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Association between low dairy consumption and determinants of health in Latin American university students: a multicenter study

Asociación entre bajo consumo de lácteos y determinantes de la salud en universitarios latinoamericanos: un estudio multicéntrico

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Abstract

Objective: to associate low dairy consumption with determinants of health and the Human Development Index (HDIs) in Latin American university students.

Methods: a cross-sectional, multicenter, observational study in university students from eleven Latin American countries.

Results: the study included 4880 subjects. In all, 66 % of the sample consumed at least one serving of dairy products per day. A higher percentage of dairy consumers was observed among participants who are in the highest quartile of quality of life as compared to those in the lowest quartile ($p < 0.001$). Dairy consumption was positively associated with the consumption of breakfast (OR, 1.58; 95 % CI, 1.36-1.85), healthy dinner (OR, 1.16; 95 % CI, 1.01-1.32), fruits (OR, 1.77; 95 % CI, 1.53-2.05), vegetables (OR, 1.19; 95 % CI, 1.02-1.39), fish (OR: 1.37; 95 % CI, 1.36-1.85), whole-grain foods (OR, 1.72; 95 % CI, 1.49-1.98), and the practice of physical activity (OR, 1.16; 95 % CI, 1.01-1.34), and was negatively associated with the consumption of fried food (non-consumption) (OR, 0.72; 95 % CI, 0.58-0.90), junk food (OR, 0.78; 95 % CI, 0.63-0.96), sweet snacks (OR, 0.69; 95 % CI, 0.57-0.82), and alcohol (OR, 0.83; 95 % CI, 0.72-0.95). Furthermore, to reside in a country whose HDI is medium-high was found to be associated as a risk factor for non-compliance with the recommended intake of at least 3 servings of dairy per day, as compared to individuals from countries with very high HDIs (OR, 2.05; 95 % CI, 1.79-2.36). In addition, the results show that being female is a protective factor and is associated with the compliance of the consumption recommendation for dairy products (OR, 0.83; 95 % CI, 0.71-0.98).

Conclusion: dairy consumption is related to better diet quality and higher levels of physical activity. Complying with the recommendation to consume 3 servings of dairy per day is associated with better quality of diet, stressing the importance of promoting dairy consumption.

Keywords:

Dairy. Diet quality. HDI (Human Development Index). Quality of life. Physical activity.

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Resumen

Objetivo: asociar el bajo consumo de lácteos con determinantes de la salud y el Índice de Desarrollo Humano (IDH) en estudiantes universitarios latinoamericanos.

Métodos: estudio observacional transversal, multicéntrico, en estudiantes universitarios de once países latinoamericanos.

Resultados: el estudio incluyó a 4880 participantes. El 66 % de la muestra consumían al menos una ración de lácteos al día. Se observó un mayor porcentaje de consumidores de lácteos entre los participantes que se encuentran en el cuartil más alto de calidad de vida, en comparación con los que se encuentran en el cuartil más bajo ($p < 0,001$). El consumo de lácteos se asoció positivamente con el consumo del desayuno (OR: 1,58; IC 95 %: 1,36-1,85), la cena saludable (OR: 1,16; IC 95 %: 1,01-1,32), las frutas (OR: 1,77; IC 95 %: 1,53-2,05), las verduras (OR: 1,19; IC 95 %: 1,02-1,39), el pescado (OR: 1,37; IC 95 %: 1,36-1,85), los alimentos integrales (OR: 1,72; IC 95 %: 1,49-1,98) y realizar actividad física (OR: 1,16; IC 95 %: 1,01-1,34), y se asoció negativamente con el consumo de frituras (no consumo) (OR: 0,72; IC 95 % 0,58-0,90), comida chatarra (OR: 0,78; IC 95 %: 0,63-0,96), aperitivos dulces (OR: 0,69; IC 95 %: 0,57-0,82) y alcohol (OR: 0,83; IC 95 %: 0,72-0,95). Además, residir en un país cuyo IDH es medio-alto, se asoció como factor de riesgo para el incumplimiento de la ingesta recomendada de al menos 3 raciones de lácteos al día, en comparación con los individuos de países con IDH muy alto (OR: 2,05; IC del 95 %: 1,79-2,36). Además, los resultados muestran que ser mujer se asocia con el cumplimiento de la recomendación de consumo de productos lácteos (OR: 0,83; IC 95 %: 0,71-0,98).

