Nutrición Hospitalaria

Nutr Hosp. 2015;31(5):2088-2094
ISSN 0212-1611 • CODEN NUHOEQ
S.V.R. 318

Original/*Síndrome metabólico*

Association between dietary habits and the presence of overweight/obesity in a sample of 21,385 Chilean adolescents

Patricia Lopez-Legarrea[1*], Pedro R. Olivares[2], Alejandro Almonacid-Fierro[2], Rossana Gomez-Campos[2,3], Marco Cossio-Bolaños[4,5] and Javier Garcia-Rubio[6]

[1]Phaculty of Health Sciences, Universidad Autonoma de Chile, Santiago, Chile. [2]Phaculty of Education, Universidad Autonoma de Chile, Talca, Chile. [3]Grupo Interdisciplinar de Estudios e Investigación en Ciencias de la salud y deporte. GEISADE. Universidad Autonoma de Chile, Talca, Chile. [4]Centro de investigación en desarrollo biológico humano. CIDEBIHU. Universidad Católica del Maule, Talca, Chile. [5]Departament of Physical Activiy Science, Universidad Católica del Maule, Talca, Chile. [6]Phaculty of Education, Universidad Autonoma de Chile, Santiago, Chile.

Abstract

Aim: **The main aim of the present study was to explore the potential associations between dietary habits and the presence of overweight and obesity in Chilean adolescents.**

Methods: **For the present study dietary habits of 21,385 Chilean students were analyzed and weight and height assessed, in order to determine potential associations between eating patterns and body mass index (BMI) values.**

Results: **The majority of participants have lunch and a snack in the afternoon every day a week (81% and 71.2%, respectively), although only a 59.5% have breakfast every day and a 22% have dinner every night. To have breakfast is common for thin and normal weight subjects, but only a half of overweight and obese individuals usually have it. The obese is the group having less dairy products. A 50.2% of all subjects have legumes once or never in a week. Around a 15% have sweets all days and nearly a 50% of all the participants consume fizzy drinks every day of the week. Interestingly, having breakfast was found to be associated with less truancy.**

Conclusions: **Nutritional education strategies should be carried out within students in Chile, since inadequate dietary habits are related to the higher values of BMI.**

(*Nutr Hosp*. 2015;31:2088-2094)

DOI:10.3305/nh.2015.31.5.8598

Key Words: Obesity. Dietary habits. Adolescents. Chile.

Correspondencia: Patricia Lopez-Legarrea
Phaculty of Health Sciences. Universidad Autonoma de Chile.
Pedro de Valdivia Av, 641.
7500138. Providencia, Santiago. Chile.
E-mail: patricia.lopez@uautonoma.cl

Recibido: 24-XII-14.
Aceptado: 13-I-15.

ASOCIACIÓN ENTRE LOS HÁBITOS DIETÉTICOS Y LA PRESENCIA DE SOBREPESO/OBESIDAD EN UNA MUESTRA DE 21.385 ADOLESCENTES CHILENOS

Resumen

Objetivos: **El principal objetivo del presente trabajo fue evaluar las posibles asociaciones entre los hábitos dietéticos y la presencia de sobrepeso y obesidad en adolescentes Chilenos.**

Método: **Para este trabajo se analizaron los hábitos dietéticos de 21.385 estudiantes Chilenos y se determinaron el peso y la talla, con el fin de explorar posibles asociaciones entre los patrones de alimentación y los valores de índice de masa corporal (IMC).**

Resultados: **La mayoría de los participantes realiza la toma del almuerzo (81%) y de la merienda (71,2%) todos los días de la semana. Sólo el 59,5% de los encuestados toma desayuno cada día y un 22% cena todas las noches. Desayunar es común entre los sujetos delgados y con peso normal, pero únicamente la mitad de los individuos con sobrepeso u obesidad desayuna habitualmente. Los obesos son el grupo que consume menos productos lácteos. Un 50,2% de todos los participantes nunca toma legumbres o lo hace una vez por semana. En torno a un 15% toma dulces todos los días y casi la mitad de los encuestados ingiere bebidas carbonatadas cada día de la semana. Además, tomar desayuno de forma habitual se asoció inversamente con el absentismo escolar.**

