Rev Med Chile 2023; 151: 725-734

Life-style behavior upon admission to higher education in Chilean university students: A longitudinal observational study

FELIPE ARAYA-QUINTANILLA[1,a], LESLIE LANDAETA-DÍAZ[2,b], ANGELA ROSATI[2,c], CATALINA SILVA-NAVARRO[2,c], ANDRÉS JERIA-DÍAZ[1,d], HÉCTOR GUTIÉRREZ-ESPINOZA[3,a]

Aim: *The main objective of this study was to analyze the change in physical activity, quality of diet, and weight upon admission to higher education and at one-year follow-up in Chilean university students.* ***Materials and methods:*** *376 Chilean university students were prospectively recruited. All participants were assessed at bas eline and one-year follow-up. Sociodemographics and other co-variables were described. Physical activity, healthy eating behavior, height, weight, and body mass index (BMI) were assessed using the Global Physical Activity Questionnaire (GPAQ), and quality of diet (with Healthy Eating Index), SECA 213 stadiometer and TANITA HD-351, respectively.* ***Results:*** *At the one-year follow-up, high-intensity METs (Metabolic equivalents) decreased by 147.9 (95% CI: 79.5 to 216; p = 0.000), moderate-intensity METs decreased by 85.0 (95% CI: 52.2 to 117.7; p = 0.000), sedentary behavior increased by 45.0 min/week (95% CI: 54.6 to 35.4; p = 0.000), total METs decreased by 793.6 (95% CI: 613.0 to 974.1; p = 0.000), HEI decreased by 45.4 points (95% CI: 48.5 to 82.1; p = 0.000), weight increased by 5.9 kg (95% CI: 3.5 to 6.3; p = 0.002), and BMI increased by 2.8 kg/m^2 (95% CI: 2.7 to 3.2; p = 0.000). The correlation between total METs and the HEI was r = 0.21 (p = 0.013).* ***Conclusions:*** *There are statistically significant differences at one-year follow-up in Chilean university students in decreased physical activity, impaired healthy eating behavior, and increased weight and BMI.*

(Rev Med Chile 2023; 151: 725-734)

Key words: *Life Style; Behavior; Exercise; Healthy Lifestyle; Feeding Behavior; Observational Study.*

Comportamiento de estilo de vida al ingresar a la educación superior en estudiantes universitarios chilenos: Un estudio observacional longitudinal

Objetivo: *El objetivo principal fue analizar los cambios en la actividad física, calidad de la dieta y el peso al ingreso a la educación superior y al año de seguimiento en estudiantes universitarios chilenos.* ***Materiales y Métodos:*** *Un total de 376 estudiantes universitarios chilenos fueron prospectivamente reclutados. Todos los participantes fueron evaluados al ingreso y al año de seguimiento. Se describieron las variables sociodemográficas y otras co-variables. La actividad física, el comportamiento de alimentación saludable, el peso, talla y el Índice de Masa Corporal (IMC) fueron evaluados con el Cuestionario*

[1]Escuela de Kinesiología, Facultad de Odontología y Ciencias de la Rehabilitación, Universidad San Sebastián. Santiago, Chile.
[2]Facultad de Salud y Ciencias Sociales, Escuela de Nutrición y Dietética. Universidad de Las Américas. Santiago, Chile.
[3]Escuela de Fisioterapia, Universidad de Las Américas. Quito, 170504, Ecuador.
[a]Kinesiólogo, Magíster, PhD.
[b]Nutricionista, PhD.
[c]Nutricionista.
[d]Kinesiólogo, Magíster.

Declaration of Interest Statement
No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

Funding:
This study was financed by the regular research fund of the Universidad de Las Américas with the sponsor code N° PI201807.

Recibido el 10 de abril de 2022, aceptado el 30 de mayo de 2023.

Corresponding author:
Héctor Gutiérrez-Espinoza,
Escuela de Fisioterapia, Facultad de Ciencias de la Salud, Universidad de las Américas, Quito, 170504, Ecuador.
kinehector@gmail.com

Global de Actividad Física (CGAF), el Índice de Alimentación Saludable (IAS), estadiómetro SECA 213 y el TANITA HD-351, respectivamente. ***Resultados:*** *Al año de seguimiento, los METs a alta intensidad disminuyeron 147,9 (95% IC: 79,5 a 216; p = 0,000), METs a moderada intensidad disminuyeron 85,0 (95% IC: 52,2 a 117,7; p = 0,000), el comportamiento sedentario incremento 45,0 min/semana (95% IC: 54,6 a 35,4; p = 0,000), los METs totales disminuyeron 793,6 (95% CI: 613,0 a 974,1; p = 0,000), IAS disminuyó 45,4 puntos (95% IC: 48,5 a 82,1; p = 0,000), el peso aumento 5,9 kg (95% IC: 3,5 a 6,3; p = 0,002), y el IMC incrementó 2,8 kg/m² (95% IC: 2,7 a 3,2; p = 0,000). La relación entre los METs totales y el IAS fue r = 0,21 (p = 0,013).* ***Conclusiones:*** *Al año de seguimiento, hubo diferencias estadísticamente significativas en la disminución de la actividad física, deterioro del comportamiento de alimentación saludable, e incremento del peso e IMC en estudiantes universitarios chilenos.*