Conclusiones: el consumo de lácteos está relacionado con una mejor calidad de la dieta y mayores niveles de actividad física. El cumplimiento de la recomendación de consumir 3 raciones de lácteos al día se asocia con una mejor calidad de dieta, lo que subraya la importancia de promover el consumo de lácteos.

Palabras clave: Lácteos. Calidad de la dieta. IDH (índice de desarrollo humano). Calidad de vida. Actividad física.

INTRODUCTION

Currently, more than 6 billion people consume milk or milk-derived products (1). Dairy products are an important source of proteins of high biological value and micronutrients such as calcium, magnesium, phosphorus, zinc, iodine, selenium, vitamins of the B-complex and vitamins A and D (2). In addition, scientific research indicates that the consumption of dairy products appears to be associated with the promotion of the development of the musculoskeletal and neurological systems (3), as well as with a reduction in the frequency of non-communicable diseases (NCDs), improvements in cardiovascular health and overall well-being (4). Globally, the average recommendation for dairy consumption consists of 3 daily servings of dairy, for individuals ≥ 9 years of age (5).

Currently, evidence shows that dairy consumption is inversely associated with weight gain, overweight and obesity, and plays a role in the physiological regulation of the intestine, adipocytes and musculoskeletal system due to its biochemical composition (6). Moreover, poor eating behaviors such as not having breakfast, eating an unhealthy dinner, poor consumption of fruits, vegetables, fish and legumes, making the choice to consume junk food and sugary drinks, just to mention a few, are associated with increased waist circumference, overweight and obesity and a low consumption of dairy products (7). In addition to the association between low dairy consumption, excess weight and poor diet quality, it has been observed that in the young population those with a poor quality diet that includes low dairy intake tend to smoke, drink alcoholic beverages and be sedentary, regardless of their gender ($p < 0.05$). Furthermore, it should be noted that only women who practice sports have less harmful determinants, such as smoking less ($p < 0.001$) (8), thus raising questions about the context, gender and determinants that may be associated with low dairy consumption.

In this context, health-related quality of life (HRQoL) has been described as the assessment of several aspects, including: 1) physical status and functional capacity; 2) psychological status and well-being; 3) social interactions; and 4) economic status and its factors (9). In this sense, low consumption of dairy products and fruits, not having breakfast, excess weight and low physical activity are associated with a worse HRQoL in young people (10). Moreover, some studies have shown that overweight and obese individuals have a negative score in most aspects of HRQoL as compared to normal-weight individuals (11). However, direct evidence is lacking to show the association between low dairy consumption and all aspects of HRQoL, although we do know that high dairy consumption is significantly associated with a lower risk of death from all causes (combined RR, 0.93; 95 % CI: 0.89, 0.98; $I^2 = 47.3$ %) and cardiovascular disease (0.89; 95 % CI: 0.81, 0.98; $I^2 = 33.2$ %). Each additional daily serving of dairy reduces the risk of all-cause mortality (0.93; 95 % CI: 0.86, 0.99; $I^2 = 63.3$ %) and cardiovascular disease (0.86; 95 % CI: 0.77, 0.99; $I^2 = 36.6$ %) (12).

In addition, it is necessary to broaden the context and analyze the influence of nationality, pursued degree program and dairy consumption. The Human Development Index (HDI) is an indicator that assesses the development of a country by considering three key dimensions: long and healthy life; access to knowledge; and decent standard of living. The HDI uses data such as life expectancy at birth, average years of schooling, and adjusted Gross National Income (GNI) per capita. The HDI provides a comprehensive view of human development beyond economics, reflecting people's opportunities and capabilities (13). A country's development may affect the process to obtain dairy products, resulting in a decrease in their consumption (14). Furthermore, it is known that the human development of a country is inversely correlated with the health of its population, especially in the case of neoplastic diseases which values range from -0.85 to -0.40 according to the Pearson's correlation analysis. In addition, sedentary behavior, alcohol, tobacco and drug use in general presented direct Pearson's correlations ranging from 0.27 to 0.89 (15).

