contain either essential amino acids or essential fatty acids (Mescoloto et al., 2024).

Apart from the economic environment, adolescents have to face different myths and false beliefs associated with the cult of the body and diet (Rathi et al., 2017). Priority is given to the use of dietary strategies without any medical control prescribed by unqualified people, which often responds to marketing campaigns by food companies or sports supplements that promise results at the level of body composition in a minimum time and with a low degree of effort (Neumark-Sztainer

et al., 2018). Consequently, and as a result of the detection of this problem, vocational education together with adequate nutritional education have been proposed as effective measures among adolescents (Sonntag et al., 2015).

The study conducted by Guevara et al. (2020) showed that, in an urban secondary education context in Spain, the consumption of healthy foods is below the recommended levels (only 11.3% of adolescents comply correctly). There are significant differences in the quality and frequency of breakfast. Fruit consumption was particularly notable, as 19.1% consume fruit less than once a week or never, and only 20.3% consume vegetables daily. However, more than 50% of students consume snacks, sugar-sweetened drinks, or sweets twice a week or more.

Nutritional habits and PA of young people in secondary education present a challenge for society, as there are serious localized health issues. However, knowledge about the analysis of urban contexts and intervention programs with young people is limited. Furthermore, most existing literature addresses nutritional habits and PA separately. Therefore, a joint analysis is required, both of their relationships and the effect of these two areas on the health of young people.

Therefore, the objective of this study is to analyze food patter consumption, the level of PA alongside the sedentary behaviors among adolescents in the 4th grade of high school education in an urban high school from Zaragoza. The approach of this study from an ecological perspective will allow the identification of intervention points and strategies tailored to the unique needs and resources of urban educational communities. The findings of this research will contribute to further advancing knowledge about health behaviors in young people within secondary education contexts. The results obtained will enrich the foundation for establishing practical applications that address localized issues, involving all social entities in promoting healthier lifestyles among young people.

2. METHODS

2.1. Design and Participants

This study employed a quantitative cross-sectional design using questionnaires to assess both nutritional habits and PA patterns in an urban high school in Zaragoza (Spain). The participating school was selected and accepted the invitation to the research study. The selected sample allows for the analysis of nutritional behaviors and PA during the adolescent phase in an urban secondary education context. The questionnaires were administered during regular school hours under supervised conditions to ensure their correct completion.

A total of 62 secondary education students (36 females and 26 males), aged 15.44±0.62 years, from a public high school in Zaragoza (Spain), participated in this study. The participating high school accepted the invitation to the study. The inclusion criteria required participants to be enrolled in secondary education in 4th grade and attend the participating school. Students with exceptional situations, such as physical or cognitive disabilities that prevented them from completing the questionnaire, medical conditions that significantly altered their dietary patterns or PA, or those involved in elite sports training programs, were excluded.

Written informed consent was obtained from parents or guardians, and assent was secured from all children. Participation was voluntary, and students could withdraw at any time without consequences. All data was coded and securely stored to ensure confidentiality.

2.2. Instruments

This study evaluated the nutritional habits, PA levels, and sedentary behaviors. Participants completed a validated self-reported questionnaire based on the International Physical Activity Questionnaire (IPAQ) and the HELENA tool, which included 21 quantitative questions. Participants filled out a descriptive information section, such as gender, age, grade and group.

The questionnaire was developed in Spanish, the native language of the participants, to ensure clear understanding and accurate responses. It consisted of 21 items divided into three main domains: nutritional habits (questions 1-13), PA patterns (questions 14-20) and information on gym training and supplementations (question 21).

The nutritional habits section evaluated daily and weekly consumption patterns of key food groups including fruits, vegetables, fish, and meat (questions 1-8). It also assessed water intake (question 9) and consumption frequency of less healthy options such as sugar beverages, fast food, and ultra-processed (questions 10-12). Response options for frequency questions ranged from 0 to 7 days per week, while quantity questions offered choices from 0 to 7 portions daily (with water intake extending to 10 glasses). Question 13 consisted of how many times the participants fasted per week (no breakfast) with a response range of 0 to 7 days.