Conclusión: **Se necesitan llevar a cabo estrategias de educación nutricional entre los estudiantes chilenos, ya que los hábitos dietéticos inadecuados se encuentran asociados con valores más elevados de IMC.**

(*Nutr Hosp*. 2015;31:2088-2094)

DOI:10.3305/nh.2015.31.5.8598

Palabras Clave: *Obesidad. Hábitos dietéticos. Adolescentes. Chile.*

Abbreviations

BMI: Body Mass Index.
SIMCE: Chilean National Physical Education Survey.
MINEDUC: Chilean Ministry of Education.

Introduction

Excessive body weight has become a major public health issue worldwide since the pressence of this disturbance has alarmingly increased in the last decades[1]. The global prevalence rates of overweight and obesity among children and adolescents have growed from 4,2% in 1990, to 6,7% in 2010, and this trend is expected to continue in the next years, being estimated in a 9,1% for the year 2020[2]. Similarly, a dramatic increase in the prevalence of overweight and obesity has occurred among children and adolescents in Chile, becoming the country with the highest rates in the Latin America region[3, 4]. This phenomenon represents a challenge for public health, not only because of the associated health problems at the infant age, including both physiological and psychological alterations[5, 6], but also because of the increased morbid-mortality in later life[7].

It is well known that obesity is a multifactorial disorder in which onset biological and genetical factors are implicated. However, although genetics predispose to the disease, lifestyles have been evidenced to play a crucial role in the manifestation and later development of this pathology[8]. Among then, a great deal of recent literature has focused on inadequate eating behaviors, together with sedentary patterns[9]. In this sense, some studies have reported the association between energy intake or macronutrient composition and adiposity[10, 11]. Also, some dietary aspects such as, meal frequency or the variety of the consumed food have been revealed to be associated with body weight, body mass index (BMI) or fat mass, among other indicators of overweight/obesity[12].

It becomes a primary necessity to prevent excessive body weight among young people as an important contributor to the multilevel response to the obesity epidemic. Therefore, it is important to detect which factors are triggering this problem in order to counteract them.

Given the presented scenario, the main aim of this study was to explore the potential associations between dietary habits and the presence of overweight and obesity in Chilean adolescents.

Methods

Sample

Food intake habits, anthropometric characteristics and truancy were evaluated in a sample of 29,745 students attending 8th grade, from every Chilean regions, with the exception of Easter Island, Juan Fernandez archipelago and Antarctica. The students were born between 1996 and 1999. Data were obtained from the 2012 SIMCE (Chilean National Physical Education Survey), carried out by the Chilean Ministry of Education (MINEDUC)[13]. After applying quality criteria, data from 8,360 individuals were excluded and the final simple size considered for the present analyses was n=21,385 (10,526 boys and 10,859 girls; Figure 1).

The test was approved by the Chilean Law of Sport 19,712, article 5. Written informed consent was required from every school prior to testing by MINEDUC. Each school was instructed to inform parents and students with a standardized script about the nature and importance of the tests, the assessment date and time, and how to prepare for the test[4]. Students with temporary illness or injury, special needs, physical disabilities or chronic illness were exempt to take the test. The study authors entered a written data use agreement with MINEDUC fulfilling all ethical safeguards[14].

Anthropometric measurements

Body weight and height were assessed with the subjects in their underwear in accordance with validated protocols[15]. Body weight was measured to the nearest 0.1 kg using a Tanita SC-330, (Tanita corp, Japan). Height was estimated with an aluminum stadiometer (Seca 713 model, Postfach, Germany) to the nearest 1 mm. BMI Values were calculated as the body weight divided by the squared height (kg/m^2). The BMI variable was categorized into thinness, normalweight, overweight and obese according to Cole *et al*. indications[16, 17].