Palabras clave: *Estilo de Vida; Ejercicio Físico; Estilo de Vida Saludable; Comportamiento de alimentación; Estudio Observacional.*

University students, having reached biological maturity, are in a period of transition to adulthood marked by dramatic lifestyle changes[1]. Admission to higher education is usually accompanied by dietary changes including unhealthy eating habits, skipping meals, inadequate nutrition and frequent fast-food intake, as well as low physical activity levels[2,3]. However, according to the World Health Organization[4], a healthy lifestyle entails regular physical exercise, abstention from smoking, limiting alcohol consumption, and eating healthy foods to prevent excess body weight gain. In this sense, several studies suggest that attendance at university is not a factor promoting a healthy lifestyle[5-7]. Despite this, university students are a social group that are at risk from a nutritional point of view, since they often do not follow healthy eating patterns[8,9]. Therefore, new responsibilities that accompany higher education, such as buying food and preparing daily meals in the home, are factors that can strongly condition eating habits and may affect students' health[10,11]. The quality of diet has been associated with several factors, including regular physical activity and body mass index (BMI)[12]. The Healthy Eating Index (HEI) is one of the most widely used measures to assess whether a diet is healthy or not, and has been translated into Spanish (IAS in Spanish)[13]. Similarly, physical activity is considered a positive health measure that is an integral part of a healthy lifestyle, as it is a determinant of overall health[14].

Some studies emphasize that the amount of time spent in front of computer screens and televisions is increasing, which, combined with a lack of physical activity, generates a negative impact on quality of life[15,16]. Others have shown a high prevalence of sedentary time among university students[17]. Additionally, in a global survey of 23 countries of different income levels, between 21.9% and 80.6% of college students were physically inactive[18]. Currently, Chile is one of the countries with the highest prevalence of overweight and obesity[19], and evidence of the relationship between diet quality, physical activity levels and nutritional status in university students is still insufficient.

A recent study in Chinese adolescents (12- to 18-year-olds) indicated that the time spent engaging in sedentary behavior has more than doubled, from 1.71 to 3.50 h/day[20]. The cost of sedentary behavior is substantial, with increased morbidity and premature death being the most important consequences, followed by a decrease in health-related quality of life[21,22]. Various studies of university students have shown an independent association of sedentary behavior with acute and chronic problems, such as cardiovascular disease, metabolic syndrome and early mortality[23,24]. Despite these associations, little is known about sedentary behavior and physical activity patterns in college students. This age group has experienced the largest increase in sedentary behavior and the largest decrease in moderate vigorous physical activity (MVPA) in recent decades, compared with all other age cohorts[25]. Another study[26] examining the levels of sedentary behavior and physical activity in university students demonstrated a

negative association of sedentary behavior and MVPA with body mass index (BMI) and other characteristics such as race or ethnicity (African American, Hispanic, mestizo). On the other hand, human behaviors are influenced to a great extent by personal and contextual motivational factors. Therefore, in the university context, the motivations for physical activity and following a healthy diet can change[24,25]. Finally, given the scarce data on physical activity and its relationship with healthy eating behavior in Latino and Chilean university students, the purpose of this study was to analyze changes in physical activity, quality of diet, weight and BMI from admission to higher education to one-year follow-up, and determine the relationship between the level of physical activity and healthy eating behavior at one-year follow-up in Chilean university students.

Materials and Methods

This prospective observational study was conducted following the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines[27]. The study was approved by the Ethics Committee of the University of the Americas (ID CEC_PI2018017) and received funding from University of the Americas with sponsor code N°PI201807. From a population of 743 students, under a convenience non-probabilistic sampling, we prospectively recruited a total of 376 university students between April 2018 and April 2019. All subjects were assessed at baseline and one-year follow-up by blinded external assessors.

Participants

The included participants were male and female university students older than 18 years who accepted and signed the informed consent form. Conversely, students with non-controlled comorbidities, such as diabetes mellitus, hypercholesterolemia, hypertension, cognitive impairment or neurological diseases, were excluded.