The PA section examined several dimensions of activity and sedentary behavior among the participants. Questions addressed weekly frequency of PA (question 14), types of activities performed (question 15, open-ended), family involvement in sports (question 16), active transportation to school (question 17), screen time divided between television viewing and video games/mobile devices (questions 18-19), and PA within the school environment including physical

education classes and recess (question 20). Similar to the nutrition section, most questions used a 0-7 scale for weekly frequency, while screen time questions extended to 10 hours. Open-ended question 21 collected information on whether participants trained in a gym and took supplementation.

2.3. Procedures

The study was conducted during the spring semester of the 2024/2025 academic year at participating schools. Prior to data collection, the researchers contacted the high school by email to inform him/her about the objective, methodology, and potential benefits of the study. Once the schools agreed to participate, the research team coordinated with the teachers to schedule the data collection sessions in a way that minimize disruption to regular academic activities.

Before administering the questionnaires, parents and guardians received information sheets detailing the study objectives and procedures, along with informed consent forms. Only students with signed parental consent forms participated in the study. The research team ensured that participants understood their rights to confidentiality and voluntary participation.

Questionnaires were administered in a classroom setting during regular high school hours. A member of the research team was present during data collection to provide standardized instructions, answer questions, and ensure proper completion of the forms. Students completed the questionnaires independently, though researchers aided clarify questions when needed without influencing responses. The questionnaire administration took approximately 20-25 minutes to complete.

To maintain consistency in each data collection, the research team followed a standardized protocol for data collection. This included reading the same introductory script to all participants, giving uniform responses to common questions, and using identical procedures for collecting and storing completed questionnaires. Demographic information (age, gender, grade and group) was collected along with the questionnaire responses, while ensuring anonymity. Once the data were collected, the questionnaires were reviewed for completeness and the responses were manually entered into a database for subsequent analysis. Data entry was verified by double-checking procedures to minimize errors.

2.4. Statistical Analysis

Data analysis was performed using Python (Version 3.x), with statistical tests conducted using libraries such as Pandas, NumPy, SciPy, and stats models. Descriptive statistics (means and standard deviations) were calculated to characterize the nutritional habits and PA patterns of the overall sample. The Shapiro-Wilk test was used to assess data normality. Based on the normality

results, parametric (independent t-tests) or non-parametric tests (Mann-Whitney U) were applied to compare differences between male and female participants. The significance level was set at *p<0.05*.

The magnitude of the correlations between key variables was assessed using Pearson's correlation coefficient for normally distributed data or Spearman's rank correlation for non-normally distributed data. Correlation coefficients were interpreted as follows: weak (0 to 0.29), moderate (0.30 to 0.49), strong (0.50 to 0.69), and very strong (0.70 to 1.00). These correlations were visualized using heatmaps to illustrate the relationships between variables, such as fruit and vegetable intake, PA, and sedentary behaviors, in both male and female subgroups. The heatmaps were generated using the Seaborn and Matplotlib libraries. All statistical analyses were conducted using custom Python scripts, and results were interpreted within the context of the study's research questions.

3. RESULTS

3.1. Nutritional Habits

The daily dietary intake among high school students (see Table 1) consisted of 1.98±1.42 portions of fruit, 2.05±1.61 portions of vegetables, 1.00±1.21 portions of fish, 2.00±1.24 portions of meat, and 7.11±2.40 glasses of water. Additionally, the weekly consumption frequency was 4.50±2.32 days for fruits, 4.24±1.99 days for vegetables, 1.71±1.38 days for fish, and 4.56±2.02 days for meat. The intake of less healthy dietary items showed an average of 2.03±1.97 days per week for sugar-sweetened beverages, 1.41±0.94 days for fast food, and 3.39±2.17 days for snacks. The average frequency of fasting was 2.55±2.97 days per week.

When comparing nutritional habits by sex, statistically significant differences were found in several variables. Females reported a significantly higher daily intake of vegetables (2.33±1.64 vs. 1.65±1.52; *p<0.05*), whereas males consumed significantly more meat per day (2.46±1.56 vs. 1.67±0.83; *p<0.05*) and per week (5.31±1.95 vs. 4.03±1.92; *p<0.05*). Additionally, fasting frequency was significantly higher in females compared to males (3.50±3.07 vs. 1.23±2.30; *p<0.05*). No significant differences were observed in other dietary variables between sexes (*p>0.05*). The detailed comparisons between males and females are presented in Table 1.