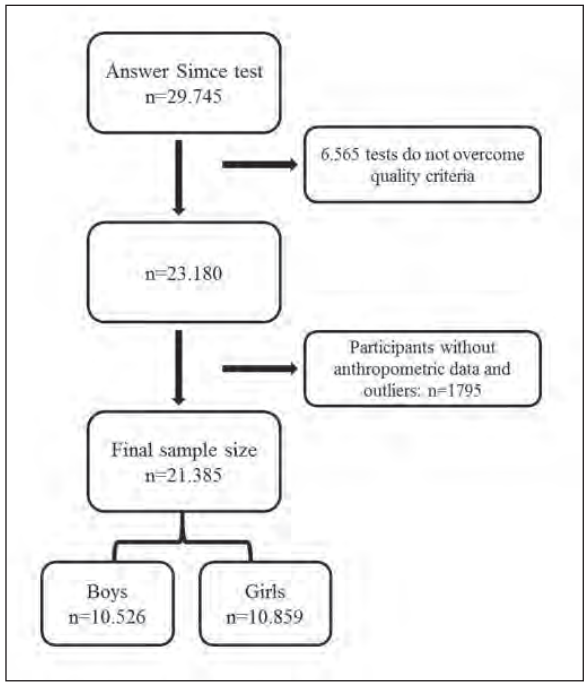

Fig. 1.– Flowchart of the study subjects from the beginning of data collection through to the end of analyses.

Table I
Anthropometric characteristics of the participants, considering the whole sample and categorized by gender

Variable	All (n=21.385)	Boys (n=10.526)	Girls (n=10.859)	p
Age (years old)	14±1	14±1	14±1	-
Weight (kg)	58.87 ±12.08	60.30 ±12.71	57.49±11.26	<0,001
Heigh (cm)	160.85 ±7.74	164.58 ±7.59	157.22 ±5.97	<0,001
BMI (kg/m^2)	22.71 ±4.16	22.19 ±4.11	23.22 ±4.16	<0,001
Waist circumference	73.55 ±9.95	74.76 ±10.05	72.37 ±9.70	<0,001

BMI: Body Mass Index

Food intake habits

Information about dietary habits of the participants was collected through validated questionnaires. Answers options were classified in three categories: "from 0 to 2 days a week"; "from 3 to 6 days a week" and "7 days a week", for meal frequency questionnaire; and in "1 or none days per week"; "between 2 and 5 days per week" and "6 or 7 days per week", in the test of food group frequency of consumption.

Truancy

Truancy was also analyzed in the study. This variable was categorized as dichotomous in order to perform the corresponding statistical analysis. Truancy assessed the number of days each student skipped along the scholar year, and was categorized as: skip 5 days or less or skip more than 5 days a year.

Statistical analyses

Descriptive statistics with means and standard deviation or frequencies and percentages depending on the nature of the variables were performed. Association between variables was analyzed using chi-squared test. Multiple regression analysis models were fitted to examine the potential relationships and associations between dietary habits and BMI values. Additionally, a logistic regression model was carried out in order to analyze the association between dietary habits and truancy. In every regression model age and gender were included as confounder factors. Statistical analyses were performed via the SPSS 21 software for Windows (SPSS Inc, Chicago, IL) and the significance was set at an alpha level of 0.05.

Results

Table I shows the mean values of the principal anthropometric characteristics of the participants. Considering the whole sample mean age was 14±1 years old, the same that when considering boys and girls separately. Regarding body weight, the mean value was 58.87±12.08 kg, higher within boys, than within girls (p<0,001). A similar trend was observed for height, also higher in the boys group (p<0,001). The mean value for height considering the whole sample was 160.85±7.74 cm. Contrariwise, BMI was higher for the girls group (23.22±4.16 kg/m^2 vs. 22.19±4.11 kg/m^2; p<0,001), and the BMI mean value altogether was 22.71±4.16 kg/m^2. Finally, the mean data of waist circumference was 73.55±9.95 cm considering the entire simple, 74.76±10.05 cm for boys and 72.37±9.70 cm for girls, (p<0,001).