Having identified the need to broaden this context towards dairy consumption and eating habits in general, the objective of this study is to assess the association between low dairy consumption with determinants of health and human development index in Latin American university students.

MATERIAL AND METHODS

STUDY DESIGN

An observational, multicenter, cross-sectional survey study was conducted in university students from eleven Latin American countries (Argentina, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Panama, Paraguay, Peru and Uruguay). Inclusion criteria to participate in the study were: subjects of both sexes aged 18 years and older who were actively enrolled in a higher education institution in one of the participant countries. Exclusion criteria were: university students who partially completed the survey and graduate students. University students were invited to participate in the study (between 5 November and 22 December 2020) through institutional social networks, as well as social networks such as Facebook and Instagram; they accepted a digital informed consent form and completed a self-administered survey. The research protocol was developed in accordance with the guidelines of the Declaration of Helsinki for research in human subjects and approved by the Scientific Ethics Committee of the Universidad de Las Américas, Chile. Resolution number 2020001, each participant gave their informed consent before completing the survey.

DATA COLLECTION

Dairy variable (central and dependent)

A validated survey on eating habits was administered to assess dairy consumption; this survey was detailed in a previously published study (16). Briefly stated the survey consisted of two parts: healthy food consumption (8 questions) and unhealthy food consumption (4 questions). Based on this information, a dichotomous variable was constructed: "Compliance" or "Non-compliance" with the consumption recommendation (5).

Variables for sociodemographic description (independent)

The survey included data on nationality, field of study for characterization purposes, and sex (1: Female 2: Male). In addition, the human development index variable was established through the individual classification by nationality (1: Very high 2: Medium-High) (17).

Variables on determinants of health (independent)

With respect to the excess weight variable, body weight in kilograms and height in meters were self-reported by asking questions such as: What is your current estimated weight? And, what is your current height? (Data necessary for the calculation of BMI and the corresponding nutritional diagnosis). This information was used to obtain the BMI of each individual, including cut-off points and diagnosis as appropriate: ≥ 25 kg/m^2: Excess weight (overweight or obesity) (18), expressed as a dichotomous variable as: "No (no excess weight)" or "Yes (excess weight)".

A validated survey on eating habits was administered to assess the consumption of dairy and other food products; this survey was detailed in a previously published study (16). On the basis of this information, variables were constructed: fruits, vegetables, fish, and legumes, and were dichotomized as: "Yes (Compliance)" or "No (Non-compliance)". Breakfast, healthy dinner, and whole-grain foods were dichotomized as: "Yes (daily consumption)" or "No (non-daily consumption)." All of these variables were validated according to global recommendations on healthy diet (19).

Alcohol and tobacco use were also evaluated; the consumption of these substances was identified as unhealthy and the dichotomous variable "No (non-consumption)" and "Yes (consumption) was constructed". Finally, participants were asked about the practice of physical activity. It was determined that not performing physical activity is a negative determinant of health and, based on the answers, the dichotomous variable "Yes (performance)" and "No (non-performance)" was generated.

Regarding the HRQoL variable, a Likert scale method (the lower the score per response, the lower the HRQoL) was used to examine fundamental dimensions such as physical, psychological-cognitive and social functioning (26 questions) (20), based on the final scores by quartiles, considering the two highest-scoring quartiles as higher HRQoL. The variable was dichotomized as: "Lower (HRQoL)" (quartiles 1 and 2) or "Higher (HRQoL)" (quartiles 3 and 4).

Human Development Index (HDI) (independent variable)

The Human Development Report 2021-22 was considered, which classifies development according to ranges of scores: Very high: countries with a HDI greater than 0.80. High: countries with a HDI between 0.70 and 0.80. Medium: countries with a HDI between 0.55 and 0.70. Low: countries with a HDI below 0.55 (17). The variable was dichotomized as: "Medium-High (HDI)" and "Very High (HDI)" according to the nationalities of the participants of the study.