3.2. Physical Activity Habits

The weekly PA patterns among high school students (see Table 1) consisted of 3.15±2.62 days of PA, 0.50±1.13 days of PA with family members, and 2.95±2.45 days of active commuting (walking or cycling) to school. Additionally, students reported 2.47±1.10 days of structured PA,

including both school-based and extracurricular activities. Screen time use averaged 1.52±0.88 hours per day watching television and 2.73±1.34 hours per day playing video games. Regarding screen time, participants spent an average of 1.52±0.88 hours per day watching television and 2.73±1.34 hours per day playing video games. The results by gender are presented in Table 1.

When comparing PA habits between sexes, statistically significant differences were found in weekly PA participation, with males (4.08±2.51 days) being more active than females (2.47±2.51 days; *p*<0.05). Similarly, structured physical education with PA at school recess was higher in males (2.81±1.23 days) compared to females (2.22±0.93 days; *p*<0.05). No significant differences were observed in other physical activity variables between sexes (*p*>0.05).

Table 1. Comparison of dietary intake, physical activity levels, and sedentary behaviors between male and female participants

	Males (M±SD)	Females (M±SD)	Total (M±SD)
Fruits per day (*units*)	2.04±1.71	1.94±1.19	1.98±1.42
Fruits per week (*days*)	4.54±2.23	4.47±2.41	4.50±2.32
Vegs per day (*units*)	1.65±1.52[*]	2.33±1.64[*]	2.05±1.61
Vegs per week (*days*)	3.96±2.24	4.44±1.80	4.24±1.99
Fish per day (*units*)	1.00±1.13	1.00±1.29	1.00±1.21
Fish per week (*days*)	1.73±1.25	1.69±1.49	1.71±1.38
Meat per day (*units*)	2.46±1.56[*]	1.67±0.83[*]	2.00±1.24
Meat per week (*days*)	5.31±1.95[*]	4.03±1.92[*]	4.56±2.02
Water (*200cc, days*)	7.69±1.85	6.69±2.68	7.11±2.40
S-S Drinks (*200cc, days*)	2.00±2.00	2.06±1.98	2.03±1.97
Fast Food (*days*)	1.27±1.12	1.51±0.78	1.41±0.94
Snacks (*days*)	2.85±2.29	3.78±2.02	3.39±2.17
Fasting (*days*)	1.23±2.30[*]	3.50±3.07[*]	2.55±2.97
PA per week (*days*)	4.08±2.51[*]	2.47±2.51[*]	3.15±2.62
Family Sport (*days*)	0.50±0.99	0.50±1.23	0.50±1.13
Active Travel (*days*)	2.77±2.49	3.08±2.44	2.95±2.45
TV (*hours*)	1.58±1.06	1.47±0.74	1.52±0.88
Videogames (*hours*)	2.81±1.27	2.67±1.41	2.73±1.34
PE + PA at school recess (*days*)	2.81±1.23[*]	2.22±0.93[*]	2.47±1.10

Note. S-S Drinks: sugar-sweetened drinks; PA: physical activity; PE: physical education; TV: television; [*]p<0.05

3.3. Correlation between Nutritional and Physical Activity Habits in Male Students

Figure 1 presents the correlation analysis between food consumption, PA, and sedentary behaviors among male students. Only significant correlations ($p<0.05$) are displayed, while non-significant correlations ($p>0.05$) are masked.

Positive correlations were observed between PA per week and fruit consumption ($r=0.55$, $p<0.05$), vegetable consumption ($r=0.49$, $p<0.05$), and water intake ($r=0.59$, $p<0.05$). Additionally, family-based PA exhibited a moderate positive correlation with fish consumption ($r=0.57$, $p<0.05$). Active commuting to school (Active Travel) also showed a moderate positive correlation with vegetable consumption ($r=0.39$, $p<0.05$).

Regarding negative correlations, video game usage was strongly and negatively associated with fruit consumption ($r=-0.48$, $p<0.05$), vegetable consumption ($r=-0.42$, $p<0.05$), and fish consumption ($r=-0.44$, $p<0.05$). Moreover, sugar-sweetened drink consumption showed a moderate negative correlation with both fruit intake ($r=-0.39$, $p<0.05$) and vegetable intake ($r=-0.39$, $p<0.05$).