Outcome measures

Physical activity

Physical activity was assessed with the Global Physical Activity Questionnaire (GPAQ)[28]. This questionnaire was originally designed by the World Health Organization as an interviewer-administered assessment tool for physical activity. The questionnaire comprises 16 items that quantify the participant's physical activity level in a week of normal activity in order to estimate the total weekly volume of moderate-to-vigorous physical activity. It includes three domains: work, transportation and recreational activities. This questionnaire has demonstrated consistent validity and reliability in the Chilean population[29].

Quality of diet

The quality of diet was assessed with a version of the Healthy Eating Index (HEI) translated into Spanish (IAS)[13]. This questionnaire comprises three items that quantify the daily consumption of different foods. Participants' diets were classified according to the total score and divided into three categories: > 80 points "healthy"; 50–80 points "needs changes"; and < 50 points "unhealthy." This questionnaire has proven useful and valid for assessing dietary quality[30].

Body mass index

Height was measured using a SECA 213 stadiometer, with the subject barefoot and upright and with the sagittal midline touching the backboard. Weight was measured using a TANITA HD-351, with the subject barefoot. The procedures were repeated twice for each subject. Finally, BMI was calculated as weight in kilograms divided by the square of height in meters[31].

Sociodemographic variables

Age, gender, work occupation (defined as a work situation that has a person who has a specific field of interest divided by the work time spent on that task), alcohol consumption, and tobacco consumption were assessed for each participant and recorded on a paper print-out. Comorbidity data, including hypertension (defined as a systolic blood pressure ≥ 140 mmHg, diastolic blood pressure 90 mmHg, or receiving treatment with an antihypertensive agent), diabetes mellitus (defined as a fasting plasma glucose ≥ 126 mg/dL, or treatment with a hypoglycemic agent or insulin) and hypothyroidism (defined as inadequate production of thyroid hormones in the body, with thyrotropin between 3 and 4.5 uUI/mL), were assessed in the health examination at university admission and registered into the student health record system.

Statistical analysis

The parametric distribution of the continuous variables was checked using both the Kolmogorov-Smirnov test and graphical procedures (normal probability plot). Descriptive statistics were used to describe the demographic characteristics of the participants and other potentially confounding variables. Continuous variables were presented as the mean and standard deviation (SD), and categorical variables as the number and percentage. Student's t-test was used to determine the significance of differences between the data at baseline and one-year follow-up. The Pearson coefficient was used to determine the correlation between GPAQ total and healthy eating behavior. Finally, the level of correlation was considered as follows: negligible (0–0.2), low (0.2–0.5), moderate (0.5–0.7), high (0.7–0.9), and very high (0.9–1)[32]. Statistical significance was established at $p < 0.05$, with the respective 95% confidence intervals (CI). Statistical analysis was performed using SPSS IBM software version 24 (SPSS Inc., Armonk, NY).

Ethical approval: The Ethics Committee of University of Americas approved the study protocol on March 2018 (n° CEC_PI2018017).

Results

The baseline characteristics of the study group are shown in Table 1. A total of 376 students were included, of which 259 were female (68.9%), with a mean age of 21.3 years and an SD of 4.2. Regarding comorbidities, most of the participants did not present any associated pathology (92.7%).

Additionally, Table 2 shows the differences between baseline data and one-year follow-up. At one-year follow up, all variables showed a statistically significant difference ($p < 0.05$). High-intensity METs (Metabolic equivalents) decreased by 147.9 (95% CI: 79.5 to 216; $p = 0.000$), moderate intensity METs decreased by 85.0 (95% CI: 52.2 to 117.7; $p = 0.000$), sedentary behavior increased by 45.0 min/week (95% CI: 54.6 to 35.4; $p = 0.000$), total METs decreased by 793.6 (95% CI: 613.0 to 974.1; $p = 0.000$), the HEI decreased by 45.4 points (95% CI: 48.5 to 82.1; $p = 0.000$), weight increased by 5.9 kg (95% CI: 3.5 to 6.3; $p = 0.002$), and BMI increased by 2.8 kg/m2 (95% CI: 2.7 to 3.2; $p = 0.000$). For the relationship between total METs and the quality of diet, the correlation coefficient was $r = 0.21$ ($p = 0.013$) (Figure 1). MVPA decreased by a mean of 12.5 min/day for the total sample at one-year follow-up. All subjects who entered the study completed the one-year follow-up. No withdrawals or dropouts were reported.

Discussion

This study aimed to analyze the changes in physical activity, quality of diet, weight, and BMI upon admission to higher education and at one-year follow-up in Chilean university students. The second objective was to determine the relationship between the level of physical activity and quality of diet at one year of follow-up in this population. Over this time, physical activity and the quality of diet showed an increase and significant impairment respectively in these subjects. Additionally, there was a significant correlation between total METs and the quality of diet.