STATISTICAL ANALYSIS

Qualitative values were expressed as absolute value (frequency) and relative value (percentage) for the description of the sample. To determine the association between dairy consumption, determinants of health, and HDI, the chi-square test (χ^2) was used. For the logistic regression, the dairy variable was dichotomized as follows: "Compliance (with the recommendation)"; those who consume 3 or more servings per day were assigned the category "0 = Compliance". Those who showed "Non-compliance (with the recommendation)", that is, do not consume dairy or consume less than 3 servings per day were assigned the category "1 = Non-compliance". The logistic regression model was used and the following adjustments were made: Model 1, dairy and excess weight. In Model 2, dietary and behavioral variables were added. In Model 3, HRQoL and HDI variables

were added. Model 4 was adjusted by gender. It was dichotomized and considered: 1 = Non-compliance (with the consumption recommendation of 3 or more servings of dairy per day). Yes (there is excess weight), No (non-daily consumption of breakfast, healthy dinner and whole-grain foods), No (non-compliance with the consumption recommendation of fruits, vegetables, fish and legumes), Yes (consumption of sugary drinks, fried foods, junk food and unhealthy snacks), No (non-performance of physical activity), Yes (consumption of alcohol and tobacco), Lower (health-related quality of life), Medium-high (human development index) and Female (gender).

A p value of < 0.05 was considered significant. To determine the association, OR values and confidence interval of 95 % (95 % CI) are presented. All the analyses were performed using the R software package, "Library (Rcmdr)".

RESULTS

At the end of the data collection period, we ended with a database of 4,958 responses. Seventy-eight students were eliminated for incomplete data. Therefore, the present study evaluated 4,880 completed the survey correctly, which represents 98.4 % of the total database; 73.8 % were female, and average age was 22.4 years. As can be seen in table I, 66 % of the total sample reported consuming at least one serving of dairy products per day. It was observed that there is a higher proportion of female consumers of dairy as compared to men (71 % vs. 29 %). There was a significantly higher percentage of dairy consumers among participants residing in countries with a high HDI as compared to those living in countries with medium-high HDIs. On the other hand, the percentage of consumers differs widely among countries, with a range varying from 16.6 % in Ecuador to 76.9 % in Uruguay. In addition, a higher proportion of dairy consumers was observed among health science students when compared to other fields of study (Table I).

The 28.8 % of participants meet the recommendation to consume 3 servings of dairy per day. However, a large variability was observed depending on the country of residence. Figure 1 shows the percentage of students who consume dairy 3 times a day, twice a day, once a day, < once a day. It was found that Chile, Argentina, Uruguay, and Costa Rica are the countries with the highest consumption, with an intake of at least 3 servings per day. Ecuador, Mexico, Peru and Panama have the highest proportion of < once a day.

Table I. Sociodemographic characteristics of the sample and proportion of dairy consumers, *n* (%)

		Consumption of dairy products		
	***n* total**	**Non-compliance**	**Compliance**	***p*-value**
Total sample	4880	3230 (66.2)	1650 (33.8)	
Sex				
Male	1281	803 (62.7)	478 (37.3)	0.002
Female	3599	2427 (67.4)	1172 (32.6)	
Human Development Index				
Medium-High	3107	718 (23.1)	2389 (76.9)	0.001
Very High	1773	687 (38.7)	1086 (61.3)	
Country				
Argentina	503	205 (40.8)	298 (59.2)	
Colombia	275	96 (34.9)	179 (65.1)	
Chile	378	182 (48.1)	196 (51.9)	
Costa Rica	586	222 (37.9)	364 (62.1)	
Ecuador	674	109 (16.6)	565 (83.8)	
Guatemala	376	94 (25.0)	282 (75.0)	< 0.001
Mexico	1242	235 (18.9)	1007 (81.1)	
Panama	293	68 (23.2)	225 (76.8)	
Paraguay	257	124 (48.2)	133 (51.8)	
Peru	283	60 (21.2)	223 (78.8)	
Uruguay	13	10 (76.9)	3 (23.1)	
Field of study				
Health Sciences	3110	2202 (70.8)	908 (29.2)	
Engineering and Exact Sciences	882	497 (56.3)	385 (43.7)	
Education, Social Sciences & Humanities	198	116 (58.6)	82 (41.4)	< 0.001
Arts, Architecture and Design	66	35 (53.0)	31 (47.0)	
Farming and Biological Sciences	207	128 (61.8)	79 (38.2)	
Other	261	167 (64.0)	94 (36.0)	

