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Factors associated with the consumption of fruits and vegetables in latin american university students

Factores asociados al consumo de frutas y verduras en estudiantes universitarios de latinoamerica

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ABSTRACT

Objective: Explore the association between compliance with recommended consumption (5-a-day) of fruits and vegetables (F&V) with sociodemographic factors of university students of Latin America. Subjects: We conducted an analytical cross-sectional study in which 4,880 university students from 10 Latin American countries completed a self-administered online survey. Methods: F&V consumption and other sociodemographic variables were measured according to a validated survey. Body mass index was self-reported. Ordinal logistic regression models were applied. Results: Regarding the consumption of F&V, 4.7% of men complied with the recommendation, while in women this value reached 7.7%. In the adjusted model, having a normal weight (OR= 0.59; 95% CI 0.44-0.7; $p<0.001$), being female (OR= 0.67; 95% CI 0.49-0.89; $p<0.01$), being enrolled in a health-related degree program (OR= 0,60; IC95% 0,45-0,78; $p<0.001$), having professional parents (OR= 0.75; 95% CI 0.60-0.95; $p<0.05$) and practicing physical activity (OR= 0.34; 95% CI 0.27-0.42; $p<0.001$) were associated with compliance to F&V consumption recommendations. In the analysis by country, physical activity was the variable most associated with F&V consumption. Conclusion: We observed a low consumption of F&V in university students. The variables associated with compliance to the F&V recommendation were being normal weight, female, being enrolled in a health-related degree program, having professional parents, and practicing physical activity, the latter being the most important variable.

Key words: Body weight; Fruits; vegetables; University students; 5 a day.

RESUMEN

Objetivo: Explorar la asociación de la frecuencia de cumplimiento de las recomendaciones de consumo (5 al día) de frutas y verduras (F&V) con factores sociodemográficos de estudiantes universitarios de América Latina. Metodología: Se realizó un estudio transversal analítico con 4.880 estudiantes universitarios de 10 países de América Latina, quienes completaron una encuesta en línea autoadministrada. Se midió el consumo de F&V y otras variables sociodemográficas según una encuesta previamente validada. El índice de masa corporal fue autoinformado. Se aplicaron modelos de regresión logística ordinal. Resultados: En cuanto al consumo de F&V, en los hombres el 4,7% cumple con la recomendación, mientras que en las mujeres este valor alcanza el 7,7%. En el modelo más ajustado, presentar normopeso (OR= 0,59; IC 95% 0,44-0,7; $p<0,001$), ser mujer (OR= 0,67; IC 95% 0,49-0,89; $p<0,01$), estar matriculado en carrera relacionada con la salud (OR= 0,60; IC95% 0,45-0,78; $p<0,001$), tener padres profesionales (OR= 0,75; IC 95% 0,60-0,95; $p<0,05$) y realizar actividad física (OR= 0,34; IC 95% 0,27-0,42; $p<0,001$) fueron las variables asociadas al cumplimiento del consumo de F&V. En el análisis por país, la actividad física fue la variable más asociada al consumo de F&V. Conclusión: Se observa un bajo consumo de F&V en estudiantes universitarios, y entre las variables asociadas al cumplimiento de la recomendación de F&V se encuentran estar normopeso, sexo femenino, estar cursando una carrera relacionada con la salud, tener los padres y la práctica de actividad física, siendo esta última la variable más importante.

Palabras clave: Estudiantes universitarios; Frutos; Peso corporal; Verduras; 5 al día.

INTRODUCTION

Consumption of fruits and vegetables (F&V) is associated with a lower mortality rate attributed to cardiovascular diseases, respiratory diseases, and cancer^{1,2,3}, and with a lower risk of high blood pressure^{4,5}, and type 2 diabetes^{6,7} in the general population, and particularly in university students. Furthermore, a lower risk of excess weight⁸ and improvements in body composition have been observed⁹. The World Health Organization (WHO) recommends consumption of at least 400 g of F&V daily, which is equivalent to 5 servings per day¹⁰.

