JOURNAL OF THE AMERICAN NUTRITION ASSOCIATION
https://doi.org/10.1080/27697061.2022.2115429

Healthy Lifestyle Habits in Latin American University Students during COVID-19 Pandemic: A Multi-Center Study

Pablo Valdés-Badilla[a*], Solange Liliana Parra-Soto[b,c], Ana Gabriela Murillo[d], Georgina Gomez[d], Jacqueline Araneda[e], Samuel Durán-Agüero[f], Gladys Morales[g,h], Israel Ríos-Castillo[i], Valeria Carpio Arias[j], Brian M. Cavagnari[k], Edna J. Nava-González[l], Saby Camacho López[m], Jhon Jairo Bejarano-Roncancio[n], Beatriz Núñez-Martínez[o], Karla Cordón-Arrivillaga[p], Eliana Romina Meza-Miranda[q], Saby Mauricio-Alza[r] and Leslie Landaeta-Díaz[s]

[a]Departamento de Ciencias de la Actividad Física, Facultad de Ciencias de la Educación, Universidad Católica del Maule, Talca, Chile; [b]BHF Glasgow Cardiovascular Research Centre, Institute of Cardiovascular and medical Sciences, University of Glasgow, Glasgow, United Kingdom; [c]Institute of Health and Wellbeing, University of Glasgow, Glasgow, United Kingdom; [d]Department of Biochemistry, School of Medicine, University of Costa Rica, San Jose, Costa Rica; [e]Departamento de Nutrición y Salud Pública, Facultad de Ciencias de la Salud y de los Alimentos, Universidad del Bío-Bío, Chillán, Chile; [f]Escuela de Nutrición y Dietética, Facultad de Ciencias para el Cuidado de la Salud, Universidad San Sebastián, Los Leones, Chile; [g]Departamento de Salud Pública, Facultad de Medicina, Universidad de La Frontera, Temuco, Chile; [h]Centro de Investigación en Epidemiología Cardiovascular y Nutricional (EPICYN), Universidad de La Frontera, Temuco, Chile; [i]Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO), Oficina Subregional de la FAO para Mesoamérica, Ciudad de Panamá, Panamá; [j]Grupo de Investigación en Alimentación y Nutrición Humana (GIANH), Facultad de Salud Pública, Escuela Superior Politécnica de Chimborazo, Riobamba, Ecuador; [k]Escuela de Nutrición, Facultad de Ciencias Médicas, Pontificia Universidad Católica Argentina, Buenos Aires, Argentina; [l]Facultad de Salud Pública y Nutrición, Universidad Autónoma de Nuevo León, Monterrey, México; [m]Nutrir México, Ciudad de México, DF, México; [n]Departamento de Nutrición Humana, Facultad de Medicina, Universidad Nacional de Colombia, Sede Bogotá, Colombia; [o]Departamento de Nutrición, Facultad de la Salud, Universidad Autónoma de Asunción, Asunción, Paraguay; [p]Unidad de Investigación en Seguridad Alimentaria y Nutricional (UNISAN), Escuela de Nutrición, Facultad de Ciencias Químicas y Farmacia, Universidad de San Carlos de Guatemala, Guatemala; [q]Universidad Nacional de Asunción - Centro Multidisciplinario de Investigaciones Tecnológicas, Paraguay; [r]EAP Nutrición Humana, Universidad Privada Norbert Wiener, Lima, Perú; [s]Escuela de Nutrición y Dietética, Facultad de Salud y Ciencias sociales, Universidad de Las Américas, Santiago, Chile

ABSTRACT

Background: Deterioration in the health-related quality of life (HRQoL) and healthy eating behavior due to the effect of COVID-19 lockdown has been reported. The aim of this study was to associate eating habits and HRQoL with physical activity behavior in Latin American university students during COVID-19 pandemic.

Methods: Measured 4,859 university students with a mean age of 22.4 years and they were mostly female (73.7%) from 10 Latin American countries (Argentina, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Panama, Paraguay and, Peru). Eating habits were measured using a survey validated with other university students, HRQoL was assessments using the short version of the World Health Organization (WHOQOL-BREF) scale and physical activity behavior with a dicotomous question based on the international recommendations for physical activity.

Results: There is a higher complaince for all the international recommendations for healthy foods intake in the physically active group of students ($p < 0.01$), with the exception of alcohol and salt. In addition, physically active students presented a significantly higher HRQoL ($p < 0.001$) in all the dimensions analyzed when compared to physically inactive students.

Conclusions: Latin American university students who are physically active are more likely to have a healthier eating behavior and a lower risk of a decreased HRQoL during COVID-19 pandemic.