In agreement with our findings, several other studies showed changes in the physical activity, BMI, weight and eating behavior of university students[33-35]. One study[33] showed that students had gained 2.7 kg by the beginning of their second year at college or university. Interestingly, in our study, the students had gained an average of 5.9 kg at one-year follow-up. Another study[34] showed that the average duration of physical activity decreased from 6.5 hours to 4.3 hours per week to high school education.

In terms of diet, a further study[35] showed that more than 40% of students did not consume vegetables at least once a day, and 50% did not consume fish several times a month. In our study, the quality of diet index showed a decrease to 45.4 points, indicating that it "needs changes," with 114 students (30.3%) reporting unhealthy eating habits. In this sense, due to the series of social and economic changes, among others, produced by the arrival to university life, it has been pointed out that food environments have been affected in one way or another. Food environments are understood as the totality of influences on people's acquisition, choice, and consumption of food and beverages, such as marketing, advertising, geographic availability, and access, among others[36-38]. Therefore, we hypothesize that dietary behavior is a factor that contributes to overweight and obesity in Chilean university students due to the transfer

Table 1. Demographic characteristic of the study sample

Variables	Total	Men	Women
Number (%)	376 (100)	117 (31.1)	259 (68.9)
Age (years), mean (SD)	21.3 (4.2)	20.9 (4.4)	21.5 (4.1)
Comorbidities, number (%)			
DM	4 (1.1)	1 (0.9)	3 (1.1)
AH	1 (0.3)	0 (0)	1 (0.4)
IR	12 (3.2)	2 (1.7)	10 (3.9)
Hypothyroidism	5 (1.3)	0 (0)	5 (1.9)
No comorbidities	354 (94.1)	114 (97.4)	240 (92.7)
BMI Kg/mt^2, mean (SD)	22.6 (1.6)	22.8 (2.1)	22.4 (2.6)
Height (cm)	1.74 (0.2)	1.75 (0.4)	1.62 (0.5)
Weight (kg)	73.4 (6.5)	70.1 (5.2)	59.5 (3.8)
GPAQ Baseline, number (%)			
High	149 (39.6)	63 (53.8)	86 (33.2)
Moderate	140 (37.2)	39 (33.3)	101 (39)
Low	87 (23.1)	15 (12.8)	72 (27.8)
MVPA (min/day)			
Mean (SD)	62.4 (50.5)	64.8 (50.3)	61.3 (50.6)
Work occupation, number (%)			
Full time	0 (0)	0 (0)	0 (0)
Part time	102 (27.2)	38 (32.4)	64 (24.8)
Not working	274 (72.8)	79 (67.6)	195 (75.2)
Alcohol consumption, number (%)			
Yes	281 (74.7)	92 (78.6)	189 (72.9)
No	95 (25.2)	25 (21.4)	70 (27.1)
Tobacco consumption, number (%)			
Yes	245 (65.2)	84 (71,7)	161(62.1)
No	131 (34.8)	33 (28.3)	98 (37,9)

DM: Diabetes Mellitus; AH: Arterial hypertension; IR: Insulin resistance; GPAQ: Global Physical Activity Questionnaire BMI: Body mass index. MVPA: Moderate to Vigorous physical activity.

of students from a mainly domestic food environment to a university institutional one, generating a series of changes in eating routines and habits. Less time available for eating and the availability of unhealthy preparations in university market are described[39,40]. Regarding changes in body weight, there has been considerable interest in recent decades in the "Freshman 15" phenomenon, the popular belief that students gain 15 lb (6.8 kg) of weight in their first year of university in the United States. Longitudinal cohort studies across several countries have provided evidence to support this observation, although the effect size has decreased to 3.38 kg[41,42].

One explanation for our results is that the unfavorable changes in students of higher education are due to the great difficulties in adapting to the new university environment, scarce time to eat, and little time for recreational activities[43]. In addition, both women and men has been showed increased BMI and weight into higher education; nevertheless, it is plausible that those students who begin university with higher levels of adiposity may have already been consuming greater amounts of food and engaging in less physical activity in the run up to enrolment. These individuals may experience a less dramatic change in lifestyle choices at or after enrolment compared to those with lower starting weights. These findings may also reflect the capacity of young adults to regulate body weight within a relatively limited range over the longer term, even after a transitory period in positive energy balance[44]. This is a common factor in clinical practice, known as the mean regression phenomenon.