In Asia, the consumption reaches 116 k and Europe consumes 112 k per year. On the other hand, despite the fact that Chile, Mexico, Colombia and Peru are world powers in the export of F&V, data for Latin American population indicate that consumption only reaches 48 k per year per person¹⁰. In Chile, only 15% of the general population meets the recommendation to consume 5 servings of F&V a day¹¹.

The five a day (5-a-day) campaign is probably the best-known information initiative to promote F&V intake in the world. Nevertheless, factors associated with compliance to 5-a-day in Latin America are unknown, particularly among university students, who have been reported to have a low consumption of F&V in

studies conducted in some countries of the region¹². Therefore, the objective of the present work is to explore the association of the frequency of consumption of F&V with sociodemographic factors of university students in Latin America.

MATERIALS AND METHODS

Study design

An analytical and multicentric cross-sectional observational study was conducted in university students from eleven Latin American countries: Argentina, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Panama, Paraguay and Peru. Inclusion criteria to participate in the study included: being 18 years and older and actively enrolled in a higher education institution in Latin America. University students were invited to participate in the study (between November and December 2020) through institutional social networks where they completed an online digital voluntary consent form and self-administered survey. Exclusion criteria were: university students who partially completed the survey and graduate students.

Assessment of fruit and vegetable consumption.

The total sample was administered a validated survey

on dietary habits, which is detailed in a previously published study¹³. The survey consisted of questions on the consumption of foods. Scores were obtained using a Likert-type scale ranging from one to five. For the assessment of fruit consumption, the question “Do you consume (fresh average-sized) fruits?” was used, and the possible answers were: I do not consume fruits; Less than once a day; Less than 1 serving a day; 1 serving a day; 2 servings a day; and 3 servings a day. And for the assessment of vegetable consumption, the question used was: “Do you consume vegetables (raw or cooked, with one serving equivalent to 1 small plate or bowl)?” and the possible answers were: I do not consume vegetables; Less than once a day; Less than 1 serving a day; 1/2 serving a day; 1 serving a day; and 2 servings a day. For analytical purposes, the 2 questions (F&V) were added together and then dichotomized between subjects who complied or did not comply with the 5 servings of F&V a day.

Self-reported nutritional status

For the assessment of perceived nutritional status of university students, the question used was: “Currently, which is your self-reported nutritional status?” and the possible answers were: Underweight; Normal weight; Overweight; and Obesity.

Sociodemographic and habit variables

The survey included information on age, sex, field of study, current year, profession of the head of household, physical activity, sitting time, hours of sleep, and tobacco consumption.

Ethical considerations

The research protocol was developed in accordance with the guidelines of the Declaration of Helsinki regarding work involving human beings and was approved by the Scientific Ethics Committee of the Universidad de las Américas, Chile, Resolution number 2020001. Each participant gave informed consent before completing the survey.

Statistical analysis

Quantitative variables are presented as mean and standard deviation (SD). Qualitative values are expressed as absolute

value (frequency) and relative value (percentage). The variable representing the daily consumption of 5 servings of F&V was dichotomized as follows: “Yes”, those who do consume 5 daily servings of F&V, and those who do not consume every day were assigned the category “No”.

In order to analyze the effect of the aforementioned variables on the daily consumption of 5 servings of F & V per day, we used an ordinal logistic regression model. The crude model did not include any adjustment variables (Model 1). For Model 2, self-reported nutritional status, sex, field of study, current year, and profession of the head of household were added. Model 3 was adjusted with self-reported nutritional status, sex, field of study, current year, profession of the head of household, physical activity, sitting time, hours of sleep, and tobacco consumption. P values of <0.05 were considered statistically significant. To determine the association, OR values and 95% confidence interval (95% CI) were calculated. All the analyses were performed in R using the Rcmdr library package.