As shown in table II, is common among children in thinness and normalweight situations to have breakfast every day (69.3% and 62.0%, respectively). However, these rates decrease in overweight and obese subjects, among which only a half have this meal all the days in a week (56.3% and 51.8%, respectively). Contrariwise, this two categories skip breakfast quite often, given that more than a 20% have breakfast twice or less a week (p<0,001). Lunch is the main meal of the day and this is represented in the data since most of the subjects in every category have it every day (around an 80%) and less than a 5% of the participants have this meal twice or less a week. It is also elevate the frequency of having a snack in the afternoon in the four BMI groups (76.6% among thin subjects; 73.9% among normal weight; 71.3% among overweight and 70.3% among obese subjects; p<0,001). However, more than half individuals of all categories do not have dinner most of the days. The percentage of adolescents that have this meal every night changes inversely to the BMI values, being 30.8% in the thinness group; 24.7% in the normal weight group; 17.8% among overweight subjects and 16.3% among the obese (p<0,001).

When considering the whole sample, the table shows that it is common in Chilean adolescent to have lunch every day (81.0%) and also to have a snack in the afternoon (72.9%). However, only a half of the population has breakfast the whole week (59.5%) and less than a quarter have dinner every day (22.0%).

Table II
Number of participants in meal frequency categories stratified by the occurrence of thinness, normal-weight, overweight and obesity

	Thinness	Normal weight	Overweight	Obesity	All	p
Breakfast						
0 to 2 days/week	14.5%	17.5%	21.3%	26.3%	19.4%	p<0.001
3 to 6 days/week	16.2%	20.5%	22.4%	21.9%	21.1%	
7 days/week	69.3%	62.0%	56.3%	51.8%	59.5%	
Lunch						
0 to 2 days/week	2.1%	3.0%	4.1%	4.3%	3.5%	p<0.001
3 to 6 days/week	11.9%	14.8%	16.4%	18.6%	15.6%	
7 days/week	85.9%	82.2%	79.5%	77.0%	81.0%	
Snack						
0 to 2 days/week	5.4%	5.8%	6.6%	7.3%	6.2%	p<0.001
3 to 6 days/week	18.0%	20.3%	22.1%	22.4%	21.0%	
7 days/week	76.6%	73.9%	71.3%	70.3%	72.9%	
Dinner						
0 to 2 days/week	43.1%	52.8%	63.5%	67.4%	57.2%	p<0.001
3 to 6 days/week	26.1%	22.5%	18.8%	16.3%	20.8%	
7 days/week	30.8%	24.7%	17.8%	16.3%	22.0%	

On the other hand, table III presents data concerning the frequency of consuming different food groups (dairy's, fruits, vegetables, meats, legumes, fast food, sweets and fizzy drinks) among subjects allocated in each BMI stratum. A third of the sample (33.9%) consumes dairy products nearly every day (6 to 7 days a week). This percentage is lightly higher for the underweight (36.9%) and the normal weight (36.2%) groups, whereas the obese subjects are the ones with the lowest rate of dairy products intake (27.2%). Concerning fruits the majority of subjects (around the 60%) of every group are situated within the 2 to 5 days/week range of consumption. The obesity and thinness BMI groups are the ones with the highest number of individuals consuming fruits every day (24.1% y 24.0%, respectively). With respect to vegetables, having them only once a week or never is the less frequent option (minus than the 10% in every groups) whereas the 90% of remaining sample is allocated between the "2 to 5" and the "6 to 7" days per week categories of intake. Contrariwise, a half of the participants (50.2%) have legumes once or never a week. The thinness and normal weight are the groups showing a higher consumption of this food: 51.7% and 47.0% have legumes 2 to 5 days a week. Additionally, participants were asked about their intake of meat. Approximately the 65% of the participants in every BMI group consumed this food between 2 and 5 days/week. Finally, information about fast food, sweets and fizzy drinks consumption was also collected. A minimum percentage of subjects have this junk food every day (less than the 4.5% in every groups). The majority of people had this kind of food once a week or never (55.6% within the thinness group; 57.4% within the normal weight group; 61.5% within the overweight group and 63.3% within the obese group). This trend changes with regard to sweets. A half of all participants consume sweets between 2 and 5 days a week. The percentage of people having this product every day is 15.0%, 15.2%, 15.3% and 11.3% within thin, normal-, overweight and obese subjects, respectively. The last item included in the poll was fizzy drinks, which intake is quite usual within the studied population. The highest consumption was found for the obese group (48.8% of the individuals have them 2 to 5 days a week).