On the other hand, an alternative explanation

Table 2. Mean differences (SD) in physical activity, healthy eating behavior, weight and Body Mass Index at 1-year follow-up

Outcome measures		Baseline Mean (SD)	At 1-year follow-up Mean (SD)	Mean differences (CI 95%)	P - Value
METs High intensity (Per week)	Total	407.6 (14.4)	259 (8.3)	147.9 (79.5 to 216)	0.000
	Men	707.3 (19.0)	459.2 (11.2)	248.1 (91.6 to 404.5)	0.002
	Women	272.2 (11.5)	169.5 (65.2)	102.6 (32.8 to 172.5)	0.004
METs Moderate intensity (Per week)	Total	368.8 (89.6)	283.8 (64.7)	85.0 (52.2 to 117.7)	0.000
	Men	523.3 (10.4)	388.16 (67.5)	135.1 (49.5 to 220.7)	0.002
	Women	299.0 (81.3)	236.7 (62.9)	62.3 (34.5 to 90.1)	0.000
Sedentary Behavior (min/day)	Total	251. 8 (117.2)	296.8 (218.7)	45.0 (54.6 to 35.4)	0.000
	Men	238.3 (15.7)	268.0 (17.6)	29.7 (41.1 to 18.3)	0.000
	Women	257.9 (18.5)	309.8 (23.4)	51.9 (64.8 to 39.0)	0.000
Total METs (Per week)	Total	3142.3 (388.2)	2348.6 (291.7)	793.6 (613.0 to 974.1)	0.000
	Men	4708.8 (516.5)	3443.8 (392.9)	1265.0 (818.8 to 1711)	0.000
	Women	2434.6 (288.0)	1853.9 (215.4)	580.6 (416.8 to 744.5)	0.000
Quality of diet	Total	98.1 (16.5)	52.7 (11.6)	45.4 (48.5 to 82.1)	0.000
	Men	91.5 (2.1)	53.1 (12.2)	38.4 (37.4 to 99.4)	0.000
	Women	100.5 (16.4)	52.5 (11.3)	48.9 (43.9 to 84.0)	0.000
BMI Kg/mt^2, mean (SD)	Total	24.6 (1.6)	27.4 (2.2)	2.8 (2.7 to 3.2)	0.000
	Men	22.8 (2.1)	25.1 (3.2)	2.3 (3.1 to 3.8)	0.003
	Women	22.4 (2.6)	24.8 (4.2)	2.4 (2.6 to 4.1)	0.000
Weight (kg) Mean (SD)	Total	73.4 (6.5)	79.3 (5.4)	5.9 (3.5 to 6.3)	0.002
	Men	70.1 (5.2)	76.3 (3.2)	6.2 (4.1 to 7.2)	0.000
	Women	59.5 (3.8)	66.1 (4.3)	6.6 (4.3 to 7.1)	0.000

Notes: SD: Standard deviation. CI: Confidence interval. METs: Metabolic equivalents. BMI: Body mass index,

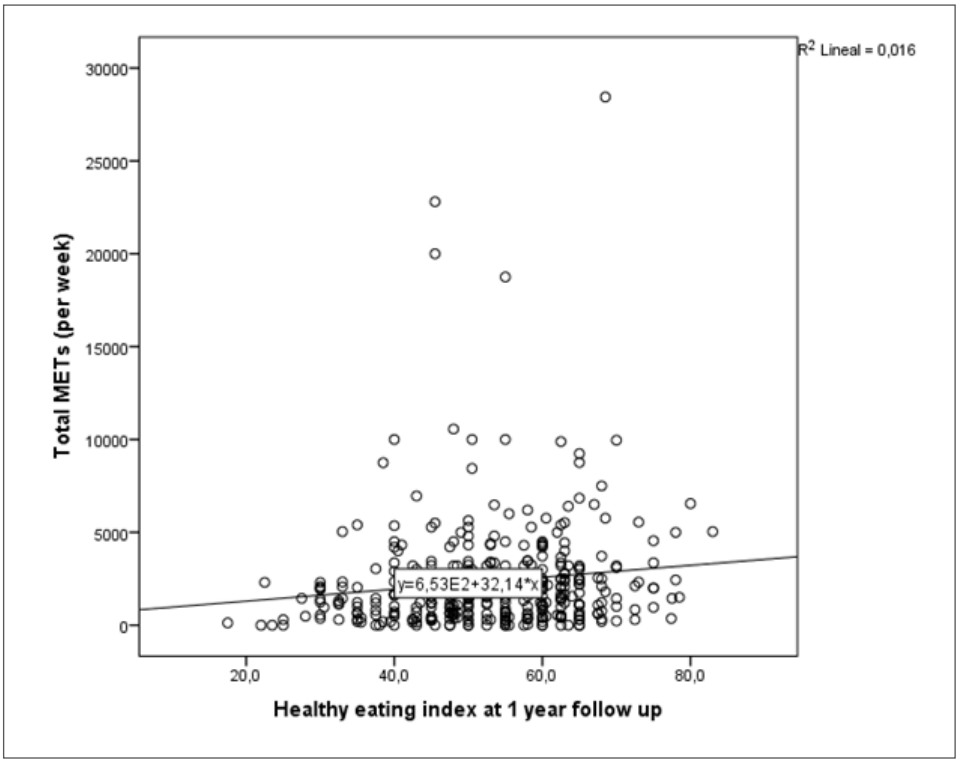

Figure 1. Relationship between total METs and the HEI at one year follow-up in Chilean university students.