RESULTS

The sample characteristics are presented in Table 1. Only 6.9% of the students complied with the F&V recommendation. When comparing by sex, only 4.7% of men complied with the recommendation, while women nearly double this percentage with 7.7%. According to field of study, architecture, arts and health sciences had the highest compliance rates with respect to the consumption of F&V. In addition, subjects who practice physical activity and did not smoke tobacco showed rates that reach the recommended daily consumption of F&V. Underweight and normal weight students had a higher prevalence regarding the consumption of 5-a-day, when compared to overweight and obese students.

Figure 1 shows the prevalence of students complying with the 5-a-day recommendation, with the best compliance among university students in Argentina at 11.7%. The rest of the countries showed a prevalence of less than 10%, with Ecuador (3.5%) and Chile (3.6%) being the countries with the lowest prevalence of F&V consumption.

In Table 2, it is observed that the frequency of consumption of

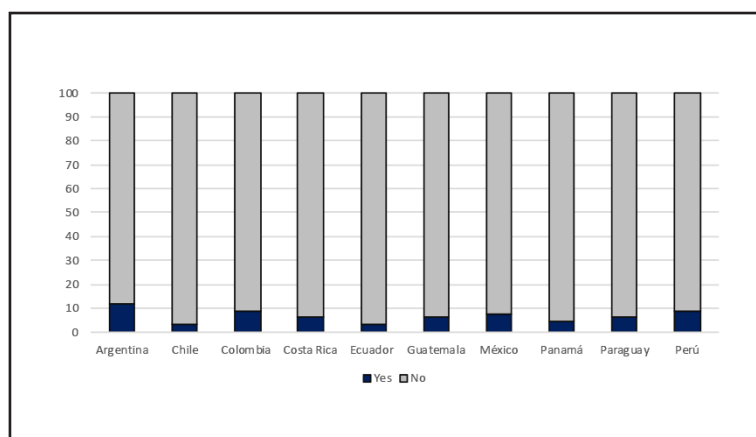


Figure 1: Frequency of compliance with the consumption of 5 servings of F&V per day, by countries.

Table 1. Demographic characteristics and habits of the sample of Latin American university students.

	Total	Consumption of 5 servings of F & V a day	
		Yes	No
n (%)	4880	338 (6.93)	4542 (93.1)
Age	22.78	23.24	22.32
Sex			
Female	3599	277 (7.70)	3322 (92.3)
Male	1281	61 (4.76)	1220 (95.2)
Field of study			
Arts, architecture and design	66	7 (10.6)	59 (89.4)
Farming and biological sciences	207	11 (5.31)	196 (94.7)
Management and economic sciences	156	5 (3.20)	151 (96.8)
Health sciences	3110	261 (8.39)	2849 (91.6)
Education, social sciences & humanities	198	7 (3.54)	191 (96.5)
Engineering and other exact sciences	882	39 (4.42)	843 (95.6)
Others	261	8 (3.07)	253 (96.9)
Current year			
First year	958	56 (5.85)	902 (94.2)
Second year	1223	74 (6.05)	1149 (94.0)
Third year	966	74 (7.66)	892 (92.3)
Fourth Year	769	61 (7.93)	708 (92.1)
Fifth year or more	964	73 (7.57)	891 (92.4)
Occupation of the head of household			
Small jobs, casual or informal work	281	10 (2.96)	271 (5.97)
Small trader/ Unskilled worker	697	30 (8.88)	667 (14.7)
Skilled worker/ micro-entrepreneur	876	56 (16.6)	820 (18.1)
Office worker/ freelance professional	1612	115 (34.0)	1497 (33.0)
Middle manager	1226	100 (29.6)	1126 (24.8)
Senior Manager	188	27 (7.99)	161 (3.54)
Physical activity (150 mins. per week)			
Yes	1624	200 (12.3)	1424 (87.7)
No	3259	138 (4.23)	3118 (95.7)
Sitting time	8.53	8.39 (338)	8.66 (4542)
Sleep (hrs.)	7.00	7.01 (338)	6.98 (4542)
Tobacco consumption			
Yes	352	18 (5.11)	334 (94.9)
No	4528	320 (7.07)	4208 (92.9)
Perceived Nutritional Status			
Underweight	317	12 (3.79)	305 (96.2)
Normal weight	2948	257 (8.72)	2691 (91.3)
Overweight	1390	57 (4.10)	1333 (95.9)
Obesity	225	12 (5.33)	213 (94.7)