Additionally, television viewing was moderately and positively correlated with snack consumption ($r=0.48$, $p<0.05$) and fast-food intake ($r=0.40$, $p<0.05$), suggesting a potential link between increased screen time and unhealthy eating habits.
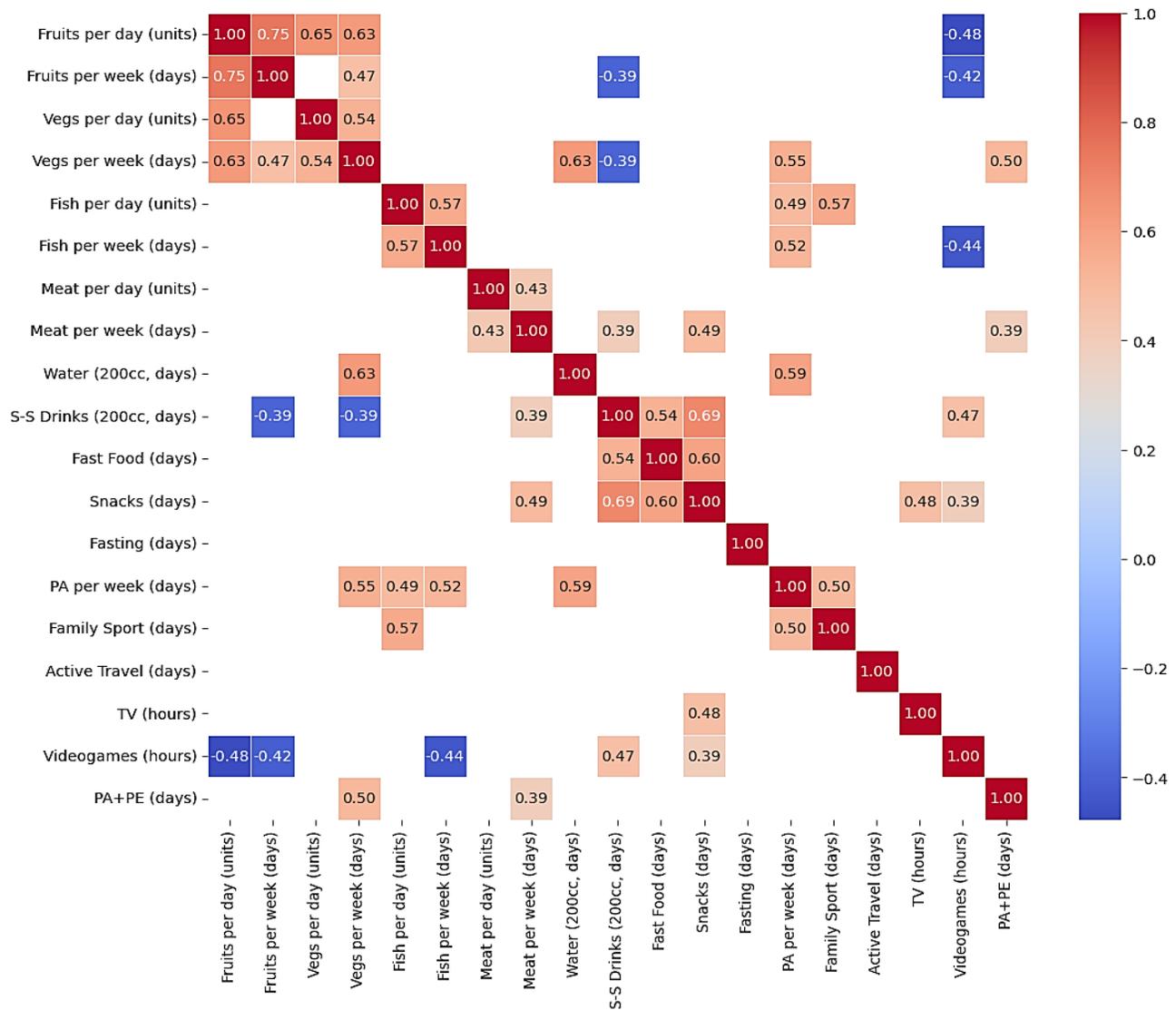
Figure 1. Correlation heatmap between food consumption patterns, physical activity, and sedentary behaviors among third-cycle male primary students

Note. Only significant correlations (p<0.05) are displayed

3.4. Correlation between Nutritional and Physical Activity Habits in Female Students

Figure 2 illustrates the relationships between dietary habits, PA, and sedentary behaviors among female students. The heatmap displays only statistically significant correlations ($p<0.05$), while non-significant associations ($p>0.05$) have been omitted.