could be the relationship between physical activity levels and the quality of diet. Our results showed a significant correlation between both outcomes. Therefore, the lower the mean level of physical activity, the greater the proportion of students categorized as "need changes." This could be explained by the existence of barriers or facilitators of healthy behaviors. It has been observed that some of the common barriers studied in this group are time constraints, economic implications, and peer influences. On the other hand, common motivators among university students to follow both, healthy eating and physical activity behaviors are physical appearance, physical health, and sports performance[45]. In both situations, the execution of a healthy or unhealthy action is associated with one of the similar characteristics as a complementary action. For example, people who are motivated to eat healthier use it as a complement to their sporting goals or physical appearance[46].

Finally, the implication of these parameters is that low physical activity and a higher BMI are good indicators of body fatness and mortality risk[47]. For example, for every 4 kg/m^2 increase in BMI, the risk of heart disease increases by at least 26%[48]. Therefore, the changes in these lifestyle behaviors are important for health status and mortality risk in this population and should be considered in the algorithmic evaluation used by physicians and health professionals. In this way, changes in diet and lifestyle have favorable results and lower costs than cardiovascular diseases. Thus, prevention and education on the implications of following a diet with healthy characteristics and an adequate level of physical activity should be considered a useful tool to reduce the prevalence of chronic diseases such as obesity, metabolic syndrome and type 2 diabetes in this segment of population[49,50].

Finally, this study has a few limitations. First, as it is an observational study, there is an inherent lack of control over confounding factors (anxiety, stress, other health outcomes, socioeconomic level, etc.), which may have led to overestimation of the results. In this sense, it is not possible to generate a causal relationship of the outcomes

studied. Second, a self-administered questionnaire was used to assess physical activity and sedentary behavior. It would have been better to perform an empirical assessment of physical activity using accelerometry and to investigate history of participation in sport. This could be included in future research.

Conclusion

In summary, there are statistically significant differences at one-year follow-up in decrease of physical activity, impaired healthy eating behavior, and increase in weight and BMI in Chilean university students, alongside a significant relationship between total METs and the quality of diet. Previous findings and our results must be carefully considered and used to support the development of programs that promote healthy lifestyles in this population.