ARTICLE HISTORY
Received 25 April 2022
Accepted 16 August 2022

KEYWORDS
Eating behavior; mental health; exercise; lifestyle; university students; COVID-19

Introduction

The COVID-19 pandemic has forced governments to decree sanitary restrictions, social distancing and confinement at a global level, intended to reduce the virus' spread and flattening the infection curve (1, 2). These measures have had other consequences on the population, such as difficulties in accessing fruits and vegetables (3), and closure of sports venues and public parks (4, 5), which reduce the possibility of preparing healthy meals at home and practicing regular physical activity (1, 2, 4, 5). Recent research has reported that in times of pandemic there has been a reduction in the consumption of healthy foods (5), with an increase in

CONTACT Leslie Landaeta-Díaz llandaeta@udla.cl Facultad de Salud y Ciencias Sociales, Universidad de las Américas, Chile. Dirección: Av. Walker Martínez 1360, piso 3 Edificio A, La Florida – Santiago, Chile.
*Carrera de Entrenador Deportivo. Escuela de Educación. Universidad Viña del Mar, Chile.
Supplemental data for this article is available online at https://doi.org/10.1080/27697061.2022.2115429

ultra-processed foods' intake (6). In addition, the reduction in physical activity and population movement has led to an increase in sedentary behavior, which has a greater impact on people with obesity (7). This is a worrisome scenario, since there is a greater risk of becoming seriously ill from COVID-19 when people are obese (8, 9).

In Latin America, the situation is not more encouraging, since it is one of the regions with the fastest growing levels of obesity (10). In addition, it presents high levels of sedentary behavior and physical inactivity (11). In this context, one of the most vulnerable groups of the population are university students, because they are more susceptible to acquire unhealthy lifestyle habits due to being in a period subject to constant changes (12), which has increased with social distancing (13).

Another aspect that has been affected by COVID-19 health restrictions is mental health. A deterioration in health-related quality of life (HRQoL) due to the effect of confinement has been reported (14), and it has even been pointed out that the frequent use of social networks increases the loneliness experienced and reduces the general well-being of the population (15). On the contrary, maintaining a healthy eating behavior has a positive impact on the HRQoL of university students (12), in this sense, the definition of what constitutes a healthy diet change continuously to reflect the roles played by different foods, essential nutrients and other dietary items components of health and disease. There is increasing evidence to support that the intake of certain types of nutrients, specific food groups or general dietary patterns positively influences health and promotes the prevention of chronic non-communicable diseases (NCDs) (16–21), and in the same way that regular physical activity improves general well-being (13, 22). Therefore, this pandemic situation poses several challenges at the social level: first, to continue efforts to reduce the rate of contagion and spread of the new coronavirus without neglecting the obesity pandemic and, second, to maintain strategies to promote healthy lifestyles in the population (23).

Although the pandemic has affected the entire population equally, it is possible that there are differences between university students who have a more physically active lifestyle versus those who are physically inactive. In this sense, the aim of the present multicenter study is to associate eating habits and HRQoL with physical activity behavior in Latin American university students during COVID-19 pandemic. It is hypothesized that physically active university students have healthier eating habits and a higher HRQoL than those who are physically inactive.

Methods

A descriptive, observational, cross-sectional and multicenter study was conducted. The sample was non-probabilistic (accidental) and consisted of 4,859 university students from 10 Latin American countries (see Supplementary material 1). The sample inclusion criteria were (i) 18 years of age or older; (ii) active enrollment in a higher education institution in Latin America. The exclusion criteria were (i) those who partially responded to the survey; (ii) postgraduate students. The university students were invited to participate in the study (between November 5th and December 22nd 2020) through the institutional social networks and then had to complete a voluntary and self-administered online digital questionnaire, where the students had to read the aim of the study, the criteria for the use and handling of the data collected, as well as explicitly accept an informed consent.

The research protocol was developed in accordance with the guidelines of the Declaration of Helsinki in relation to research involving human subjects and was approved by the Scientific Ethics Committee of the Universidad de Las Americas, Chile (code: CEC_FP_2020017).

Assessment of eating habits

Eating habits were assessd through a survey (in Spanish, encuesta sobre hábitos alimentarios), created by Durán et al. (24). The survey aimed to measure people's eating habits and is composed of two self-administered areas. The first is composed of nine items with a minimum score of 1 and a maximum of 5 per question (Likert-type scale), which indicates the frequency of healthy eating habits (consumption of breakfast, lunch and dinner) as well as the frequency of consumption of food groups recommended by the dietary guidelines (dairy products, fruits, vegetables, legumes, fish and whole grains), ranging from not consumed (1-point) to consumed (5-point), fruits, vegetables, legumes, fish and whole grains), ranging from no consumption (1-point), to the suggested daily/weekly portions (5-point), obtaining a rating of the responses ranging from 9 to 45 points (higher value better eating habits). The second area consists of seven items, foods or food groups identified as promoters of NCDs (sugary drinks, alcohol, fried foods, fast food, sweet snacks, coffee), and a negative food habit was added, such as adding salt to meals without tasting them; six of the questions have a score identical to the previous one (1, no consumption, to 5, more than three portions per day/week) and only one rated from 1 to 3 (salt), reaching a value ranging from 7 to 33 points (higher value, worse eating habits). In relation to the items that make up the survey, we can cite as examples: do you eat vegetables (raw or cooked/portion equivalent to 1 napkin plate), used for healthy eating habits; and do you drink sugary drinks or juices? (portion 1 glass of 200 cc), used for unhealthy eating habits (24). For the purpose of this study the survey questions were dichotomized based on the American and Latin American dietary guidelines (25), a recommendation for healthy food (i.e., dairy products, fruits, vegetables, legumes, fish, whole grains, breakfast) or unhealthy food (i.e., sugary drinks, alcohol, fried foods, fast food, snacks, salt) was sought for each food or preparation, only the healthy dinner did not have the support of any dietary guide, and at that point, by consensus among the authors (mostly nutritionists), it was considered healthy that dinner should be consumption every day, categorizing the answers in: follow the recommendation or does not follow the recommendation (see Supplementary material 2).

