






Consumption of ultra-processed food and its association with obesity in Chilean university students: A multi-center study

Ultra-processed food and obesity in Chilean university students

Samuel Durán-Agüero, PhD^a , Pablo Valdés-Badilla, PhD^{b,c} , Macarena Valladares, PhD^d ,
Valentina Espinoza, MSc^e, Francisco Mena, MSc^f, Gloria Oñate, MSc^g, Macarena Fernandez, MSc^g,
Andres Godoy-Cumillaf, MSc^h  and Mirta Crovetto, PhD 

^aFacultad de Ciencias para el Cuidado de la Salud, Universidad San Sebastián, Sede Los Leones, Chile; ^bDepartment of Physical Activity Sciences, Faculty of Education Sciences, Universidad Católica del Maule, Talca, Chile; ^cCarrera de Entrenador Deportivo, Escuela de Educación, Universidad Viña del Mar, Viña del Mar, Chile; ^dCentro Integrativo de Biología y Química Aplicada (CIBQA), Universidad Bernardo ÓHiggins, Santiago, Chile; ^eDepartamento de Procesos Diagnósticos y Evaluación, Facultad de Ciencias de la Salud, Universidad Católica de Temuco, Temuco, Chile; ^fEstudiante Doctorado en Nutrición y Alimentos, Universidad de Chile, Santiago, Chile; ^gCarrera Nutrición y Dietética, Universidad Autónoma de Chile, Santiago, Chile; ^hPedagogía en Educación Física, Facultad de Educación, Universidad Autónoma de Chile, Santiago, Chile; ⁱCentro de Estudios Avanzados, Facultad de Ciencias de la Salud, Universidad Playa Ancha, Valparaíso, Chile

ABSTRACT

Objective: To explore the associations between the consumption of three categories of ultra-processed food (sugary beverages, sweet, and salty snacks) and body mass index (BMI) among Chilean university students. **Methods:** We conducted a multi-center, descriptive study among 2,039 students from 6 Chilean universities. Food consumption was surveyed using a validate food survey. That height and body weight were objectively measured to calculate BMI for determining weight status, and also, tobacco use and physical activity were measured. **Results:** An intake equal to or higher than 1 serving of sugary beverage a day was associated with greater odds of obesity in university students (OR:1.32 [95% CI: 1.00, 1.74]), 2 servings/day (OR: 1.30 [95% CI: 1.04, 1.50]), and 3 servings/day (OR: 1.39 [95% CI: 1.05, 1.80]). Neither consumption of sweet nor salty snacks (≥ 1 servings/day) related to differential odds of obesity: (OR: 0.83 [95% CI: 0.42, 1.64]) and (OR: 1.79 [95% CI: 0.93, 3.41]), respectively. **Conclusion:** In a sample of Chilean university students, consumption of sugary beverages, and not consumption of sweet or salty snacks, was associated with obesity.

ARTICLE HISTORY

Received 8 May 2019
Revised 7 July 2021
Accepted 6 August 2021

KEYWORDS

Obesity;
snacks;
sugary beverages;
ultra-processed;
university students

Introduction

Obesity is a global problem; 1,900 million people worldwide are overweight and 650 million are obese.¹ This increasing issue is also affecting a particular group of the population: university students. In Chile, the country with the highest prevalence of obesity among countries of the Organization for Economic Co-operation and Development (OCDE),² obesity has been steadily increasing among all age groups in the last decade.^{3,4} In the 20 to 29 years old age group, 24.6% are obese and 35.8% are overweight (60.4%)⁴ – up from 25.1% and 8.7%, respectively, reported in the 2010 National Health Survey.³

One of the multiple factors contributing to the obesity is excessive caloric intake, especially calories coming from ultra-processed foods (UPFs). These foods are defined as "industrial formulations elaborated from substances derived from food or synthesized from other organic sources."⁵ UPFs are highly manipulated industrial products that contain few-to-no whole foods, have a high-energy value, are high

in saturated fats, sodium, and added sugars, and are easy-to-serve due to the minimal cooking needed.⁵ Several studies have shown that the intake of UPF is associated with a higher obesity risk in all age groups.^{6–11} However, UPF consumption, especially among children and adolescents, is controversial in various countries, which has led to an intensification of government campaigns and labeling regulations aimed to reduce consumption.^{12–14} Chile is listed as one of the major consumers of UPF, being ranked seventh worldwide.⁵ In addition, a study that analyzed the last National Food Survey (2010) mentioned that the highest consumption occurred among the youngest participants (aged 18 to 39).^{3,4}