If the complete sample is considered for evaluating the frequency of intake of each food group, it can be set that vegetables was the most consumed one, with a 44.7% of the participants having it every day a week, followed by fizzy drinks (42.9% have them every day). About a half of the population have dairy´s, legumes and sweets from 2 to 5 days a week. Fruits are consumed from 2 to 5 times a week by a 59.9% of the sample and the 64.2% have meat with the same frequency. Fast food represents less the consumed food since only a 4.1% of the individuals have it every day.

Other interesting datum were obtained after regression analyses evidencing that having breakfast was inversely associated with BMI (B=-0,103±0,040; p<0,001), adjusted for gender. The same association with BMI was found for dinner (-0,889±0,078; p<0,001) and also having a snack in the afternoon

Table III
Number of participants in meal frequency categories stratified by the occurrence of thinness, normal-weight, overweight and obesity

	Thinness	Normal weight	Overweight	Obesity	All	p
Dairy products						
0 to 1 days/week	13.6%	15.1%	17.6%	19.3%	16.2%	
2 to 5 days/week	49.5%	48.7%	51.1%	53.6%	49.9%	p<0,001
6 to 7 days/week	36.9%	36.2%	31.3%	27.2%	33.9%	
Fruits						
0 to 1 days/week	18.6%	16.5%	16.2%	15.8%	16.4%	
2 to 5 days/week	57.4%	59.8%	60.2%	60.0%	59.9%	p>0.05
6 to 7 days/week	24.0%	23.7%	23.6%	24.1%	23.7%	
Vegetables						
0 to 1 days/week	9.9%	9.7%	8.4%	9.1%	9.3%	
2 to 5 days/week	47.9%	46.3%	45.5%	45.5%	46.0%	p>0.05
6 to 7 days/week	42.2%	44.0%	46.1%	45.4%	44.7%	
Meat						
0 to 1 days/week	10.5%	11.9%	12.0%	12.8%	12.0%	
2 to 5 days/week	65.3%	64.0%	64.4%	64.5%	64.2%	p>0.05
6 to 7 days/week	24.2%	24.2%	23.6%	22.7%	23.9%	
Legums						
0 to 1 days/week	45.0%	49.4%	51.5%	52.2%	50.2%	
2 to 5 days/week	51.7%	47.0%	45.1%	44.8%	46.3%	p>0.05
6 to 7 days/week	3.3%	3.5%	3.4%	3.0%	3.4%	
Fast food						
0 to 1 days/week	55.6%	57.4%	61.5%	63.3%	59.1%	
2 to 5 days/week	40.8%	38.2%	34.9%	33.1%	36.8%	p<0,001
6 to 7 days/week	3.6%	4.4%	3.7%	3.6%	4.1%	
Sweets						
0 to 1 days/week	31.0%	32.4%	34.5%	38.3%	33.6%	
2 to 5 days/week	54.0%	52.4%	53.1%	50.4%	52.4%	p<0,001
6 to 7 days/week	15.0%	15.2%	12.3%	11.3%	14.0%	
Fizzy drinks						
0 to 1 days/week	9.2%	10.3%	12.2%	13.6%	11.2%	
2 to 5 days/week	46.2%	45.1%	46.6%	48.8%	45.9%	p<0,001
6 to 7 days/week	44.5%	44.6%	41.2%	37.7%	42.9%	

shows this negative association with BMI (B=-0,115±0,018; p<0,001), irrespective of confounding factors.