Positive correlations were observed between PA per week and fruit consumption (r=0.42, $p<0.05$), vegetable consumption (r=0.39, $p<0.05$), and fish consumption (r=0.44, $p<0.05$). Additionally, family-based PA exhibited a moderate positive correlation with fruit consumption

(r=0.67, *p*<0.05). Active commuting to school (Active Travel) also showed a moderate positive correlation with fish consumption (r=0.46, *p*<0.05).

Regarding negative correlations, meat consumption per day was negatively associated with fruit intake per week (r=-0.43, *p*<0.05). Additionally, sugar-sweetened drink consumption was moderately and positively correlated with fast food intake (r=0.47, *p*<0.05) and snack consumption (r=0.43, *p*<0.05), indicating a pattern of unhealthy eating habits clustering together.
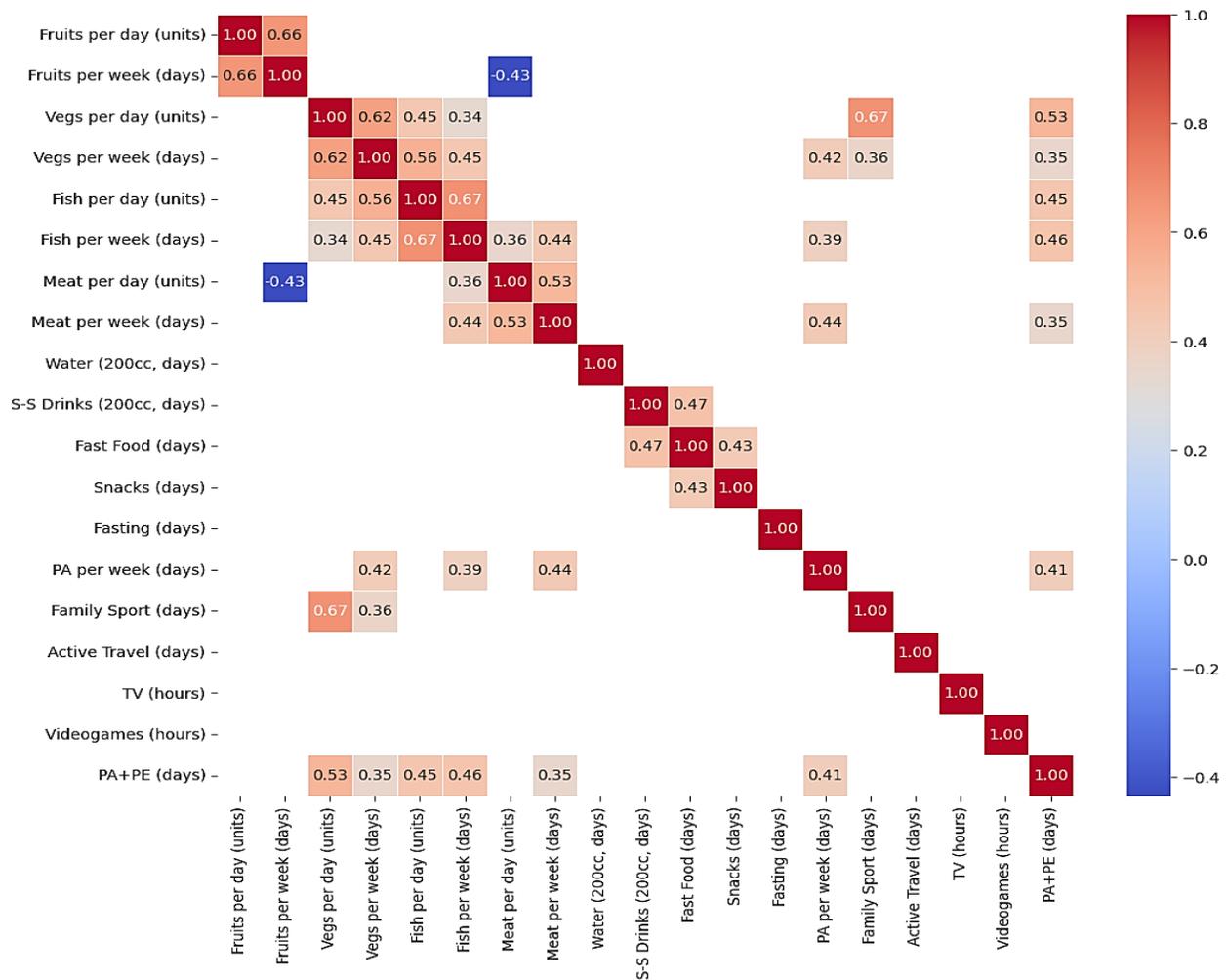