Undergraduate students are considered a high-risk group for overweight/obesity, since they often have irregular meal schedules, skip breakfast, and have a low intake of fruits and vegetables.^{15,16} These same factors make them prone to consume UPF, because of the wide availability, low cost, and flavor of UPF. Some authors have considered UPF flavors to be addictive.^{17,18} University students might consume UPF for several reasons, such as: i) food advertising

targeting young consumers;^{19,20} ii) class schedules and long study hours, that make it difficult to establish meal schedules;²¹⁻²³ iii) a limited budget that reduces the possibilities of choosing healthy food; iv) the availability of vending machines at university facilities and street food in the areas surrounding the university;²⁴⁻²⁶ and v) living far from the family home, which may negatively impact the consumption of home-cooked meals.²⁷⁻³⁰ In this respect, it is necessary that governmental institutions engage in remedial actions that promote healthy eating among all population groups, providing universities with the instruments to facilitate nutrition education to contribute to the comprehensive training of professionals.

The relationship between UPF consumption and weight status among Chilean university students is still unknown. In this regard, the aim of this study was to explore associations between the consumption of three categories of UPFs (sugary beverages, sweet, and salty snacks) and BMI of Chilean university students.

Methods

This was a multi-center, observational, descriptive study. The sample consisted of 2,039 students from higher education institutions located in different geographical regions (Northern, Central, and Southern Chile). The following universities participated: Universidad de Antofagasta (Antofagasta; $n=206$); Universidad de Playa Ancha (Valparaíso; $n=155$); Universidad San Sebastián (Santiago; $n=634$); Universidad Bernardo O'Higgins (Santiago; $n=135$); Universidad Autónoma de Chile (with campuses in Temuco and Santiago; $n=790$); and Universidad Católica de Temuco (Temuco; $n=119$). Students were invited to participate in the study through the institution's social networks, of which 1,947 complete all forms. All the participants were informed of the scope of the investigation and signed an informed consent form that authorized the use of the information for scientific purposes. This research was developed according to the guidelines of the Declaration of Helsinki regarding research involving human subjects and it was approved by the Ethics Committee of the Universidad Católica de Temuco.

Assessment of UPF consumption

University students answered questions from a previously validated eating habits survey.³¹ The survey consists of two parts: consumption of healthy (nine questions) and unhealthy foods (six questions). The two parts are scored using a Likert-type scale ranging from one to five points. In this study, three questions about unhealthy foods were used to evaluate the intake of sugary beverages, sweet, and salty snacks: Do you consume sugary beverages or juices? (serving: 200 cc glass): a) Do not consume, b) Less than once a day, c) one serving a day, d) two servings a day, e) three servings a day; Do you consume salty snacks like: pizza, potato chips, sopaipillas (a deep-fried pastry), Doritos?: a) Do not consume, b) Less than once a day, c) one serving

a day, d) two servings a day, e) three servings a day; Do you consume cookies or sweet snacks?: a) Do not consume, b) Less than once a day, c) one serving a day, d) two servings a day, e) three servings a day.

Assessment of BMI

An anthropometric evaluation was carried out to measure body weight in kilos and height in meters. Students wore light clothing and were weighed using a mechanical scale (SECA, Spain) with a maximum capacity of 220 kg and an accuracy of 50 g. Height was measured using a measuring rod integrated into the scale (SECA, Spain). BMI was calculated dividing body weight by the squared value of height (kg/m^2). Participants were classified, according to their weight status as: healthy weight ($\leq 24.9 \text{ kg}/\text{m}^2$), overweight (25.0 to $29.9 \text{ kg}/\text{m}^2$), and obese ($\geq 30 \text{ kg}/\text{m}^2$), according to the criteria of the World Health Organization.³² Only three students presented a BMI <18.5 and were classified as healthy weight.

The application of the survey and the assessment of BMI were performed by nutritionists and researchers trained on the application of measurement protocols. Physical activity was self-reported and classified as follows: i) performs <30 min of physical activity a week (physically inactive); ii) performs between 30 and 149 min per week (insufficiently active); and iii) performs ≥ 150 min of moderate or >75 min of vigorous physical activity per week (physically active). Regarding tobacco use, students reported current tobacco use (yes/no).

Statistical analysis

Data tabulation was performed using Microsoft Excel 7.0. Arithmetic mean and standard deviation were calculated for quantitative variables, as well as absolute and relative frequencies for categorical variables. The Kolmogorov-Smirnov test was carried out to determine normality and the Pearson correlation test was used to assess the relationship between body weight, BMI, and age with the frequency of consumption of UPF. The chi-squared test was used to establish differences in proportions (qualitative variables). To analyze the factors associated with BMI, a logistic regression model was used and the results were expressed as odds ratio (OR) with 95% confidence intervals. The dependent variable was obesity and the independent variables of interest were intake of sugary beverages, sweet, and salty snacks. All models adjusted for age, sex, physical activity level, and tobacco use. The level of statistical significance was $\alpha < 0.05$. Data were statistically processed using SPSS Statistics 22.0 software package.