5-a-day was significantly associated with the perception of normal nutritional status, in the Model 1 (OR= 0.50; 95% CI 0.38 – 0.65; $p<0.001$), Model 2 (OR=0.51; 95% CI, 0.39 -0.67; $p<0.001$) and Model 3 (OR= 0.59; 95% CI 0.44-0.70; $p<0.001$). Regarding associations between the consumption of 5-a-day, a significant association was observed in the most adjusted model with females (OR= 0.67; 95% CI 0.49-0.89; $p<0.01$), health sciences (OR= 0.60; 95% CI 0.45-0.78; $p<0.001$), having professional parents (OR=0.75; 95% CI 0.60-0.95; $p<0.05$), and practicing physical activity (OR= 0.34; 95% CI 0.27-0.42; $p<0.001$). There was

no association between F&V consumption and non-tobacco consumption, sitting time and hours of sleep.

Table 3 shows the frequency of compliance of recommended consumption (5-a-day) of F&V per country. The factor most associated with breakfast consumption was physical activity in all countries except Panama. Other factors associated with F&V were occupation of the head of household in Costa Rica and Ecuador, tobacco consumption in Ecuador, and hours of sleep, being a health science student and perceived normal nutritional status in Mexico.

Table 2. Association of the consumption of 5 servings of fruits and vegetables a day with self-reported perceived nutritional status and general characteristics of the sample.

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Perception of nutritional status	0.50 (0.38-0.65)***	0.51 (0.39-0.67)***	0.59 (0.44-0.70)***
Sex (Female)		0.72 (0.53-0.96)*	0.67 (0.49-0.89)**
Field of study (Health sciences)		0.57 (0.43-0.75)***	0.60 (0.45-0.78)***
Current year (Fourth year or more)		1.13 (0.90-1.42)	1.14 (0.90-1.44)
Occupation of the head of household (Senior Manager)		0.72 (0.57-0.91)**	0.75 (0.60- 0.95)*
Physical activity (yes)			0.34 (0.27-0.42)***
Sitting time (4 hrs or more)			0.99 (0.96-1.03)
Hours of sleep (7-9 hrs.)			0.98 (0.90-1.07)
Tabacco (no)			0.83 (0.49-1.33)

Table 3. Compliance to recommended consumption (5-a-day) of F&V with self-reported perceived nutritional status and general characteristics of the sample by country.

		Model 3 OR (95% CI)
Argentina	Sex (Female)	0.12 (0.01 - 0.58)*
	Physical activity (yes)	0.44 (0.25 - 0.79)**
Chile	Physical activity (yes)	0.19 (0.03 – 0.81)*
Colombia	Physical activity (yes)	0.13 (0.05 - 0.30)***
	Sitting time (4 hrs or more)	1.14 (1.00 - 1.30)*
Costa Rica	Current year (Fourth year or more)	3.23 (1.59 - 6.68)**
	Occupation of the head of household (Senior Manager)	0.44 (0.20 - 0.90)*
	Physical activity (yes)	0.46 (0.22 - 0.94)*
Ecuador	Occupation of the head of household (Senior Manager)	0.39 (0.16 - 1.01)*
	Physical activity (yes)	0.30 (0.12 - 0.74)**
	Tabacco (no)	7.04 (1.35 - 29.72) *
Guatemala	Perception of nutritional status	0.29 (0.08 - 0.81)*
	Physical activity (yes)	0.13 (0.04 - 0.34)***

...continuation table 3.