Assessment of health-related quality of life (HRQoL)

WHOQOL–100 (26) is a short version of the World Health Organization WHOQOL-BREF scale (26, 27). Briefly, participants must rate their response on a 5-point Likert scale, measuring four HRQoL domains: physical health, psychological health, social relationships and the environment with a total of 26-items. Based on previous studies (13, 28, 29) the 25th percentile (p25) was used as a cutoff point; scores ≤ p25 were considered lower and > p25 as a higher score. In addition, to determine the physical activity behavior, a dichotomous question was incorporated based on the recommendations established by the American College of Sports Medicine (30) which considers a physically active person when they perform at least 150 min of moderate physical activity or 75 min of vigorous physical activity per week.

Statistical analysis

Descriptive statistics were applied for data analysis. The quantitative data were expressed in mean and standard deviation. The qualitative data were expressed in number and percentage, and for the qualitative data analysis, the Chi-square or Fisher test was used. A multivariate logistic regression was applied adjusted for profession household, sex, sleep hours and robust standard errors to determine the association between eating habits and HRQoL with the physical activity behavior. The final regression model was obtained through the procedure called step by step or stepwise, keeping in the final model those variables with an association probability of 0.10. Odds ratios (OR) and the 95% confidence interval (CI) were used to present the magnitude of the association, the reference group were physically inactive students. For the statistical analysis, the statistical package Stata 16 was used. A value of $p < 0.05$ was considered significant.

Results

The average age of the Latin American university students who participated in this study was 22.4 years, and consisted of mostly female respondents (73.7%). Mexico, Ecuador and Costa Rica were the countries with the higher number of participants, mean at 51.5%. A high percentage (69.4%) has been in lockdown more than five months and was still in lockdown when the survey was released similar trends according to the distribution by physical activity behavior were saw (see Supplementary material 1).

In Table 1 are presented the different food items with respect to the physical activity behavior in Latin American university students. For physically active students the proportions of achievement were higher in most of the food items studied, except for alcohol, salt and dinner consumption (Table 1), and the magnitude of these associations were greater compared with physically inactive students, especially for fruits and vegetables, where the achievement in physically active students was three times higher (OR: 3.27, 95% CI: 2.60 to 4.11) (Figure 1). In addition, when the same analysis was performed by sex, female appear to have better behaviors (see Supplementary material 3).

A higher total score of HRQoL was observed among those who were physically active. Same results were observed for every domain evaluated (environment, psycological heath, social relationships and physical health) (Table 2 and Figure 2). When the same analysis were done by sex, female appear to had healthier behaviors (see Supplementary material 4).

Discussion

The aim of this multicenter study was to associate eating habits and HRQoL with physical activity behavior in Latin American university students during COVID-19 pandemic. The results indicated being physically active was related to a higher probability of meeting the consumption of healthy food groups recommendations and a higher HRQoL. These findings strengthen the literature on the beneficial role of physical activity on the eating habits and mental health of the population during COVID-19 pandemic (1, 2, 4, 5, 15).

In relation to healthy eating habits, physically active Latin American university students achieved significantly higher compliance values in almost all the food groups studied (i.e., fruits, vegetables, legumes, fish, whole grains) and daily intake of breakfast and dinner compared to physically inactive students. On the contrary, inactive students were more likely to meet the recommendation of the consumption of home-cooked meals. These results are consistent with the behavior of university students prior to the pandemic (12, 13). It has been reported that in times of pandemic, there are more difficulties in accessing healthier foods such as fruits and vegetables (3), making healthy behaviors of the population harder to achieve (5). In contrast, individuals who incorporate more fruits and vegetables into their diets are those with a more favorable nutritional status (4).

Regarding unhealthy eating habits, physically active Latin American university students show a significantly lower consumption of sugary drinks, fast food, snacks and fried foods than physically inactive students. However, they show a higher consumption of alcohol and salt. It is to be expected that physically active students have a lower consumption of unhealthy foods (12), but the higher consumption of alcohol and salt is striking, which may be the result of greater permission due to the physical activity practice (24). A previous study has reported that the higher intake of ultra-processed foods and junk food increases the risk of cardiometabolic diseases and obesity in university students (31). Unfortunately, the intake of unhealthy foods increases in quarantine, partly because these types of foods are easier to transport and deliver, and quicker to prepare (6). In this context, it is necessary to consider university education content that favors the orientation and choice of healthy foods, since food education has been reported as a facilitating element for healthy behavior (32).