Results

A total of 1,947 students (22% male) were on average: 21.6 ± 7.4 years of age, weighed 64.9 ± 11.5 kg, were 1.64 ± 0.08 m height, and had a BMI of $23.6 \pm 3.0 \text{ kg}/\text{m}^2$

Table 1. Sample characteristics ($n=1,947$).

	Mean (SD)	Minimum	Maximum
Age (years)	21.4 (2.7)	18	39
Body weight (kg)	64.9 (11.5)	40	120
Height (m)	1.64 (0.1)	1.45	1.95
BMI (kg/ m ²)	23.6 (3.0)	16.2	38.7
Weight status	N (%)		
Normal	1453 (74.6%)		
Overweight	424 (21.8%)		
Obese	70 (3.6%)		
Physical activity			
Physically inactive	370 (19%)		
Insufficiently active	1361 (69.9%)		
Physically active	216 (11.1%)		
Current smoker			
Yes	574 (29.5%)		
No	1373 (70.5%)		

SD: Standard deviation; BMI: body mass index.

(Table 1). Most students (74.6%) had a healthy weight, 21.8% were overweight, and 3.6% obese. Nearly, a third of students (29.5%) consumed tobacco and 88.9% were inactive/insufficiently active.

Figure 1A shows the frequency of sugary beverage consumption. Almost 50% of the students reported an intake of 1 or more glasses of sugary beverages a day and 10% had an intake of three or more glasses a day, with no differences by BMI. Figure 1B shows the frequency of consumption of salty snacks; almost 20% of students consumed one or more servings of this food per day, with no differences by BMI. Figure 1C shows the frequency of consumption for sweet snacks; almost 40% of students consumed this food on a daily basis, no differences by BMI.

Sugary beverages were positively correlated with body weight, BMI, and age (Table 2). Salty snacks were positively correlated with body weight and negatively correlated with age, while sweet snacks were only negatively correlated with age.

Table 3 shows the final logistic regression model between UPF and BMI. Intake of one serving a day of sugary beverages was associated with higher odds of obesity among the evaluated students: OR: 1.32 (95% CI: 1.00–1.74), two servings a day of sugary beverages (OR: 1.30 [95% CI: 1.04, 1.50]), and three servings a day of sugary beverages (OR: 1.39 [95% CI: 1.05, 1.80]). Neither intake of sweet nor salty snacks did were significantly related to differential odds of obesity.

Comments

The main result of the study indicates that in a large sample of Chilean university students an intake equal to or higher than a glass of sugary beverage per day was associated with obesity. However, consumption of sweet or salty snacks was not. In addition, students assessed showed a high consumption of sugary beverages, regardless of their BMI.

Chile ranks first in the world for the consumption of sugary beverages³³ and seventh with respect to UPF consumption.⁵ According to a study that analyzed the latest Chilean National Health Survey, UPF represents 28.6% of total energy intake and 58.6% of added sugar intake.³³ In addition, sugary beverages are the main contributor of

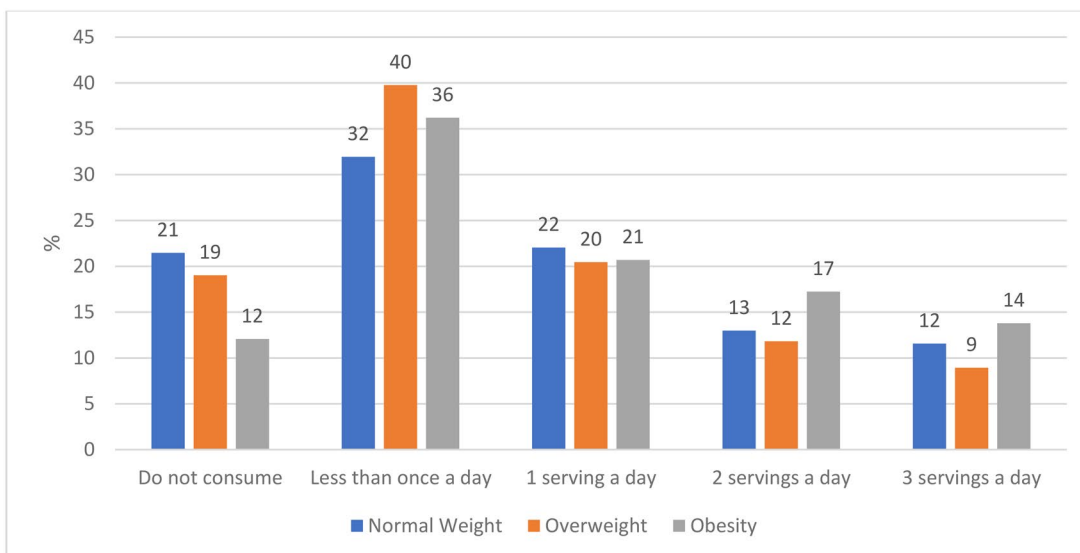
sugar in Chilean diets. High consumption of these foods has been associated not only with obesity, but also with a greater risk of developing cancer³⁴ and cardiovascular disease;^{35,36} this fact might be related to adiposity increase.³⁷ In addition, these foods are readily available, have a low cost,³⁸ and are widely publicized in the media, attracting the attention of children and youths who are sensitive to large-scale publicity campaigns.³⁹ UPF are products of high-energy density because they are made up of large proportions of added sugars and saturated fats, and, in some cases, have a low proportion of water (foods with higher crunchiness). Therefore, these foods are very attractive to the senses, have a low cost, and are widely available and many of them are available in large sizes, promoting weight gain.^{40–48}