		Model 3 OR (95% CI)
Mexico	Perception of nutritional status	0.46 (0.25 - 0.78)**
	Field of study (Health sciences)	0.58 (0.34 - 0.98)*
	Physical activity (yes)	0.43 (0.28 - 0.67)***
	Hours of sleep (7-9 hrs.)	0.83 (0.70 - 0.97)*
Panama	Current year (Fourth year or more)	3.91 (1.17 - 14.40)*
Paraguay	Physical activity (yes)	0.34 (0.11 - 0.99)*
Peru	Perception of nutritional status	0.23 (0.05 - 0.74)*
	Occupation of the head of household (Senior Manager)	0.32 (1.12 - 0.87)*
	Physical activity (yes)	0.34 (0.13 - 0.85)*

***: <0.001, **: <0.01, *: <0.05. Model 3: Perception of nutritional status, sex, field of study, current year, and profession of the head of household, sitting time, hours of sleep, and tobacco consumption.

DISCUSSION

The main result of the present research was that 6.9% of university students meet the recommended consumption of F&V (5-a-day). The variables associated with greater compliance were: having a normal nutritional status, being female, being enrolled in a health-related degree program, having professional parents, and practicing physical activity.

Our results are similar to those found in other studies in university students, such as a study conducted among university students from Ireland, which showed a low consumption of F&V, with only 21% reporting the intake of the 5 daily servings recommended by the WHO¹⁴. Moreover, a study conducted among men in Saudi Arabia showed a low frequency of consumption of these foods, with 10% of men indicating that they do not consume them¹⁵.

Our results are in line with those of the Latin American Study of Nutrition and Health (ELANS), whose sample consisted of 9,218 subjects and that evaluated food consumption in eight Latin American countries, finding that only 7.20% of the sample complied with the WHO recommendation of F&V intake¹⁶. In addition, a 2021 FAO report notes that governments could do more to reduce trade barriers for nutritious foods.

Doak et al. found a negative correlation between the intake of F&V and body mass index (BMI), that is, the greater the consumption of F&V, the lower the BMI of higher education students¹⁴. In contrast, students who have poor eating habits, that is, a higher consumption of ultra-processed food (greater amounts of sugary drinks, fast food and fried foods), are more likely to suffer from malnutrition by excess¹⁷.

In general, students who consume the amount of F&V recommended by the WHO have better habits, for instance, a study conducted among Italian and Spanish university students found that there was a positive association between the practice of physical activity and a greater fruit consumption [9]. Another study among university students found a greater

intake of F&V is correlated with greater physical activity, less stress and lower alcohol consumption¹⁴.

We found that being female was among the factors associated with compliance. This result is consistent with another study conducted in the region and whose aim was to assess diet quality, including F&V consumption, showing as a result that the consumption of these foods is greater in women¹⁸.

Silva et al. found that 18.7% confirmed that price is the main determinant of the consumption of F&V, furthermore, the authors mentioned that satiety is a key determinant for low socioeconomic status households, unlike middle-status households, where comfort is a determinant when it comes to healthy eating¹⁹. Educational level and being male are closely related to a poor intake of F&V and healthy food in general¹⁴. In our study, an important determinant in achieving the recommended consumption of F&V was the profession of the head of household, students whose father or mother was in the "senior manager" category presented 16.7% compliance with the recommendation, while in the other groups the percentage decreased, for example "middle manager" was 8.8%, "office/worker" 7.6%, "stilled worker" 6.8%, "small trader" 4.4% and "small jobs" 3.6%.