References

1. Arnett JJ. Emerging adulthood: A theory of development from the late teens through the twenties. Am Psychol. 2000; 55(5): 469–80.
2. Cervera Burriel F, Serrano Urrea R, Vico García C, Milla Tobarra M, García Meseguer MJ. Hábitos alimentarios y evaluación nutricional en una población universitaria. Nutr Hosp. 2013; 28(2): 438–46.
3. Papadaki A, Hondros G, A. Scott J, Kapsokefalou M. Eating habits of University students living at, or away from home in Greece. Appetite. 2007; 49(1): 169–76.
4. World Health Organization. Healthy living: what is a healthy lifestyle?: WHO Regional Office for Europe [Internet]. 1999. Available from: https://apps.who.int/iris/handle/10665/108180
5. Castro Cuesta JY, Abellán Huerta J, Leal Hernández M, Gómez Jara P, Ortín Ortín EJ, Abellán Alemán J. Estilos de vida relacionados con el riesgo cardiovascular en estudiantes universitarios. Clínica e Investig en Arterioscler. 2014 Jan 1; 26(1): 10–6.
6. Yahia N, Wang D, Rapley M, Dey R. Assessment of weight status, dietary habits and beliefs, physical activity, and nutritional knowledge among university students. Perspect Public Health. 2016 Jul 1; 136(4): 231–44.
7. Lazarevich I, ME IC, MC V-A, NL F, O NM, MA ZZ. Depression and food consumption in Mexican college students. Nutr Hosp [Internet]. 2018;35(3):620–6. Available from: https://pubmed.ncbi.nlm.nih.gov/29974771/
8. Durán S, Valdés P, Godoy A, Herrera T, Dirigir L, Samuel P, et al. Eating habits and physical condition of physical education students. Vol. 41, Rev Chil Nutr. 2014.
9. Baldini M, Pasqui F, Bordoni A, Maranesi M. Is the Mediterranean lifestyle still a reality? Evaluation of food consumption and energy expenditure in Italian and Spanish university students. Public Health Nutr [Internet]. 2009; 12(2): 148–55. Available from: https://www.cambridge.org/core.
10. Neslişah R, Emine AY. Energy and nutrient intake and food patterns among Turkish university students. Nutr Res Pract. 2011; 5(2): 117–23.
11. Bergier J, Tsos A, Popovych D, Bergier B, Ni E, Ács P, et al. Level of and Factors Determining Physical Activity in Students in Ukraine and the Visegrad Countries. 2018; Available from: www.mdpi.com/journal/ijerph
12. Pate RR, Taverno Ross SE, Liese AD, Dowda M. Associations among physical activity, diet quality, and weight status in US adults. Med Sci Sports Exerc. 2015; 47: 743–50.
13. Norte Navarro AI, Ortiz Moncada R. Calidad de la dieta española según el índice de alimentación saludable [Spanish diet quality according to the healthy eating index]. Nutr Hosp. 2011; 26(2): 330-6.
14. Hans-Christian Miko A, Zillmann N, Ring-Dimitriou S, Ernst Dorner T, Titze S, Bauer R, et al. Thieme Übersichtsarbeit Thieme Auswirkungen von Bewegung auf die Gesundheit Effects of Physical Activity on Health. 2020; Available from: https://creativecommons.
15. Davies CA, Vandelanotte C, Duncan MJ, van Uffelen JGZ. Associations of physical activity and screen-time on health related quality of life in adults. Prev Med (Baltim) [Internet]. 2012; 55(1): 46–9. Available from: http://dx.doi.org/10.1016/j.ypmed.2012.05.003
16. Rouse PC, Biddle SJH. An ecological momentary assessment of the physical activity and sedentary behaviour patterns of university students. Health Educ J. 2010; 69(1): 116–25.
17. Oyeyemi AL, Muhammed S, Oyeyemi AY, A Adegoke BO. Patterns of objectively assessed physical activity and sedentary time: Are Nigerian health professional students complying with public health guidelines? 2017; Available from: https://doi.org/10.1371/journal.pone.0190124
18. Pengpid S, Peltzer K, Kumar H, Jacques K, Tsala P, Vanphanom T, et al. Physical inactivity and associated factors among university students in 23 low-, middle- and high-income countries. Int J Public Health [Internet]. Available from: http://www.ipaq.ki.se
19. Ministerio de Salud. Informe Encuesta Nacional de Salud 2016-2017: Estado Nutricional. Santiago de Chile;