The results of this study are partially in line with the current literature, which shows the association of UPF with weight gain.¹⁰ Nevertheless, previous studies carried out in Chile involving students of Physical Education and Sport Pedagogy³¹ and young soldiers⁴³ do not follow this trend, probably, because of their physical activity habits that put them in the category of physically active.⁴⁴ Additionally, a cohort study conducted among Brazilian adolescents shows that UPF consumption is a marker of an unhealthy diet, but did not show an association between UPF consumption and an increase in BMI.⁴⁵

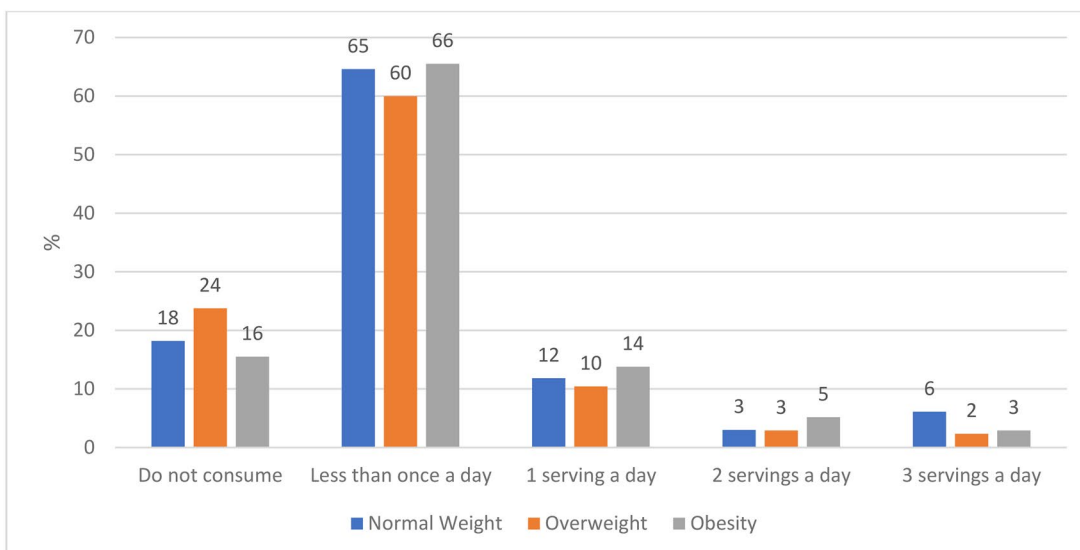
It is interesting to note that, according to the results obtained, only sugary beverages consumption was associated with obesity, while we did not observe a significant association with sweet and salty snack consumption. The variety of products considered snacks (both sweet and salty) is likely to make it difficult for participants to answer surveys (because of the different calorie densities and intake volumes). Thus, students may have under- or over-estimated snacks consumption. On the other hand, quantifying sugary beverages consumption is relatively easy since the measurement format is well known (glasses/bottles/cans), making it simpler to keep a record, because the interviewer adapted the measurement indicated by the interviewed to the reference serving size.

Chile has enforced food labeling regulations that allow consumers to identify the high presence of critical nutrients, those found often in UPF.¹⁴ At present, diverse countries are adopting similar mandatory systems of front labeling, for example, Peru, Ecuador, and Uruguay, or optional labeling that occurs in many European countries. This additional information could help university students choose healthier foods. New requirements have led the industry to reformulate products to reduce calories, saturated fat, sugar, and sodium.⁴⁹ This strategy is expected to have a medium- to long-term impact on the population's buying and eating behaviors, especially among those who are more likely to consume UPF, such as children and youth. Besides potentially promoting the development of obesity, a diet rich in UPF might alter the microbiota,⁴⁷ leading to intestinal dysbiosis. This alteration may favor the development of chronic diseases, which is a different mechanism than one associated with adiposity increase.^{46,47}