Figure 2. Correlation heatmap between food consumption patterns, physical activity, and sedentary behaviors among third-cycle female primary students

Note. Only significant correlations (p<0.05) are displayed

4. DISCUSSION

The global context in which society finds itself today reflects a significant issue regarding health problems among young people, related to nutritional habits and PA. Due to the complexity of these elements, they must be analyzed together, providing conclusions from a comprehensive

perspective in specific environments, such as in this case, a high school in Spain in an urban setting. Therefore, this study aimed to analyze food consumption patterns, the level of PA, and sedentary behaviors among adolescents in the 4th grade of high school education at an urban high school in Zaragoza. The main findings of this study show that participants consume fruits, vegetables, and meat on most days, however, fish consumption was less frequent. Regarding PA, certain deficiencies were observed. Screen time was notably high and should be considered. In this sense, gender differences were also observed.

4.1. Nutritional Habits

The findings of this study reveal a mixed picture of the nutritional habits of high school students. While fruit (4.50±2.32 days/week) and vegetable (4.24±1.99 days/week) consumption were reported at moderate levels, the low intake of fish (1.71±1.38 days/week) is a concern. This trend is consistent with previous studies highlighting that adolescents often consume insufficient amounts of fish, despite its known benefits for cognitive and cardiovascular health (Guevara Ingelmo et al., 2020). The preference for meat (4.56±2.02 days/week) over fish may be influenced by cultural factors, taste preferences, and accessibility issues. Additionally, the high intake of fast food (1.41±0.94 days/week), snacks (3.39±2.17 days/week), and sugar-sweetened beverages (2.03±1.97 days/week) observed in this study aligns with broader research showing that adolescents often favor energy-dense, nutrient-poor foods, which can contribute to long-term health risks such as obesity and metabolic disorders (Pagliai et al., 2021)

Gender differences in dietary habits were also notable. Female students reported a significantly higher daily intake of vegetables (2.33±1.64 portions) compared to males (1.65±1.52 portions; $p<0.05$), aligning with previous studies that suggest females tend to adopt more health-conscious dietary patterns (McCormack & Meendering, 2016). However, the finding that males consumed more meat per day (2.46±1.56 portions vs. 1.67±0.83 portions; $p<0.05$) and per week (5.31±1.95 vs. 4.03±1.92; $p<0.05$) reflects traditional dietary tendencies, where males are more likely to prioritize protein-rich foods, as documented by Borghese et al. (2014). Another concerning trend was the significantly higher fasting frequency among females (3.50±3.07 days/week) compared to males (1.23±2.30 days/week; $p<0.05$), which may indicate the influence of societal pressures and body image concerns on their eating behaviors. Research by Neumark-Sztainer et al. (2018) emphasizes that such behaviors can increase the risk of disordered eating patterns and nutrient deficiencies. This finding underscores the need for targeted educational interventions promoting balanced eating habits and addressing unhealthy weight-control practices among adolescents.

4.2. Physical Activity Habits

The results of this study reveal that PA levels among high school students are lower than recommended guidelines, reinforcing global concerns about declining PA in adolescence (Chaput et al., 2020). On average, students engaged in PA 3.15±2.62 days per week, structured PA 2.47±1.10 days per week, and active commuting to school 2.95±2.45 days per week. Additionally, participation in PA with family members was particularly low (0.50±1.13 days/week), suggesting that family involvement in exercise is not a strong influence in this sample.