Finally, the relationships between dietary habits and truancy were analyzed and it was notice that having breakfast was associated with less truancy (B=-0,251±0,050; p<0,001). As shown in figure 2, truancy changed inversely to breakfast frequency from 17.2% among subject having breakfast twice o less a week, to 15.6% among the ones having breakfast from 3 to 6 days a week and to 13.0% in subjects having breakfast daily.

Discussion

The aim of the present analysis was to determine dietary habits potentially associated with the presence of overweight and/or obesity among Chilean students of fourteen years old.

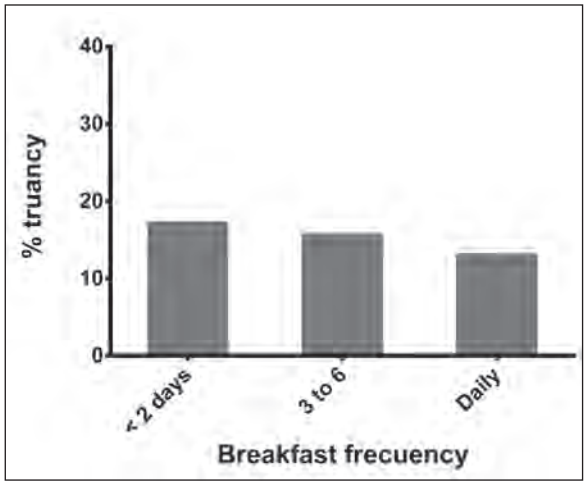

Fig. 2.– Number of participants skipping more than 5 days a year depending on the frequency of having breakfast (<2 days/ week; 3-6 days/week; daily).

Obesity has become a major public health problem due to the high number of people suffering it and because of the diversity of metabolic complications that it entails. Dietary habits have been evidenced as one of the main factors implicated in the onset and development of this disease[18]. Interestingly, it has been also evidenced that strategies focusing on improving food intake habits lead to important improvements in excessive body weight control and/or prevention[19], although there are also some studies that do not evidenced that effectiveness[20]. Thus, more work is need in order to clarify the key factors concerning the dietary cornerstone of the obesity intricate. With that purpose dietary habits and BMI data about 21,385 students obtained from the Ministry of Education of Chile were analyzed.

The first evaluated aspect was meal frequency. Regarding this aspect, not much literature is available but in general, a higher frequency has been associated with a better maintenance of body weight and greater reductions when following weight loss treatments[21]. This has been explained to be due, mainly, to the increased satiety sensation[22]. In this sense, in the present study participants were asked about how often on a week they have breakfast, lunch, a snack in the afternoon and dinner. The higher percentages of having these meals every day a week were found for individuals allocated within the thinness and normalweight groups. Therefore, these results are in agreement with the established idea that having various meals a day helps to control body weight[23]. Moreover, to have breakfast, dinner and a snack in the afternoon were separately and inversely associated with BMI, reinforcing this hypothesis. Interestingly, we have found that having breakfast is associated with less truancy, which represents one of the most important factors regarding school performance and academic success. This result is in accordance with previous literature displaying breakfast as the most important meal, for every age population, but especially for children and adolescents at growing age[21].