p-*value according to the chi² test.*

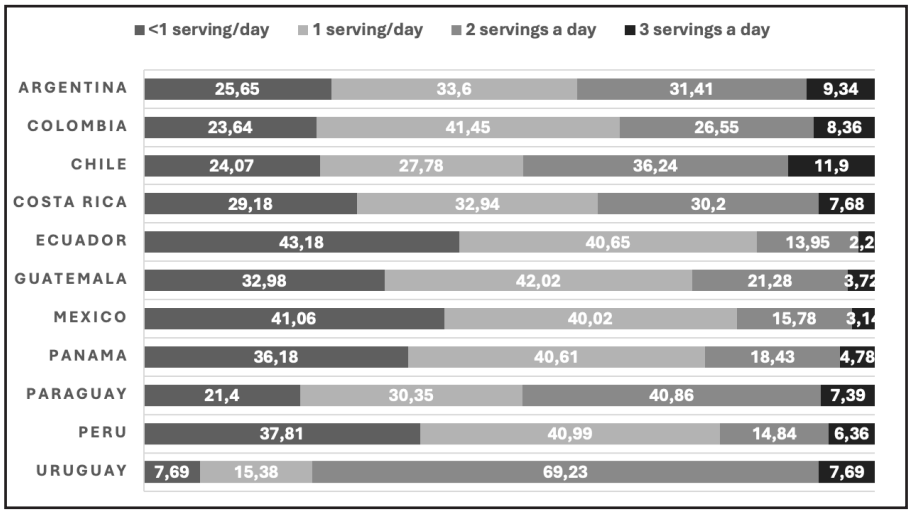

Figure 1.
Description of dairy consumption according to the nationality of the sample.

Table II shows the association between dairy consumption (compliance with the recommendation) and the determinant of health, including the presence or absence of excess weight. It is observed that there was no statistically significant difference between both groups ($p = 0.054$).

Table III displays the associations between dairy consumption (compliance with the recommendation) and dietary and behavioral determinants of health. It is observed that the proportion of students who have desired determinants is higher among those who meet the dairy consumption recommendation. There were significant differences between groups of dairy products and the consumption of breakfast ($p < 0.001$), healthy dinner ($p < 0.001$), fruit consumption ($p < 0.001$), vegetable consumption ($p < 0.001$), fish consumption ($p < 0.001$), legume consumption ($p < 0.05$), consumption of whole-grain foods ($p < 0.001$), and lower consumption of sugary drinks ($p < 0.001$), unhealthy snacks ($p < 0.001$), alcohol ($p < 0.001$) and practice of physical activity ($p < 0.001$). No differences were observed between the consumption of fried food, junk food and tobacco use. In addition, a higher percentage of dairy consumers was observed among participants who are in the highest quartiles of quality of life as compared to those in the lowest quartiles ($p < 0.001$) (Table IV).

Furthermore, a higher percentage of dairy consumers was found among participants whose country of residence had a HDI ranging from medium to high as compared to very high HDIs ($p < 0.001$) (Table V).

Finally, table VI displays the association between dairy consumption and health-related and sociodemographic behavioral variables. It was found that dairy consumption was associated with the consumption of breakfast (OR, 1.58; 95 % CI, 1.36-1.85), healthy dinner (OR, 1.16; 95 % CI, 1.01-1.32), fruits (OR, 1.77; 95 % CI, 1.53-2.05), vegetables (OR, 1.19; 95 % CI, 1.02-1.39), fish (OR, 1.37; 95 % CI, 1.36-1.85), whole-grain foods (OR, 1.72; 95 % CI, 1.49-1.98), and the practice of physical activity (OR, 1.16; 95 % CI, 1.01-1.34). On the other hand, dairy consumption was negatively associated with the consumption of fried food (non-consumption) (OR, 0.72; 95 % CI, 0.58-0.90), junk food (OR, 0.78; 95 % CI, 0.63-0.96), sweet snacks (OR, 0.69; 95 % CI, 0.57-0.82), and alcohol (OR, 0.83; 95 % CI, 0.72-0.95).