The HRQoL was significantly higher in physically active Latin American university students in all domains (i.e., physical health, psychological health, social relationships, environment, and total score) compared to physically inactive students. This is in agreement with what was reported by

Table 1. Association Healthy and Unhealthy Food Items According to the Physical Activity Behavior

	Physically Inactive n (%)	Physically Active n (%)	*p* value
HEALTHY FOOD	3240 (66.7)	1619 (33.3)	
Fruits & vegetables			
Fails the recommendation	3106 (95.9)	1422 (87.8)	<0.001
Achieves the recommendation	134 (4.1)	197 (12.2)	
Vegetables			
Fails the recommendation	2463 (76.0)	961 (59.4)	<0.001
Achieves the recommendation	777 (24.0)	658 (40.6)	
Fruits			
Fails the recommendation	2991 (92.3)	1332 (82.3)	<0.001
Achieves the recommendation	249 (7.7)	287 (17.7)	
Diary			
Fails the recommendation	2412 (74.4)	1057 (65.3)	<0.001
Achieves the recommendation	828 (25.6)	562 (34.7)	
Legumes			
Fails the recommendation	1449 (44.7)	640 (39.5)	0.001
Achieves the recommendation	1791 (55.3)	979 (60.5)	
Fish			
Fails the recommendation	2985 (92.1)	1411 (87.2)	<0.001
Achieves the recommendation	255 (7.9)	208 (12.8)	
Breakfast consumption			
Fails the recommendation	1175 (36.3)	407 (25.1)	<0.001
Achieves the recommendation	2065 (63.7)	1212 (74.9)	
Dinner consumption			
Fails the recommendation	2134 (65.9)	959 (59.2)	<0.001
Achieves the recommendation	1106 (34.1)	660 (40.8)	
Homemade meals			
Fails the recommendation	881 (27.2)	511 (31.6)	0.002
Achieves the recommendation	2359 (72.8)	1108 (68.4)	
Whole grain			
Fails the recommendation	1738 (53.6)	628 (38.8)	<0.001
Achieves the recommendation	1502 (46.4)	991 (61.2)	
UNHEALTHY FOOD			
Sugary drinks			
Fails the recommendation	2211 (68.2)	896 (55.3)	<0.001
Achieves the recommendation	1029 (31.8)	723 (44.7)	
Alcohol consumption			
Fails the recommendation	1314 (40.6)	696 (43.0)	0.111
Achieves the recommendation	1926 (59.4)	923 (57.0)	
Add salt			
Fails the recommendation	2758 (85.1)	1408 (87.0)	0.091
Achieves the recommendation	482 (14.9)	211 (13.0)	
Fast Food			
Fails the recommendation	2798 (86.4)	1302 (80.4)	<0.001
Achieves the recommendation	442 (13.6)	317 (19.6)	
Snack			
Fails the recommendation	2633 (81.3)	1239 (76.5)	<0.001
Achieves the recommendation	607 (18.7)	380 (23.5)	
Fritters			
Fails the recommendation	2919 (90.1)	1315 (81.2)	<0.001
Achieves the recommendation	321 (9.9)	304 (18.8)	

n: number of cases.

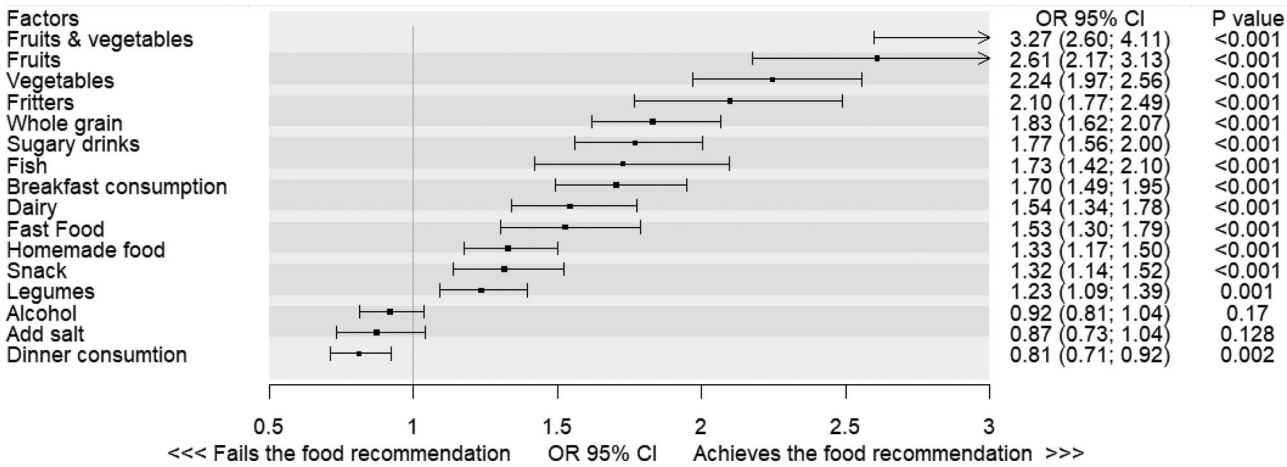

Figure 1. Association food recommendations with the physical activity behavior. Data is presented as Odds Ratios (OR) with their 95% confidence intervals. The reference group is physically inactive students. Analysis was adjusted by area study, sex and sleep hours.