Then, the frequency of consumption for each food group was also asked within the poll. The groups included were dairy products, fruits, vegetables, meats, legumes, fast food, sweets and fizzy drinks. Recent investigations regarding nutrition and body weight control have focused on macronutrient composition of the diet, instead of only in calorie restriction, as traditionally[24]. In this sense, new data have evidence that specific macronutrient distribution may confer additional benefits for body weight and adiposity indicators management[25]. Vegetables were the most consumed food, since a half of the participants have them every day a week, followed by dairy products. Nevertheless, this cannot be considered an indicator of "healthy habits" for the studied population since according to recommendations most of them and not only a half should have these kind of product every day[26]. When analyzing fruit consumption, only a quarter of the subject have them every day and the majority of participants in every BMI groups have them between 2 and 5 days a week, again not achieving recommendations[26]. The data revealed that the intake of fruits and vegetables was higher among obese subjects than among other BMI categories. This can be explained by the fact that these individuals usually have elevate amounts of every food groups, and does not necessarily represent a healthy behavior. It is also surprising that obese people showed the lowest consumption of junk food. In this sense, it can be probably a confusing data given that due to social "pressures" it is not well considered to admit to consume this kind of food when suffering excessive body weight. Other interesting data is the elevate consumption of fizzy drinks. Nearly a half of the participants have them daily. This is in accordance with other studies in Chilean population, which revealed that these drinks are included within the habitual diet in all-age stratus[27].

The study has some limitations since the obtained information is self-reported. Some items, such as fish consumption, are missed from the test and also the answers categorization may be a confusing factor of the results. In turn, including more detailed items would contribute to obtain more precise information, for example, specifying "whole", "skimmed" or "semi-skimmed" dairy products. Moreover, using frequency questionnaires instead of weighted dietary records do not allow to get macro and micronutrient information. Nevertheless, this study enrolled a huge sample of nearly 22,000 people, which is nationally representative, since participants belong to 600 different schools from all along the country.

Conclusions

This study shows the main dietary habits of a large and nationally representative sample of Chilean

adolescents. The results indicate that most of them have lunch and a snack in the afternoon every day, but breakfast and dinner are less frequent. Chilean adolescents showed an elevate consumption of fizzy drinks and it has been showed an interesting inverse association between having breakfast and truancy. Nutritional education strategies must be implemented for Chilean students considering the close relationship between dietary habits, BMI and truancy.

Acknowledgements

This research used as information source the database from the Agency of the Quality for Education. The authors want to thank the access to the database. All results of this study are the sole responsibility of the authors and do not necessarily represent the views of SIMCE. Internal Research Grants from the Universidad Autonoma de Chile (07/2014) supported the study.