Similarly, to reside in a country whose HDI is medium-high was found to be associated as a risk factor for non-compliance with the recommended intake of at least 3 servings of dairy per day, as compared to individuals from countries with very high HDIs (OR, 2.05; 95 % CI, 1.79-2.36). In addition, the results show that being female is a protective factor and is associated with the compliance of the consumption recommendation for dairy products (OR, 0.83; 95 % CI, 0.71-0.98).

Table II. Association between dairy consumption (according to the recommendation) and excess weight (according to BMI)

	Excess weight		*p*-value
Dairy products	**Yes**	**No**	
Non-compliance	1140 (32.8)	2335 (67.2)	0.054
Compliance	421 (30.0)	984 (70.0)	

Note: "Non-compliance" or "Compliance" with the consumption recommendation of 3 or more servings of dairy per day. "Yes" or "No" for the presence of overweight or obesity. p-*Value according to the chi² test.*

Table III. Proportion of university students -*n* (%)- and compliance with recommendations with respect to dietary and behavioral determinants of health, according to dairy consumption

Determinants of health (diet and habits)			
Dairy products	**No**	**Yes**	***p*-value**
Breakfast			
Non-compliance	1262 (36.3)	2213 (63.7)	< 0.001
Compliance	328 (23.3)	1077 (76.7)	
Healthy dinner			
Non-compliance	2311 (66.5)	1164 (33.5)	< 0.001
Compliance	798 (56.8)	607 (43.2)	
Fruits			
Non-compliance	2428 (69.9)	1047 (30.1)	< 0.001
Compliance	705 (50.2)	700 (49.8)	
Vegetables			
Non-compliance	2596 (74.7)	879 (25.3)	< 0.001
Compliance	840 (59.8)	565 (40.2)	
Fish			
Non-compliance	3192 (91.9)	283 (8.1)	< 0.001
Compliance	1221 (86.9)	184 (13.1)	
Legumes			
Non-compliance	1535 (44.2)	1940 (55.9)	< 0.05
Compliance	566 (40.3)	839 (59.7)	
Whole-grain foods			
Non-compliance	1871 (53.8)	1604 (46.2)	< 0.001
Compliance	509 (36.2)	896 (63.8)	
Sugary drinks			
Non-compliance	1187 (34.2)	2288 (65.8)	< 0.001
Compliance	574 (50.9)	831 (59.1)	
Fried food			
Non-compliance	461 (13.3)	3014 (86.7)	0.216
Compliance	168 (12.0)	1237 (88.0)	
Junk food			
Non-compliance	565 (16.3)	2910 (83.7)	0.059
Compliance	198 (14.1)	1207 (85.9)	
Unhealthy snacks			
Non-compliance	766 (22.0)	2709 (78.0)	< 0.001
Compliance	228 (16.2)	1177 (83.8)	
Physical activity			
Non-compliance	2416 (69.5)	1059 (30.5)	< 0.001
Compliance	840 (59.8)	565 (40.2)	
Alcohol			
Non-compliance	2093 (60.2)	1382 (39.8)	< 0.001
Compliance	764 (54.4)	641 (45.6)	
Tobacco			
Non-compliance	3217 (92.6)	258 (7.4)	0.369
Compliance	1311 (93.3)	94 (6.7)	

Note: "Non-compliance" or "Compliance" with the consumption recommendation of 3 or more servings of dairy per day. "Yes" (meet the recommendation) or "No" (does not meet the recommendation) on the consumption of breakfast, healthy dinner, fruits, vegetables, fish, legumes, whole-grain foods, sugary drinks, fried food, junk food, unhealthy snacks, alcohol, tobacco and physical activity. p*-value according to the chi² test.*

Table IV. Association between dairy consumption (according to the recommendation) and health-related quality of life (by score quartiles)

Dairy products	Determinants of Health (HRQoL)		*p*-value
	Lower	Higher	
			< 0.001
Non-compliance	2679 (72.6)	796 (66.9)	
Compliance	1012 (27.4)	393 (33.1)	