Table 2. Health-Related Quality of Life According to the Physical Activity Behavior

	Physically Inactive n (%)	Physically Active n (%)	*p* value
	3240 (66.7)	1619 (33.3)	
Total Scores Quality of Life			
Lower	1004 (31.0)	297 (18.3)	<0.001
Higher	2236 (69.0)	1322 (81.7)	
Environment domain			
Lower	1100 (34.0)	351 (21.7)	<0.001
Higher	2140 (66.0)	1268 (78.3)	
Psychological health			
Lower	1134 (35.0)	383 (23.7)	<0.001
Higher	2106 (65.0)	1236 (76.3)	
Social relationships			
Lower	949 (29.3)	392 (24.2)	<0.001
Higher	2291 (70.7)	1227 (75.8)	
Physical health			
Lower	1102 (34.0)	328 (20.3)	<0.001
Higher	2138 (66.0)	1291 (79.7)	

n: number of cases.

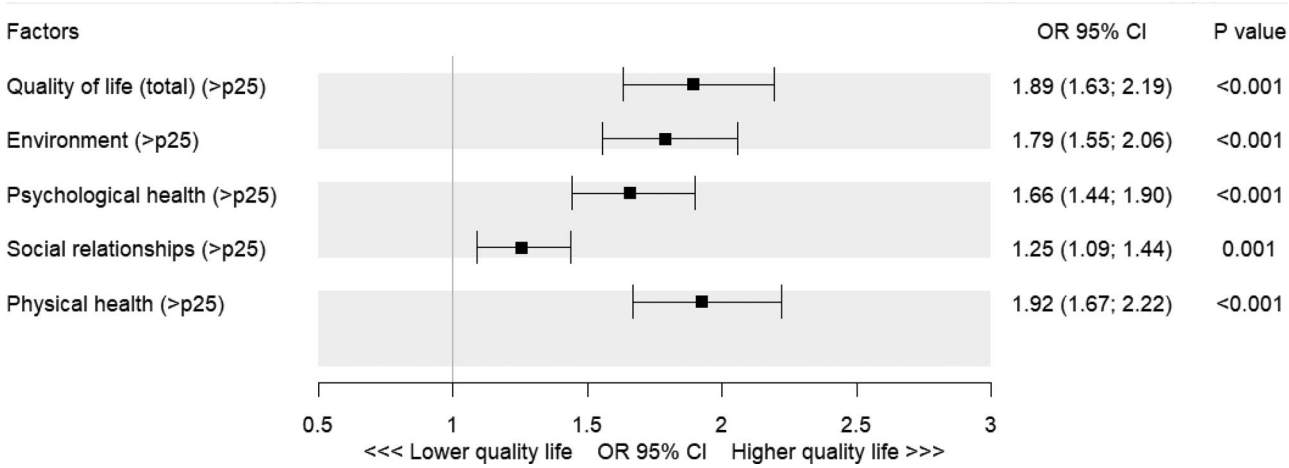

Figure 2. Association health-related quality of life with the physical activity behavior.Data is presented as Odds Ratios (OR) with their 95% confidence intervals. The reference group is physically inactive students. Analysis was adjusted by area study, sex and sleep hours. Lower quality of life: score ≤ 25th percentile.

a study that linked the physical activity practice with the HRQoL in young adults during COVID-19 confinement (33), indicating that regardless of the intensity of physical activity (i.e., light, moderate or vigorous), its practice can be highly recommended to reduce the negative psychosocial effect of confinement. This is relevant, since several studies have reported a decrease in the HRQoL in different population groups with social distancing measures (14, 15).

Regular physical activity is considered one of the most economical tools for health prevention (34), whereas physical inactivity is a risk factor for premature mortality even greater than excess weight (35). Despite this, our study reported that only 3 out of 10 students are physically active. In this regard, current recommendations suggest 150 to 300 min of moderate-intensity physical activity or 75 to 150 min of vigorous-intensity physical activity per week (36). In quarantine by COVID-19, physical activity is widely recommended by means of cardiorespiratory fitness, muscular strength, flexibility and balance exercises, which can be performed with one's own body weight or with easily accessible implements (37). University students correspond to a group of high vulnerability to sedentary behaviors during the pandemic (38), due to, e.g., long hours of study and increased sedentary time and more hours online, which also alters sleep habits and reduces physical activity (39), facts that have a negative impact on healthy lifestyle habits.