(a) Sugary beverages



(b) Salty snacks



(c) Sweet snacks

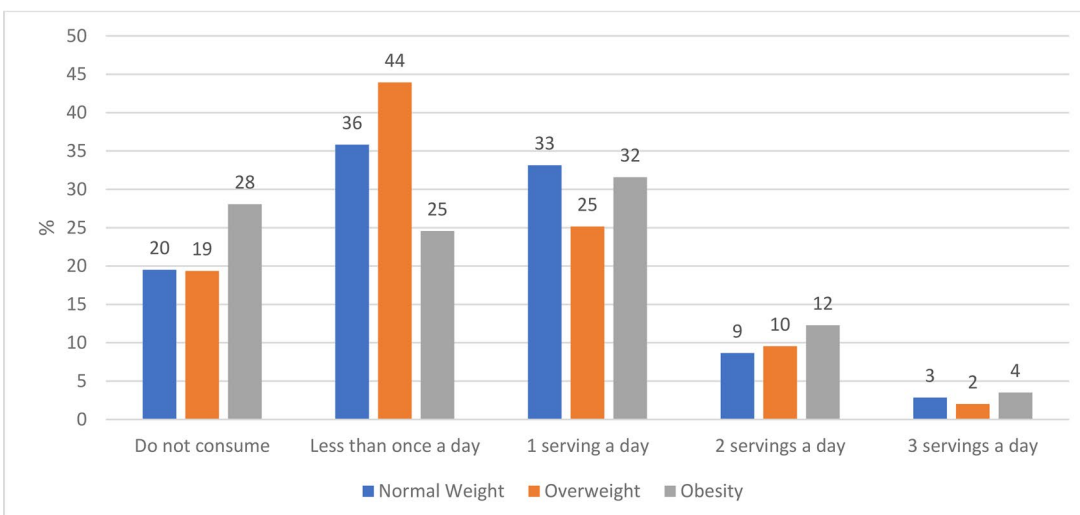


Figure 1. Frequency of consumption of ultra-processed foods according to weight status (%).

Table 2. Correlation of body weight, BMI, and age with the frequency of consumption of ultra-processed foods in Chilean university students.

(n = 1,947)	Sugary beverages	Salty snacks	Sweet snacks
Body weight (kg)	$r = 0.18^{**}$	$r = 0.08^*$	$r = -0.02$
BMI (kg/ m ²)	$r = 0.06^*$	$r = 0.02$	$r = -0.03$
Age (years)	$r = -0.08^*$	$r = -0.08^*$	$r = -0.06^*$

BMI: Body mass index. Pearson's correlation coefficient.

*: <0.05;

** : <0.01.

Table 3. Association of ultra-processed food consumption with obesity status among Chilean university students.

	OR	95% CI	p value
Sugary beverages (Reference = no intake)	1		
Sugary beverages (less than once a day)	0.685	0.476 - 0.986	.085
Sugary beverages (one serving a day)	1.321	1.000 - 1.744	.049
Sugary beverages (two servings a day)	1.303	1.045 - 1.502	.045
Sugary beverages (three servings a day)	1.396	1.055 - 1.806	.042
Salty snacks (Reference = no intake)	1		
Salty snacks (less than once a day)	1.577	0.866 - 3.211	.087
Salty snacks (one serving a day)	1.790	0.937 - 3.418	.078
Salty snacks (two servings a day)	1.770	0.920 - 3.412	.076
Salty snacks (three servings a day)	1.810	0.950 - 3.552	.067
Sweet snacks (Reference = no intake)	1		
Sweet snacks (less than once a day)	0.977	0.730 - 1.308	.274
Sweet snacks (one serving a day)	0.863	0.426 - 1.640	.162
Sweet snacks (two servings a day)	0.743	0.337 - 1.462	.393
Sweet snacks (three servings a day)	1.029	0.674 - 1.572	.410

Adjusted for age, sex, physical activity level, and tobacco consumption.

Among the strengths of this research we can point out the application of a validated survey designed for university students; the contribution of data about the association of UPFs with BMI, which was previously unknown, and the number of participants who come from different geographical regions of Chile.

Limitations

The primary weaknesses include the study design, which prohibits establishing a causal relationship, and having a non-representative sample, which makes extrapolation to the larger university population difficult. In addition, the self-reported nature of UPF intake, and low recruitment of overweight and obese students, reduces external validity. Finally, the study design did not allow us to determine the impact of calories and nutrients such as fats and sucrose.

Future research should include the analysis of dietary habits over time, as well as the development of interventions capable of demonstrating the implications of UPF on the weight status.