2018, 42p. Disponible en: https://goo.gl/oe2iVt
20. Zhang J, Seo D-C, Kolbe L, Middlestadt S, Zhao W. Associated trends in sedentary behavior and BMI among Chinese school children and adolescents in seven diverse Chinese provinces.2012 International Journal of Behavioral Medicine, 19, 342–350. https://doi.org/10.1007/s12529-011-9177-2
21. AHA. (2011). Understanding childhood obesity: 2011 statistical sourcebook. American Heart Association. Retrieved from http://www.heart.org/idc/groups/heart-public/@wcm/@fc/documents/downloadable/ucm_428180.pdf
22. Guallar-Castillón P, Bayán-Bravo A, León-Muñoz LM, Balboa-CastilloT, López García E, Gutiérrez-Fisac JL, et al. The association of major patterns of physical activity, sedentary behavior and sleep with health-related quality of life: A cohort study. Preventive Medicine. 2014; 67, 248–54. https://doi.org/10.1016/j.ypmed.2014.08.015
23. Ekelund U, Steene-Johannessen J, Brown WJ, Fagerland MW, Owen N, Powell KE, et al. Does physical activity attenuate, or even eliminate, the detrimental association of sitting time with mortality? A harmonised meta-analysis of data from more than 1 million men and women. The Lancet. 2016: 388, 1302–1310. https://doi.org/10.1016/S0140-6736(16)30370-1
24. Gibbs BB, Hergenroeder AL, Katzmarzyk PT, Lee IM, Jakicic JM. Definition, measurement, and health risks associated with sedentary behavior. Medicine and Science in Sports and Exercise. 2015: 47, 1295–1300. https://doi.org/10.1249/MSS 0000000000000517
25. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. (2008). Emerging adulthood and college-aged youth: An overlooked age for weight-related behavior change. Obesity. 2008: 16, 2205–2211. https://doi.org/10.1038/oby.2008.365
26. Peterson NE, Sirard JR, Kulbok PA, DeBoer MD, Erickson JM. Sedentary behavior and physical activity of young adult university students. Research in nursing & health. 2018: 41(1), 30–38. https://doi.org/10.1002/nur.21845
27. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. Int J Surg. 2014; 12(12): 1495-9.
28. Mead N, Bower P, Roland M. The General Practice Assessment Questionnaire (GPAQ)- development and psychometric characteristics. BMC Fam Pract. 2008: 20; 9: 13.
29. Aguilar-Farías N, Leppe Zamora J. Is a single question of the Global Physical Activity Questionnaire (GPAQ) valid for measuring sedentary behaviour in the Chilean population? J Sports Sci. 2017 Aug; 35(16): 1652-7.
30. Feskanich D, Rockett HR, Colditz GA. Modifying the Healthy Eating Index to assess diet quality in children and adolescents. J Am Diet Assoc. 2004; 104(9): 1375-83.
31. WHO. (2015). Preventing and managing the global epidemic of obesity. WHO. World Health Organization.
32. Mukaka MM. Statistics corner: A guide to appropriate use of correlation coefficient in medical research. Malawi Med J. 2012; 24(3): 69-71.
33. Deforche B, Van Dyck D, Deliens T, De Bourdeaudhuij I. Changes in weight, physical activity, sedentary behaviour and dietary intake during the transition to higher education: a prospective study. Int J Behav Nutr Phys Act. 2015; 12(1): 16.
34. Miller J, Nelson T, Barr-Anderson DJ, Christoph MJ, Winkler M, Neumark-Sztainer D. Life events and longitudinal effects on physical activity: adolescence to adulthood. Med Sci Sports Exerc. 2019;51(4): 663-70
35. Suwalska J, Kolasińska K, Łojko D, Bogdański P. Eating Behaviors, Depressive Symptoms and Lifestyle in University Students in Poland. Nutrients. 2022 Mar 6; 14(5): 1106.
36. United Nations System Standing Committee on Nutrition. The COVID-19 pandemic is disrupting people's food environments: A resource list on Food Systems and Nutrition responses. 2021. https://www.unscn.org/en/news-events/recent-news?idnews=2039
37. Grier SA, Kumanyika SK. The context for choice: Health implications of targeted food and beverage marketing to African Americans. Am J Public Health. 2008; 98: 1616-29.
38. Beltrán M del PD, Romero YMH. Healthy eating and restaurants. A review of recent evidence in the literature. Cien Saude Colet. 2019; 24: 853-64.
39. Alakaam A, Willyard A. Eating habits and dietary acculturation effects among international college students in the United States. AIMS Public Health 2020; 7: 228-40.
40. Mensah FZ, Lane KE, Richardson LD. Determinants of eating behaviour in Black, Asian and Minority Ethnic (BAME) university students when living at and away from home: With a focus on the influence of food enculturation and food acculturation. Appetite 2022; 171: 105932.
41. Vella-Zarb RA, Elgar FJ. The "freshman 5": a meta-analysis of weight gain in the freshman year of college. J Am Coll Health. 2009; 58 (2): 161-6.
42. Vadeboncoeur C, Townsend N, Foster C. A meta-analysis of weight gain in first year university students: is freshman 15 a myth? BMC Obes. 2015; 2(1): 22.
43. Deliens T, Deforche B, De Bourdeaudhuij I, Clarys P. Changes in weight, body composition and physical fitness after 1.5 years at university. Eur J Clin Nutr. 2015;

69(12): 1318-22.
44. Finlayson G, Cecil J, Higgs S, Hill A, Hetherington M. Susceptibility to weight gain. Eating behaviour traits and physical activity as predictors of weight gain during the first year of university. Appetite. 2012 Jun; 58(3): 1091-8.
45. Arzu D, Tuzun EH, Eker L. Perceived barriers to physical activity in university students. Journal of Sports Science & Medicine. 2006. 5, 615-20.
46. Ashton LM, Hutchesson MJ, Rollo ME, Morgan PJ, Thompson DI, Collins CE. Young adult males' motivators and perceived barriers towards eating healthily and being active: a qualitative study. The international journal of behavioral nutrition and physical activity. 2015 12, 93.
47. Romero-Corral A, Somers VK, Sierra-Johnson J, et al. Accuracy of bodymass index in diagnosing obesity in the adult general population. Intl. J. Obes. 2008. 32, 959–66.
48. Nordestgaard BG, Palmer TM, Benn M, Zacho J, Tybjærg Hansen A, Smith GD, Timpson NJ. The effect of elevated body mass index on ischemic heart disease risk: causal estimates from a mendelian randomization approach. PLoS Med. 2012: 9(5): e1001212.
49. Coppola A, Sasso L, Bagnasco A, Giustina A, Gazzaruso C. The role of patient education in the prevention and management of type 2 diabetes: an overview. Endocrine. 2016 Jul; 53(1): 18-27.
50. Atakan MM, Koşar ŞN, Güzel Y, Tin HT, Yan X. The Role of Exercise, Diet, and Cytokines in Preventing Obesity and Improving Adipose Tissue. Nutrients. 2021 Apr 25; 13(5): 1459.