Among the main strengths of the study are: (i) the number of Latin American university students and the diversity of countries of residence, which broadens the scope of the study; (ii) the similarity of the baseline characteristics of the sample, which homogenizes the data; (iii) the use of validated surveys, which allows comparison with other studies. As limitations we point out: (i) the study design that does not allow cause and effect relationships; (ii) the type of sampling (non-probabilistic accidental) that does not allow extrapolation of the data to the entire population of university students; and (iii) the use of self-report surveys, which could reduce the external validity of the data. Despite this, our study strengthens the scientific literature and provides valuable information on the benefits of being physically active.

Conclusion

Physically active Latin American university students are more likely to have a healthier eating behavior and a lower risk of having a decreased HRQoL. This shows that even in unprecedented times such as a pandemic, practicing physical activity regularly favors the physical and mental health of university students.

Given this trend, we consider that for university students, or any age group, promotion of healthy eating behaviors and physical activity are essential complementary strategies to promote health, specifically in times of pandemic, where confinement and social distances can have such negative impact in a person's health and well-being. In addition, the channels of healthy food distribution should be strengthen, in order to provide healthy choices at a accessible price for the general population. The gradual and organized opening of public spaces that allow for physical activity in a safely manner should be consider a priority.

Acknowledgments

The authors are grateful for the participation of the university students to carry out this study.

Author contributions

PVB, SPS and SDA wrote the first draft of the manuscript. LLD, JA, GM, IRC, BMC, GG, GM, VCA, ENG, BN, EM, JB, SM, KC, SDA collected data. PVB, SPS and SDA analyzed and interpreted the data. LLD, JA, GM, IRC, BMC, GG, GM, VCA, ENG, BN, EM, JB, SM, KC, revised the original manuscript. All authors read and approved the final manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Informed consent statement

Informed consent was obtained from all subjects involved in the study.

Data availability statement

The data presented in this study are available on request from the corresponding author.

ORCID

Pablo Valdés-Badilla http://orcid.org/0000-0002-3948-8280
Solange Liliana Parra-Soto http://orcid.org/0000-0002-8443-7327
Ana Gabriela Murillo http://orcid.org/0000-0003-0155-9343
Georgina Gomez http://orcid.org/0000-0003-3514-2984
Jacqueline Araneda http://orcid.org/0000-0002-0415-2920
Samuel Durán-Agüero http://orcid.org/0000-0002-0548-3676
Gladys Morales http://orcid.org/0000-0001-7194-8833
Israel Ríos-Castillo http://orcid.org/0000-0001-9443-3189
Valeria Carpio Arias http://orcid.org/0000-0003-2989-1751
Brian M. Cavagnari http://orcid.org/0000-0002-4360-4686
Edna J. Nava-González http://orcid.org/0000-0001-8818-2600
Saby Camacho López http://orcid.org/0000-0003-3372-7719
Jhon Jairo Bejarano-Roncancio http://orcid.org/0000-0003-2527-3753
Beatriz Núñez-Martínez http://orcid.org/0000-0001-6585-9607
Karla Cordón-Arrivillaga http://orcid.org/0000-0003-3825-739X
Eliana Romina Meza-Miranda http://orcid.org/0000-0001-9791-8835
Saby Mauricio-Alza http://orcid.org/0000-0001-7921-7111
Leslie Landaeta-Díaz http://orcid.org/0000-0001-8970-1150