Conclusions

High consumption of sugary beverages was associated with obesity in Chilean university students evaluated, while the consumption of sweet and salty snacks did not have a significant impact on their BMI. We also observed a positive correlation between the consumption of sugary beverages with body weight and BMI, and between salty snacks with body weight, while there was a negative correlation between sugary beverages, sweet, and salty snacks with age. Higher education institutions need to promote the healthier environments. For example, they may start by restricting the sale of sugary beverages, educating students about diet and encouraging physical activity through complementary courses, as the university period should contribute to comprehensive training of students.

Author contributions

SDA and PVB designed the study, carried it out, analyzed the data, and wrote the article; SDA, PVB, MC, VE, FM, GO, MF, AGC, and MC carried it out, analyzed the data, and wrote the article.

Conflict of interest disclosure

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Universidad Católica de Temuco of the ethics committee. Written informed consent was obtained from all participants.

Funding

No funding was used to support this research and/or the preparation of the manuscript.

ORCID

Samuel Durán Agüero  <http://orcid.org/0000-0002-0548-3676>

Pablo Valdes-Badilla  <http://orcid.org/0000-0002-3948-8280>

Macarena Valladares  <http://orcid.org/0000-0001-6967-997X>

Andres Godoy  <http://orcid.org/0000-0001-8613-6838>

Mirta Crovetto  <http://orcid.org/0000-0003-4724-4099>

References

1. Obesity and overweight. Available at: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>. Accessed April 4, 2021
2. Overweight or obese population. Organisation for Economic Co-operation and Development (OECD) Available at: <https://data.oecd.org/healthrisk/overweight-or-obese-population.htm> Updated. Accessed December 8, 2018.