References

1. Lobstein T, Baur L, Uauy R. Obesity in children and young people: a crisis in public health. *Obes Rev.* 2004;5 Suppl 1:4-104.
2. de Onis M, Blossner M, Borghi E. Global prevalence and trends of overweight and obesity among preschool children. *Am J Clin Nutr.* 2010;92[5]:1257-64.
3. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet.* 2014;384(9945):766-81.
4. Garber MD, Sajuria M, Lobelo F. Geographical variation in health-related physical fitness and body composition among Chilean 8th graders: a nationally representative cross-sectional study. *PLoS One*. 2014;9[9]:e108053.
5. Lawlor DA, Benfield L, Logue J, Tilling K, Howe LD, Fraser A, et al. Association between general and central adiposity in childhood, and change in these, with cardiovascular risk factors in adolescence: prospective cohort study. *Bmj*. 2010;341:c6224.
6. De Niet JE, Naiman DI. Psychosocial aspects of childhood obesity. *Minerva Pediatr.* 2011;63[6]:491-505.
7. Owen CG, Whincup PH, Orfei L, Chou QA, Rudnicka AR, Wathern AK, et al. Is body mass index before middle age related to coronary heart disease risk in later life? Evidence from observational studies. *Int J Obes (Lond)*. 2009;33[8]:866-77.
8. Skelton JA, Irby MB, Grzywacz JG, Miller G. Etiologies of obesity in children: nature and nurture. *Pediatr Clin North Am*. 2011;58[6]:1333-54, ix.
9. Rey-Lopez JP, Vicente-Rodriguez G, Biosca M, Moreno LA. Sedentary behaviour and obesity development in children and adolescents. *Nutr Metab Cardiovasc Dis*. 2008;18[3]:242-51.
10. Gomez-Miranda LM, Jimenez-Cruz A, Bacardi-Gascon M. Randomized clinical trials on the sugar sweetened beverages on adiposity in olders than 13 y; systematic review. *Nutr Hosp*. 2013;28[6]:1792-6.
11. Hasnain SR, Singer MR, Bradlee ML, Moore LL. Beverage intake in early childhood and change in body fat from preschool to adolescence. *Child Obes*. 2014;10[1]:42-9.
12. Martinez JA, Navas-Carretero S, Saris WH, Astrup A. Personalized weight loss strategies-the role of macronutrient distribution. *Nat Rev Endocrinol*. 2014;10[12]:749-60.
13. Garcia-Rubio J, Lopez-Legarrea P, Gomez R, Cossio-Bolaños M, Merellano-Navarro E, Olivares P. Ratio Cintura-Estatura y riesgo de Síndrome Metabólico en adolescentes chilenos. *Nutr Hosp*. 2015. In press.
14. Informe técnico SIMCE 2012. *Santiago de Chile: Ministry of Education*. 2014.
15. Lopez-Legarrea P, de la Iglesia R, Abete I, Bondia-Pons I, Navas-Carretero S, Forga L, et al. Short-term role of the dietary total antioxidant capacity in two hypocaloric regimes on obese with metabolic syndrome symptoms: the RESMENA randomized controlled trial. *Nutr Metab (Lond)*. 2013;10[1]:22.
16. Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. *Bmj*. 2007;335(7612):194.
17. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *Bmj*. 2000;320(7244):1240-3.
18. Vargas-Hernandez G, Romero-Velarde E, Vasquez-Garibay EM, Vizmanos-Lamotte B, Troyo-Sanroman R. Calcium intake and adiposity in adolescents aged 12-16 years in Guadalajara, Mexico. *Arch Latinoam Nutr.* 2013;63[2]:157-63.
19. Abete I, Astrup A, Martinez JA, Thorsdottir I, Zulet MA. Obesity and the metabolic syndrome: role of different dietary macronutrient distribution patterns and specific nutritional components on weight loss and maintenance. *Nutr Rev.* 2010;68[4]:214-31.
20. Kain J, Leyton B, Concha F, Weisstaub G, Lobos L, Bustos N, et al. Evaluation of an obesity prevention intervention which included nutrition education and physical activity applied in public schools of Santiago, Chile. *Arch Latinoam Nutr.* 2012;62[1]:60-7.
21. Toschke AM, Thorsteinsdottir KH, von Kries R. Meal frequency, breakfast consumption and childhood obesity. *Int J Pediatr Obes*. 2009;4[4]:242-8.
22. Allirot X, Saulais L, Seyssel K, Graeppi-Dulac J, Roth H, Charrie A, et al. An isocaloric increase of eating episodes in the morning contributes to decrease energy intake at lunch in lean men. *Physiol Behav.* 2013;110-111:169-78.
23. Kant AK, Schatzkin A, Graubard BI, Ballard-Barbash R. Frequency of eating occasions and weight change in the NHANES I Epidemiologic Follow-up Study. *Int J Obes Relat Metab Disord*. 1995;19[7]:468-74.
24. Lopez-Legarrea P, de la Iglesia R, Abete I, Navas-Carretero S, Martinez JA, Zulet MA. The protein type within a hypocaloric diet affects obesity-related inflammation: the RESMENA project. *Nutrition*. 2014;30[4]:424-9.
25. Westerterp-Plantenga MS, Lemmens SG, Westerterp KR. Dietary protein - its role in satiety, energetics, weight loss and health. Br J Nutr. 2012;108 Suppl 2:S105-12.
26. Food and Nutrition Board NRC. Recomended Dietary Allowances. 10th edition. *Washington, DC: The National Academy Press*. 1989.
27. Milla Tobarra M, Martínez-Vizcaíno V, Lahoz García N, García-Prieto J, Arias-Palencia N, Garcia-Hermoso A. The relationship between beverage intake and weight status in children: the Cuenca study. *Nutr Hosp*. 2014;30[4]:818-24.