References

1. Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, Bouaziz B, Bentlage E, How D, Ahmed M, On Behalf of the ECLB-COVID19 Consortium, et al. Effects of COVID-19 home confinement on eating behaviour and physical activity: Results of the ECLB-COVID19 International Online Survey. Nutrients. 2020;12(6):1583. doi:10.3390/nu12061583.
2. Stockwell S, Trott M, Tully M, Shin J, Barnett Y, Butler L, McDermott D, Schuch F, Smith L. Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: a systematic review. BMJ Open Sport Exerc Med. 2021;7(1):e000960. doi:http://dx.doi.org/10.1136/bmjsem-2020-000960.
3. Richards TJ, Rickard B. COVID-19 impact on fruit and vegetable markets. Can J Agri Econ. 2020;68(2):189–94. doi:10.1111/cjag.12231.
4. Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, Leggeri C, Caparello G, Barrea L, Scerbo F, et al. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. J Transl Med. 2020;18(1):229. doi:10.1186/s12967-020-02399-5.
5. Robinson E, Boyland E, Chisholm A, Harrold J, Maloney NG, Marty L, Mead BR, Noonan R, Hardman CA. Obesity, eating behavior and physical activity during COVID-19 lockdown: A study of UK adults. Appetite. 2021;156:104853. doi:10.1016/j.appet.2020.104853.
6. Ruíz-Roso MB, de Carvalho Padilha P, Matilla-Escalante DC, Brun P, Ulloa N, Acevedo-Correa D, Arantes Ferreira Peres W, Martorell M, Rangel Bousquet Carrilho T, de Oliveira Cardoso L, et al. Changes of physical activity and ultra-processed food consumption in adolescents from different countries during Covid-19 pandemic: An observational study. Nutrients. 2020;12(8):2289. doi:10.3390/nu12082289.
7. Flanagan EW, Beyl RA, Fearnbach SN, Altazan AD, Martin CK, Redman LM. The impact of COVID-19 stay-at-home orders on health behaviors in adults. Obesity (Silver Spring). 2021;29(2):438–45. doi:10.1002/oby.23066.
8. Yang J, Hu J, Zhu C. Obesity aggravates COVID-19: A systematic review and meta-analysis. J Med Virol. 2021;93(1):257–61. doi:10.1002/jmv.26237.
9. Popkin BM, Du S, Green WD, Beck MA, Algaith T, Herbst CH, et al. Individuals with obesity and COVID-19: A global perspective on the epidemiology and biological relationships. Obes Rev. 2020;21(11):e13128. doi:10.1111/obr.13128.
10. Halpern B, Louzada MLdC, Aschner P, Gerchman F, Brajkovich I, Faria-Neto JR, Polanco FE, Montero J, Juliá SMM, Lotufo PA, et al. Obesity and COVID-19 in Latin America: A tragedy of two pandemics-official document of the Latin American Federation of Obesity Societies. Obes Rev. 2021;22(3):e13165. doi:10.1111/obr.13165.
11. Werneck AO, Baldew SS, Miranda JJ, Díaz Arnesto O, Stubbs B, Silva DR, on the behalf of the South American Physical Activity and Sedentary Behavior Network (SAPASEN) collaborators. Physical activity and sedentary behavior patterns and sociodemographic correlates in 116,982 adults from six South American countries: the South American physical activity and sedentary behavior network (SAPASEN). Int J Behav Nutr Phys Act. 2019;16(1):68. doi:10.1186/s12966-019-0839-9.
12. Valdes-Badilla P, Godoy-Cumillaf A, Herrera-Valenzuela T, Durán-Agüero S. Comparación en hábitos alimentarios y condición física entre estudiantes de Educación Física y Otras Carreras