In our study, sitting for longer periods, tobacco consumption and less sleep than recommended were not associated (global analysis) with a lower intake of F&V. However, non-tobacco use in Ecuador and sleep in Mexico were associated with greater F&V consumption. A study in adults showed that more hours sitting was associated with unhealthy behaviors including lower fruit consumption²⁰. With respect to tobacco consumption, a study in Chilean university students indicated that those who consume tobacco consume less fruit²¹. Furthermore, insufficient sleep has been associated with inadequate eating patterns and increased body weight^{22,23}.

Among the strengths of this study we can highlight the

participation of 11 Latin American countries, which provides population diversity and a wide scope of the study. The use of validated surveys enables comparisons with other studies. The large sample size of 4,880 university students, who have similar baseline characteristics, homogenizes the studied sample. The survey incorporated diverse questions, allowing the analysis of different variables.

Limitations of the study include that nutritional status was self-reported, as well as the low participation of males (26%). Due to the online nature of the survey some students without internet access might have been excluded, which may cause sampling bias, potentially impacting the representativeness of the sample. Since this is a cross-sectional study, only associations can be determined and no causal inferences can be made.

CONCLUSION

We observed a low consumption of F&V in university students. Variables associated with compliance to the F&V recommendation included being normal weight, female, being enrolled in a health-related degree program, having professional parents, and practicing physical activity. In the analysis by country, physical activity was the variable most associated with F&V consumption. It is necessary to increase nutrition education and to promote the presence of F&V in the menus served at institutions and in the meals (snacks) of university students.

Conflict of interest. Author declares any conflict of interest. **Financing:** Self-financed.