HRQoL: Health-related quality of life. Note: "Non-compliance" or "Compliance" with the consumption recommendation of 3 or more servings of dairy per day. "Lower" or "Higher" level of Health-related quality of life. p-*value according to the chi² test.*

Table V. Association between dairy consumption (according to the recommendation) and human development index (according to the HDI classification)

Dairy products	HDI		*p*-value
	Medium-high	Very high	
			< 0.001
Non-compliance	2389 (76.9)	1086 (61.3)	
Compliance	718 (23.1)	687 (38.7)	

HDI: Human Development Index. Note: "Non-compliance" or "Compliance" with the consumption recommendation of 3 or more servings of dairy per day. "Medium-High" or "Very High" according to the Human Development Index classification. p-*value according to the chi² test.*

Table VI. Association of dairy products (as a dependent variable) with excess weight (crude Model 1), dietary and behavioral variables (Model 2), health-related quality of life and Human Development Index (Model 3), adjusted by sex (most fully adjusted Model 4)

	Crude Model 1 OR (95 % CI)	Model 2 OR (95 % CI)	Model 3 OR (95 % CI)	Model 4 OR (95 % CI)
Excess weight (Yes)	1.14 (0.99-1.30)§	1.00 (0.87-1.15)	0.99 (0.86-1.14)	0.97 (0.84-1.12)
Breakfast (No)		1.56 (1.34-1.81)‡	1.59 (1.36-1.85)‡	1.58 (1.36-1.85)‡
Healthy dinner (No)		1.24 (1.08-1.42)†	1.15 (1.00-1.32)*	1.16 (1.01-1.33)*
Fruits (No)		1.68 (1.45-1.94)‡	1.78 (1.54-2.06)‡	1.77 (1.53-2.05)‡
Vegetables (No)		1.35 (1.16-1.57)‡	1.21 (1.04-1.41)*	1.19 (1.02-1.39)*
Fish (No)		1.36 (1.10-1.68)†	1.37 (1.10-1.69)†	1.37 (1.10-1.69)†
Legumes (No)		0.96 (0.84-1.09)	0.96 (0.84-1.10)	0.96 (0.84-1.10)
Whole-grain foods (No)		1.60 (1.39-1.83)‡	1.72 (1.49-1.98)‡	1.72 (1.49-1.98)‡
Sugary drinks (Yes)		1.20 (1.03-1.38)*	1.13 (0.97-1.31)§	1.11 (0.96-1.29)
Fried food (Yes)		0.78 (0.62-0.97)*	0.72 (0.57-0.90)†	0.72 (0.58-0.90)†
Junk food (Yes)		0.76 (0.62-0.93)†	0.77 (0.63-0.94)*	0.78 (0.63-0.96)*
Unhealthy snacks (Yes)		0.67 (0.56-0.80)‡	0.68 (0.57.0.82)‡	0.69 (0.57-0.82)‡
Physical activity (No)		1.19 (1.04-1.37)*	1.15 (1.00-1.33)*	1.16 (1.01-1.34)*
Alcohol (Yes)		0.76 (0.66-0.87)‡	0.84 (0.73-0.96)*	0.83 (0.72-0.95)*
Tobacco (Yes)		1.06 (0.82-1.39)	1.05 (0.81-1.38)	1.04 (0.79-1.36)
HRQoL (Lower quality)			1.01 (0.86-1.17)	1.02 (0.87-1.19)
HDI (Medium-high)			2.09 (1.82-2.40)‡	2.05 (1.79-2.36)‡
Sex (Female)				0.83 (0.71-0.98)*

p < 0.05; †p < 0.01; ‡p < 0.001; §p < 0.1; HRQoL: health-related quality of life; HDI: Human Development Index. Note: In this document, 1 = Non-compliance (with the consumption recommendation of 3 or more servings of dairy per day). Yes (there is excess weight); No (non-daily consumption of breakfast, healthy dinner and whole-grain foods); No (non-compliance with the consumption recommendation of fruits, vegetables, fish and legumes); Yes (consumption of sugary drinks, fried food, junk food and unhealthy snacks); No (non-performance of physical activity); Yes (consumption of alcohol and tobacco); Lower (health-related quality of life); Medium-high (human development index); and Female (gender).