Univertistarias. Nutr Hosp. 2015;32(2):829–36. doi:10.3305/nh.2015.32.2.9194.
13. Lanuza F, Morales G, Hidalgo-Rasmussen C, Balboa-Castillo T, Ortiz MS, Belmar C, et al. Association between eating habits and quality of life among Chilean university students. J Am Coll Health. 2020;28:1–7. doi:10.1080/07448481.2020.1741593.
14. Guzmán-Muñoz E, Concha-Cisternas Y, Oñate-Barahona A, Lira-Cea C, Cigarroa-Cuevas I, Méndez-Rebolledo G, Castillo-Retamal M, Valdés-Badilla P, Zapata-Lamana R. Factores asociados a una baja calidad de vida en adultos chilenos durante la cuarentena por COVID-19 [Factors associated with low quality of life in Chilean adults during the COVID-19 quarantine. Rev Méd Chile. 2020;148(12):1759–66. doi:10.4067/S0034-98872020001201759.
15. Geirdal AØ, Ruffolo M, Leung J, Thygesen H, Price D, Bonsaksen T, et al. Mental health, quality of life, wellbeing, loneliness and use of social media in a time of social distancing during the COVID-19 outbreak. A cross-country comparative study. J Ment Health. 2021;9:1–8. doi:10.1080/09638237.2021.1875413.
16. Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Sacks FM, Bray GA, Vogt TM, Cutler JA, Windhauser MM, et al. A clinical trial of the effects of dietary patterns on blood pressure.DASH Collaborative Research Group. N Engl J Med. 1997;336(16):1117–24. doi:10.1056/NEJM199704173361601.
17. Marcason W. What are the components to the MIND diet? J Acad Nutr Diet. 2015;115(10):1744. doi:10.1016/j.jand.2015.08.002.
18. Adamsson V, Reumark A, Cederholm T, Vessby B, Risérus U, Johansson G. What is a healthy Nordicdiet? Foods and nutrients in the NORDIET study. Food Nutr Res. 2012;56(1):18189. doi:10.3402/fnr.v56i0.18189.
19. Rosato V, Temple NJ, La Vecchia C, Castellan G, Tavani A, Guercio V. Mediterranean diet andcardiovascular disease: A systematic review and meta-analysis of observational studies. Eur J Nutr. 2019;58(1):173–91. doi:10.1007/s00394-017-1582-0.
20. Schwingshackl L, Schwedhelm C, Galbete C, Hoffmann G. Adherence to Mediterranean diet and risk ofcancer: An updated systematic review and meta-analysis. Nutrition. 2017;9(10):1063. doi:10.3390/nu9101063.
21. Esposito K, Maiorino MI, Bellastella G, Chiodini P, Panagiotakos D, Giugliano D. A journey into aMediterranean diet and type 2 diabetes: A systematic review with meta-analyses. BMJ Open. 2015;5(8):e008222. doi:10.1136/bmjopen-2015-008222.
22. Marquez DX, Aguiñaga S, Vásquez PM, Conroy DE, Erickson KI, Hillman C, Stillman CM, Ballard RM, Sheppard BB, Petruzzello SJ, et al. A systematic review of physical activity and quality of life and well-being. Transl Behav Med. 2020;10(5):1098–109. doi:10.1093/tbm/ibz198.
23. King AC, Whitt-Glover MC, Marquez DX, Buman MP, Napolitano MA, Jakicic J, Fulton JE, Tennant BL, 2018 Physical Activity Guidelines Advisory Committee*. Physical activity promotion: Highlights from the 2018 physical activity guidelines advisory committee systematic review. Med Sci Sports Exerc. 2019;51(6):1340–53. doi:10.1249/MSS.0000000000001945.
24. Durán S, Valdés P, Godoy A, Herrera T. Hábitos alimentarios y condición física en estudiantes de pedagogía en educación física. Rev Chil Nutr. 2014;41(3):251–9. doi:http://dx.doi.org/10.4067/S0717-75182014000300004.
25. FAO (Food and Agriculture Organization of the United Nations). Food-based dietary guidelines; 2012. http://www.fao.org/nutrition/education/food-dietary-guidelines/en/.
26. WHOQOL Group. Development of the World Health Organization WHOQOL-BREF quality of life assessment. Psychol Med. 1998;28(3):551–8. doi:http://dx.doi.org/10.1017/s0033291798006667.
27. Saxena S, Carlson D, Billington R, WHOQOL Group. The WHO quality of life assessment instrument (WHOQOL-Bref): the importance of its items for cross-cultural research. Qual Life Res. 2001;10(8):711–21. doi:10.1023/a:1013867826835.
28. Hidalgo-Rasmussen C, Franco K, Diaz Reséndiz F, Rojas MJ, Vilugrón F. Risk eating behaviors and tobacco, alcohol and marijuana consumption by gender among chilean university students. Rev Mexicana de Trastornos Alimentarios. 2015;6(1):30–7. doi:10.1016/j.rmta.2015.05.002.
29. Hidalgo-Rasmussen CA, Ramírez-López G, Hidalgo-San Martín A. Actividad física, conductas sedentarias y calidad de vida en adolescentes universitarios de Ciudad Guzmán, Jalisco, México. Ciênc Saúde Coletiva. 2013;18(7):1943–52. doi:10.1590/S1413-81232013000700009.
30. Riebe D, Ehrman JK, Liguori G, Magal M, editors. ACSM's Guidelines fo Exercise Testing and Prescription 10th ed. Philadelphia, PA: Wolters Kluwer; 2018.
31. Ali M, Yusuf HI, Stahmer J, Rahlenbeck SI. Cardiovascular risk factors and physical activity among university students in Somaliland. J Community Health. 2015;40(2):326–30. doi:10.1007/s10900-014-9938-3.
32. Sogari G, Velez-Argumedo C, Gómez MI, Mora C. College students and eating habits: A study using an ecological model for healthy behavior. Nutrients. 2018;10(12):1823. doi:10.3390/nu10121823.
33. Slimani M, Paravlic A, Mbarek F, Bragazzi NL, Tod D. The relationship between physical activity and quality of life during the confinement induced by COVID-19 outbreak: A pilot study in Tunisia. Front Psychol. 2020;11(1882):1–5. doi:10.3389/fpsyg.2020.01882.
34. Reis RS, Salvo D, Ogilvie D, Lambert EV, Goenka S, Brownson RC, Lancet Physical Activity Series 2 Executive Committee. Scaling up physical activity interventions worldwide: stepping up to larger and smarter approaches to get people moving. Lancet. 2016;388(10051):1337–48. doi:10.1016/S0140-6736(16)30728-0.
35. McAuley PA, Artero EG, Sui X, Lee D-c, Church TS, Lavie CJ, Myers JN, España-Romero V, Blair SN. The obesity paradox, cardiorespiratory fitness, and coronary heart disease. Mayo Clin Proc. 2012;87(5):443–51. doi:10.1016/j.mayocp.2012.01.013.
36. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, Carty C, Chaput J-P, Chastin S, Chou R, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020;54(24):1451–62. doi:10.1136/bjsports-2020-102955.
37. Polero P, Rebollo-Seco C, Adsuar JC, Pérez-Gómez J, Rojo-Ramos J, Manzano-Redondo F, Garcia-Gordillo MÁ, Carlos-Vivas J. Physical activity recommendations during COVID-19: Narrative review. IJERPH. 2020;18(1):65. doi:10.3390/ijerph18010065.
38. Brancaccio M, Mennitti C, Gentile A, Correale L, Buzzachera CF, Ferraris C, Montomoli C, Frisso G, Borrelli P, Scudiero O, et al. Effects of the COVID-19 pandemic on job activity, dietary behaviours and physical activity habits of university population of Naples, Federico II-Italy. IJERPH. 2021;18(4):1502. doi:10.3390/ijerph18041502.
39. Chaturvedi K, Vishwakarma DK, Singh N. COVID-19 and its impact on education, social life and mental health of students: A survey. Child Youth Serv Rev. 2021;121:105866. doi:10.1016/j.childyouth.2020.105866.