3. Encuesta Nacional de Salud 2009-2010 [National Health Survey], Chile. Available at: <http://www.minsal.cl/portal/url/item/bcb03d-7bc28b64dfe040010165012d23.pdf>. Updated December 11, 2010. Accessed September 4, 2018.
4. ENCUESTA NACIONAL DE SALUD 2016-2017 Primeros resultados [National Health Survey 2016-2017, First results]. Available at: http://www.minsal.cl/wp-content/uploads/2017/11/ENS-2016-17_PRIMEROS-RESULTADOS.pdf. Updated November 1, 2017. Accessed August 30, 2018.
5. Pan American Health Organization. Ultra-processed Food and Drink Products in Latin America: Trends, Impact on Obesity, Policy Implications. Washington, DC: Pan American Health Organization; 2015. Available at: <https://www.paho.org/hq/dm-documents/2014/alimentos-bebidas-ultra-procesados-ops-e-obesidad-america-latina-2014.pdf>. Updated November 2014. Accessed July 19, 2018.
6. Juul F, Martinez-Steele E, Parekh N, Monteiro CA, Chang VW. Ultra-processed food consumption and excess weight among US adults. *Br J Nutr*. 2018;120(1):90–100. doi:10.1017/S0007114518001046.
7. Silva FM, Giatti L, de Figueiredo RC, et al. Consumption of ultra-processed food and obesity: cross sectional results from the Brazilian Longitudinal Study of Adult Health (ELSA-Brasil) cohort (2008-2010). *Public Health Nutr*. 2018;21(12):2271–2279. doi:10.1017/S1368980018000861.
8. Rohatgi KW, Tinus RA, Cade WT, Steele EM, Cahill AG, Parra DC. Relationships between consumption of ultra-processed foods, gestational weight gain and neonatal outcomes in a sample of US pregnant women. *PeerJ*. 2017;5:e4091. doi:10.7717/peerj.4091.
9. Melo ISV, Costa CACB, Santos JVL, Santos AFD, Florêncio TMMT, Bueno NB. Consumption of minimally processed food is inversely associated with excess weight in adolescents living in an underdeveloped city. *PLoS One*. 2017;12(11):e0188401. doi:10.1371/journal.pone.0188401.
10. Monteiro CA, Moubarac JC, Levy RB, Canella DS, Louzada MLDC, Cannon G. Household availability of ultra-processed foods and obesity in nineteen European countries. *Public Health Nutr*. 2018;21(1):18–26. doi:10.1017/S1368980017001379.
11. Costa CS, Del-Ponte B, Assunção MCF, Santos IS. Consumption of ultra-processed foods and body fat during childhood and adolescence: a systematic review. *Public Health Nutr*. 2018; 21(1):148–159. doi:10.1017/S1368980017001331.
12. Poder Ejecutivo emitió decreto y proyecto de ley sobre rotulado frontal de alimentos envasados. Uruguay. Available at: <http://www.msp.gub.uy/noticia/poder-ejecutivo-emiti%C3%B3-decret-o-y-proyecto-de-ley-sobre-rotulado-frontal-de-alimentos>. Updated March 21, 2018. Accessed March 20, 2019.
13. Ley 20606 [Regulation 20606], Chile. Ministerio de Salud - Gobierno de Chile. Ley núm. 20.606 sobre composición nutricional de los alimentos y su publicidad. 2012. Available at: <http://bcn.cl/luxwz>. Updated November 13, 2015. Accessed March 20, 2019.
14. Decreto Supremo que aprueba el Reglamento de la Ley N° 30021, Ley de Promoción de la Alimentación Saludable. Perú. Available at: <https://busquedas.elperuano.pe/normaslegales/decreto-supremo-que-aprueba-el-reglamento-de-la-ley-n-30021-decreto-supremo-n-017-2017-sa-1534348-4/>. Updated November 1, 2017. Accessed May 2, 2019.
15. Croveto M, Valladares M, Espinoza V, et al. Effect of healthy and unhealthy habits on obesity: a multicentric study. *Nutrition* 2018;54:7–11. doi:10.1016/j.nut.2018.02.003.
16. Durán Agüero S, Fernández Godoy E, Fuentes Fuentes J, et al. [FOOD PATTERNS ASSOCIATED WITH A HEALTHY BODY WEIGHT IN CHILEAN STUDENTS OF NUTRITION AND DIETETICS]. *Nutr Hosp*. 2015;32(4):1780–1785. doi:10.3305/nh.2015.32.4.9515.
17. Nieto-Orozco A, Chanin Sangochiana A, Tamborrel Signoreta N, Vidal González E, Tolentino-Mayo L, Vergara-Castaneda A. Perception about the consumption of processed foods and ultra-processed products in postgraduate students in Mexico City. *JBHS&R*. 2017;9:82–88. doi:10.1016/j.jbhsi.2018.01.006.
18. Valladares M, Durán E, Matheus A, Durán-Agüero S, Obregón AM, Ramírez-Tagle R. Association between eating behavior and academic performance in university students. *J Am Coll Nutr*. 2016;35(8):699–703. PMID: 27736367. doi:10.1080/07315724.2016.1157526.
19. Lapierre MA, Fleming-Milici F, Rozendaal E, McAlister AR, Castonguay J. The effect of advertising on children and adolescents. *Pediatrics*. 2017;140(Suppl 2):S152–S156. doi:10.1542/peds.2016-1758V.
20. Britto SR, Viebig RF, Morimoto JM. Analysis of food advertisements on cable television directed to children based on the food guide for the Brazilian population and current legislation. *Rev Nutr*. 2016;29(5):721–729. doi:10.1590/1678-98652016000500010.
21. Concha C, González G, Piñuñuri R, Valenzuela C. Relationship between feeding schedule, nutritional composition of breakfast and nutritional status among university students in Valparaíso, Chile. *Rev Chil Nutr*. 2019;46(4):400–408. doi:10.4067/S0717-75182019000400400.
22. Doepking C, Zuñiga C, Troncoso C. Qualitative study on college student's perceptions on lunch. *Medwave*. 2013;13(02):e5638–e5638. doi:10.5867/medwave.2013.02.5638.
23. Alzubaidi AH, Togoo RA, Alqahtani GA, Alkahtani LA, Alshehri NY, Soliman AEM. A descriptive study on dietary pattern and biophysical profile among Saudi female dental students. *Int J Adolesc Med Health*. 2020. Online ahead of print.
24. Park H, Papadaki A. Nutritional value of foods sold in vending machines in a UK University: formative, cross-sectional research to inform an environmental intervention. *Appetite*. 2016;96: 517–525. doi:10.1016/j.appet.2015.10.022.
25. Matthews MA, Horacek TM. Vending machine assessment methodology. A systematic review. *Appetite*. 2015;90:176–186. PMID: 25772195 doi:10.1016/j.appet.2015.03.007.
26. Durán-Agüero S, Arboleda LM, Velásquez Vargas JE, et al. Caracterización del consumo de comida callejera según edad, estudio multicéntrico. *Rev Esp Nutr Hum Diet*. 2018;22(3): 243–250. doi:10.14306/renhyd.22.3.554.
27. Anigstein MS. Nutritional habits of Chilean university students in the context of alimentary modernity. *Rev Chil Nutr*. 2013;40(3):243–249. doi:10.4067/S0717-75182013000300005.
28. Ratner R, Hernández P, Martel J, Atalah E. Calidad de la alimentación y estado nutricional en estudiantes universitarios de 11 regiones de Chile. *Rev Med Chile*. 2012;140(12):1571–1579.
29. Troncoso C, Amaya JP. Factores sociales en las conductas alimentarias de estudiantes universitarios. *Rev Chil Nutr*. 2009;36(4):1090–1097.
30. Oltra Tormo-Santamaria CL. M. Cambios generacionales en las pautas de consumo alimentario de los alumnos universitarios. Universidad de Alicante. 2003-2018. *Nutr Clín Diet Hosp*. 2019;39(3):115–123. doi:10.12873/393catala.
31. Durán S, Valdés P, Godoy A, Herrera T. Eating habits and physical condition of physical education students. *Rev Chil Nutr*. 2014;41:251–259.
32. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO Consultation. Geneva: World Health Organization; 2000. Available at: http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/. Updated March 1, 2004. Accessed March 15, 2019.
33. Popkin BM, Hawkes C. Sweetening of the global diet, particularly beverages: patterns, trends, and policy responses. *Lancet Diabetes Endocrinol*. 2016;4(2):174–186. doi:10.1016/S2213-8587(15)00419-2.
34. Fiolet T, Srouf B, Sellem L, et al. Consumption of ultra-processed foods and cancer risk: results from NutriNet-Santé prospective cohort. *BMJ*. 2018;360:k322. doi:10.1136/bmj.k322.PMID: 29444771.
35. Moreira PV, Hyseni L, Moubarac J-C, et al. Effects of reducing processed culinary ingredients and ultra-processed foods in the Brazilian diet: a cardiovascular modelling study. *Public Health Nutr*. 2018;21(1):181–188. doi:10.1017/S1368980017002063.