Gender disparities in PA levels were prominent in this study, with males (4.08±2.51 days/week) being significantly more active than females (2.47±2.51 days/week; $p<0.05$). Similarly, structured PA participation was higher in males (2.81±1.23 days/week) compared to females (2.22±0.93 days/week; $p<0.05$). This pattern is well-documented in the literature, with studies indicating that males tend to engage more frequently in sports and high-intensity activities, whereas females often face social and psychological barriers to participation (Abarca-Sos et al., 2016).

4.3. Relationship between Nutritional and Physical Activity Habits

The correlation analysis in this study highlights important links between dietary habits, PA, and sedentary behaviors. Higher levels of PA were positively associated with greater consumption of fruits, vegetables, and water among males (fruit: $r=0.55$; vegetables: $r=0.49$; water: $r=0.59$; $p<0.05$) and females (fruit: $r=0.42$; vegetables: $r=0.39$; fish: $r=0.44$; $p<0.05$). Additionally, family-based PA showed a strong correlation with fish consumption in males ($r=0.57$; $p<0.05$) and fruit consumption in females ($r=0.67$; $p<0.05$). Active commuting to school was also positively linked to vegetable intake in males ($r=0.39$; $p<0.05$) and fish consumption in females ($r=0.46$; $p<0.05$).

Conversely, video game usage was negatively correlated with healthy food choices in males, including fruit ($r=-0.48$), vegetables ($r=-0.42$), and fish ($r=-0.44$; $p<0.05$). Similarly, television viewing was positively correlated with unhealthy eating habits, such as snack consumption ($r=0.48$) and fast-food intake ($r=0.40$; $p<0.05$). Among females, sugar-sweetened drink consumption was positively correlated with fast food ($r=0.47$) and snack intake ($r=0.43$; $p<0.05$), suggesting a clustering of unhealthy dietary habits.

These findings reinforce the importance of addressing both dietary habits and PA in a holistic manner. Given the associations between sedentary behaviors and poor dietary choices, interventions should target reducing screen time while promoting healthier eating and active lifestyles. Moreover,

the gender differences observed suggest the need for tailored approaches, focusing on increasing PA participation in females and enhancing nutritional awareness among males.

5. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study provides valuable information about nutritional habits and PA patterns in young people within the context of an urban high school in Zaragoza, Spain. However, these results should be interpreted with caution due to several limitations. The sample is small and specific to an urban high school context, consisting of fourth-year students, so these results would only be applicable to similar contexts. The use of questionnaires in this type of study provides valuable but limited information, so the study of eating habits and PA may require mixed and complex methods that allow for a more comprehensive interpretation of the information. Nevertheless, this study provides satisfactory insight into the context in which it is framed, offering useful information to support future interventions.

Future lines of research may include longitudinal studies to track behaviors from the early years of primary school through to secondary school and adolescence, as well as the design of mixed, quantitative-qualitative, and complex studies that address all areas of intervention. On the other hand, further exploration of contextual, gender, and individual environmental differences is necessary. Our results highlight the need for specific interventions that address the differences observed in both nutritional habits and PA. The data from this study can serve as a basis for the development of school programs tailored to address both PA and nutrition simultaneously.

6. CONCLUSIONS

This study provides valuable insights into the nutritional and PA habits of high school students, revealing both positive behaviors and areas for improvement. While fruit, vegetable, and meat consumption were moderate, fish intake remained low, and unhealthy eating patterns were prevalent, particularly among males. PA levels were insufficient, with females exhibiting significantly lower participation than males. High screen time usage further contributed to sedentary behaviors and poor dietary choices. The observed correlations between PA, sedentary behaviors, and dietary habits reinforce the interconnected nature of these lifestyle factors.

To address these concerns, targeted interventions should focus on promoting healthier eating habits, increasing PA opportunities—especially for females—and reducing sedentary behaviors. Schools, families, and community organizations all have roles to play in fostering environments that

encourage balanced nutrition and active lifestyles. Future research should continue exploring gender-specific strategies and the long-term effects of combined interventions to enhance adolescent well-being.

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AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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