REFERENCES

1. Wang DD, Li Y, Bhupathiraju SN, Rosner BA, Sun Q, Giovannucci EL, et al. Fruit and Vegetable Intake and Mortality: Results From 2 Prospective Cohort Studies of US Men and Women and a Meta-Analysis of 26 Cohort Studies. *Circulation*. 2021; 143: 1642-1654.
2. Bechthold A, Boeing H, Schwedhelm C, Hoffmann G, Knüppel S, Iqbal K, De Henauw S, Michels N, Devleeschauwer B, Schlesinger S, Schwingshackl L. Food groups and risk of coronary heart disease, stroke and heart failure: A systematic review and dose-response meta-analysis of prospective studies. *Crit Rev Food Sci Nutr*. 2019; 59: 1071-1090.
3. Bhandari B, Liu Z, Lin S, Macniven R, Akombi-Inyang B, Hall J, Feng X, Schutte AE, Xu X. Long-Term Consumption of 10 Food Groups and Cardiovascular Mortality: A Systematic Review and Dose Response Meta-Analysis of Prospective Cohort Studies. *Adv Nutr*. 2023; 14: 55-63.
4. Li B, Li F, Wang L, Zhang D. Fruit and Vegetables Consumption and Risk of Hypertension: A Meta-Analysis. *J Clin Hypertens (Greenwich)*. 2016; 18:468-476.
5. Schwingshackl L, Schwedhelm C, Hoffmann G, Knüppel S, Iqbal K, Andriolo V, Bechthold A, Schlesinger S, Boeing H. Food Groups and Risk of Hypertension: A Systematic Review and Dose-Response Meta-Analysis of Prospective Studies. *Adv Nutr*. 2017; 8: 793-803.
6. Jiang Z, Sun T yu, He Y, Gou W, Zuo L shi yuan, Fu Y, et al. Dietary fruit and vegetable intake, gut microbiota, and type 2 diabetes: results from two large human cohort studies. *BMC Med*. 2020; 18: 1-11.
7. Schwingshackl L, Hoffmann G, Lampousi AM, Knüppel S, Iqbal K, Schwedhelm C, Bechthold A, Schlesinger S, Boeing H. Food groups and risk of type 2 diabetes mellitus: A systematic review and meta-analysis of prospective studies. *Eur J Epidemiol*. 2017; 32: 363-375.
8. Guedes DP, Silva ALDS. Exercise and fruit/vegetable intake, and their associations with body weight status in university students. *Nutr Hosp*. 2021; 38: 545-554.
9. Aiello P, Peluso I, Di Giacomo S, Di Sotto A, Villaño Valencia D. Body Composition and Metabolic Status of Italian and Spanish University Students: Relationship with Fruit and Vegetable Consumption. *Nutrients*. 2022; 14(16).
10. World Health Organization/Food and Agriculture Organization (WHO-FAO). Report of a joint WHO-FAO expert consultation. Diet, nutrition and the prevention of chronic diseases. WHO Technical Report Series, no. 916. Geneva: WHO; 2003.
11. Vio F. [International year of fruits and vegetables 2021]. *Rev Med Chil*. 2022; 150: 131-132.
12. Crovetto M, Valladares M, Espinoza V, Mena F, Oñate G, Fernandez M, et al. Effect of healthy and unhealthy habits on obesity: a multicentric study. *Nutrition*. 2018; 54: 7-11.
13. Durán Agüero S, Valdés BP, Godoy CA, Herrera VT, Herrera V. T. Eating habits and physical condition of physical education students Rev Chil Nutr. 2014; 41: 251-259.
14. Doak S, Kearney JM, McCormack JM, Keaver L. The relationship between diet and lifestyle behaviours in a sample of higher education students; A cross-sectional study. *Clin Nutr ESPEN*. 2023; 54: 293-299.
15. Gonzalez-Salazar F, Al-Delaimy AK, Monlezun D, Al-Qahtani AM. Lifestyle habits among Najran University students, Najran, Saudi Arabia. *Front Public Health*. 2022; 10: 938062.
16. Kovalskys I, Fisberg M, Gómez G, Pareja RC, Yépez García MC, Cortés Sanabria LY, et al. Energy intake and food sources of eight Latin American countries: Results from the Latin American Study of Nutrition and Health (ELANS). *Public Health Nutr*. 2018; 21: 2535-2547.
17. Morales C, Durán-Agüero S, Parra-Soto S, Landaeta-Díaz L, Carpio V, Cavagnari B, et al. Ultra-processed food and homemade fried food consumption is associated with overweight/obesity in Latin American university students during COVID-19. *Am J Hum Biol*. 2023; e23900.
18. Durán-Agüero S, Ortiz A, Pérez-Armijo P, Vinueza-Veloz MF, Ríos-Castillo I, Camacho-Lopez S, et al. Quality of the diet during the COVID-19 pandemic in 11 Latin-American countries. *J Health Popul Nutr*. 2022; 41: 33.
19. Silva A, Astorga A, Durán-Agüero S, Domper A. Revisiting fruit and vegetable determinants: Evidence from Latin America. *Front Sustain Food Syst*. 2023; 6.
20. Kettle VE, Hamer M, Munir F, Houdmont J, Wilson K, Kerr R, et al. Cross-sectional associations between domain-specific sitting time and other lifestyle health behaviours: The Stormont study. *J Public Health (Oxf)*. 2022; 44(1): 51-59.
21. Vera V, Oñate G, Fernández M, Valladares M, Crovetto M, Espinoza V, et al. Tobacco consumption in Chilean university students and associations with anthropometry, eating habits and sleep quality multicentric study. *J Prev Med Hyg*. 2021; 62(2): E430-E438.
22. Delpino FM, Figueiredo LM, Flores TR, Silveira EA, Silva Dos Santos F, Werneck AO, et al. Intake of ultra-processed foods and sleep-related outcomes: A systematic review and meta-analysis. *Nutrition*. 2023; 106: 111908.
23. Grimaldi M, Bacaro V, Natale V, Tonetti L, Crocetti E. The Longitudinal Interplay between Sleep, Anthropometric Indices, Eating Behaviors, and Nutritional Aspects: A Systematic Review and Meta-Analysis. *Nutrients*. 2023 Jul 18; 15(14): 3179.