36. Gibney MJ, Forde CG, Mullally D, Gibney ER. Ultra-processed foods in human health: a critical appraisal. *Am J Clin Nutr*. 2017;106(3):717–483. doi:10.3945/ajcn.117.160440.
37. Nakamura K, Fuster JJ, Walsh K. Adipokines: a link between obesity and cardiovascular disease. *J Cardiol*. 2014;63(4):250–259. PMID: 24355497.
38. Monteiro CA, Moubarac JC, Cannon G, Ng SW, Popkin B. Ultra-processed products are becoming dominant in the global food system. *Obes Rev*. 2013;14 Suppl 2(suppl 2):21–28. doi:10.1111/obr.12107.
39. Boyland EJ, Whalen R. Food advertising to children and its effects on diet: review of recent prevalence and impact data. *Pediatr Diabetes*. 2015;16(5):331–337. doi:10.1111/pedi.12278.
40. Drewnowski A. Nutrient density: addressing the challenge of obesity. *Br J Nutr*. 2018;120(s1):S8–S14. doi:10.1017/S0007114517002240.
41. Drewnowski A, Specter SE. Poverty and obesity: the role of energy density and energy costs. *Am J Clin Nutr*. 2004;79(1):6–16. PMID: 14684391. doi:10.1093/ajcn/79.1.6.
42. Darmon N, Drewnowski A. Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: a systematic review and analysis. *Nutr Rev*. 2015;73(10):643–660. PMID: 26307238. doi:10.1093/nutrit/nuv027.
43. Durán Agüero S, Maraboli Ulloa D, Cubillos Schmied G, Fernández-Frías F. Asociación entre hábitos alimentarios e índice de masa corporal normal en soldados chilenos. *Rev Esp Nutr Hum Diet*. 2016;20(4):316–332. doi:10.14306/renhyd.20.4.265.
44. Garber CE, Blissmer B, Deschenes MR, American College of Sports Medicine, et al. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc*. 2011;43(7):1334–1359. PMID: 21694556 doi:10.1249/MSS.0b013e318213fefb.
45. Cunha DB, da Costa THM, da Veiga GV, Pereira RA, Sichieri R. Ultra-processed food consumption and adiposity trajectories in a Brazilian cohort of adolescents: ELANA study. *Nutr Diabetes*. 2018;8(1):28. PMID: 29795367. doi:10.1038/s41387-018-0043-z.
46. Chassaing B, Van de Wiele T, Gewirtz A. Dietary emulsifiers directly impact the human gut microbiota increasing its pro-inflammatory potential and ability to induce intestinal inflammation. *Inflamm Intestest Dis*. 2017;23(suppl. 1):S5–S5.
47. Zinöcker MK, Lindseth IA. The western diet-microbiome-host interaction and its role in metabolic disease. *Nutrients*. 2018;10(3):E365. PMID: 29562591. doi:10.3390/nu10030365.
48. Aguayo-Patrón SV, Calderón de la Barca AM. Old fashioned vs. ultra-processed-based current diets: possible implication in the increased susceptibility to type 1 diabetes and celiac disease in childhood. *Foods*. 2017;6:E100. PMID: 29140275. doi:10.3390/foods6110100.
49. Etiquetado: grandes empresas tendrán 50% de sus productos con advertencia, y han reformulado 1.550 alimentos. ABChile. Available at: <http://abchile.cl/index.php?mact=News,cntnt01,detail,0&cntnt01articleid=171&cntnt01returnid=59>. Updated March 23, 2016. Accessed April 02, 2019.