DISCUSSION

The main result of this study is that dairy consumption in Latin American university students is positively and significantly associated with healthier dietary patterns. In addition, students who reported compliance with the consumption recommendation for dairy had a better quality of life and higher levels of physical activity than those who did not meet the recommendation.

Another important finding is that there was no association between not meeting dairy consumption recommendations and excess weight. Research on this association has yielded contrasting results in different studies; some have found a positive association (21), and others, an inverse relationship (22). A study conducted in Chile in adult population showed that dairy consumption was associated with lower body weight and BMI and better diet quality in men, while, in women, it was only associated with better diet quality (6). A recent meta-analysis showed that increasing total dairy intake without energy restriction in adults does not affect body composition. However, in the context of an energy-restricted diet, increased dairy intake leads to a reduction in fat mass and body weight, with no conclusive effects on waist circumference or lean mass (23). One possible explanation for the non-association between dairy consumption and nutritional status could be that nutritional status was estimated by self-report. It is known that the perception of obesity is distorted by several factors (24,25).

Studies conducted in different age groups have shown that dairy consumption is associated with improved diet quality. One example of the above is a study in American children and adolescents using data from the NHANES 2003-2006 which found that only one third of the sample consumed yogurt at least once a week, with these individuals having a better diet quality, as assessed by the HEI-2005 (26). In another study that included children 8 to 18 years of age who participated in the NHANES 2005-2008, yogurt consumption was associated with higher intakes of calcium, vitamin D and protein, and lower intakes of total fat and saturated fat (27).

Various studies have assessed diet quality in university students, with results demonstrating a high consumption of sugary drinks, ultra-processed foods and alcohol; on the other hand, there is a low consumption of fruits, vegetables and legumes (28,29). This eating pattern, along with low physical activity, favors the development of chronic diseases that are highly prevalent in the region. Moreover, it is possible to observe the occurrence of a double burden of disease within the same family, that is, family members with chronic malnutrition and others with obesity or other chronic diseases (30,31).

Additionally, dairy products are a heterogeneous group that offers great versatility. In general, milk products are easy to find at universities, since they are available in university canteens, cafeterias, vending machines, in the form of a carton of milk, yogurt, or cheese in preparations such as sandwiches, therefore, they are easily accessible food products. Barriers to an adequate consumption of dairy include following a vegan diet, being intolerant to lactose, disliking the taste of dairy, or the economic cost of this food product (32,33). Our study found that university students from higher-income countries consume more dairy products than those from middle-to-low-income countries, thus their cost is probably the main barrier to consumption.

A recent systematic review reported that a higher dairy intake (regardless of fat content) did not show detrimental effects on anthropometric outcomes, blood lipids, and blood pressure. Both low-fat and full-fat dairy improved systolic blood pressure levels, however, they may simultaneously impair glycemic control. Yogurt improved waist circumference, triglycerides, and HDL cholesterol as compared to milk. Overall it appears that current recommendations for dairy food intake did not have a negative influence on the markers of cardiometabolic health (34).

Although the consumption of dairy products should be recommended in university students due to their contribution of protein, calcium, vitamin D, among other nutrients, it is important that the recommendation considers low-sugar or sugar-free dairy products, since a large proportion of sugar consumed by adolescents may come from yogurt or flavored milk (35).

Among the limitations of this study it can be mentioned that it is based on a cross-sectional survey, therefore, it is only possible to establish associations but not to determine causality. In addition, the survey was administered online and included self-reported height and body weight, which may provide little certainty about the accuracy of data. Although the study included a large sample of university students, the sample was not representative of the population.

Among the strengths of this research, the use of validated instruments and the possibility of replicating the study may be highlighted.

CONCLUSIONS

Dairy consumption in Latin American university students is positively associated with better diet quality, furthermore, students who reported compliance with the consumption recommendation of 3 or more servings of dairy per day had a better quality of life and higher levels of physical activity than those who did not meet the recommendation. This stresses the importance of promoting the consumption of dairy products among university students.

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