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Factors associated with the Diet Quality of Plant-Based Diets in Health Sciences University Students: An exploratory report in Chilean sample

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RESUMEN

INTRODUCCIÓN: Las dietas basadas en plantas (DBP) se fundamentan principalmente en el consumo de alimentos de origen vegetal, con distintos grados de exclusión de productos animales. Estas dietas se reconocen como patrones alimentarios que promueven la sostenibilidad y la salud humana. Sin embargo, una implementación inadecuada puede conllevar deficiencias nutricionales significativas en quienes las adoptan. Los estudiantes universitarios suelen elegir este tipo de alimentación y pueden estar expuestos a DBP de baja calidad debido a múltiples factores. El objetivo fue evaluar los factores asociados a la calidad nutricional de las DBP en estudiantes de ciencias de la salud de una universidad privada en Chile. **MATERIALES Y MÉTODOS:** Se realizó un estudio descriptivo transversal con 50 voluntarios que seguían una DBP durante al menos dos años. Se evaluaron variables sociodemográficas, actitudinales y nutricionales, junto con una encuesta sobre tendencias de consumo y una evaluación de hábitos saludables/no saludables. **RESULTADOS:** La encuesta alcanzó el 104% del tamaño muestral calculado, conformada principalmente por mujeres y participantes ovolactovegetarianos. El 70% de los voluntarios presentó hábitos saludables adecuados, observándose puntajes significativamente mayores en quienes consumían suplementos de omega-3 (p = 0,009) y en quienes optaban por preparar sus comidas (p = 0,001). Destaca que la ingesta semanal de legumbres se asoció positivamente con mayores puntajes de hábitos saludables (r=0,49; IC 95%: 0,23–0,68; p=0,000), mientras que el consumo de snacks (r=0,44; IC 95%: 0,17–0,64; p=0,001) y de alcohol (r=0,39; IC 95%: 0,11–0,61; p=0,006) contribuyeron en mayor medida a hábitos vinculados al desarrollo de enfermedades crónicas no transmisibles. **CONCLUSIONES:** Los estudiantes de ciencias de la salud que siguen DBP presentan una calidad nutricional adecuada en sus dietas, asociada a factores actitudinales y dietéticos específicos. Estos hallazgos resaltan la necesidad de confirmar estos factores en muestras más amplias para desarrollar estrategias educativas e intervenciones que faciliten la adecuada adopción de dietas basadas en plantas.

PALABRAS CLAVES: Dietas basadas en plantas, calidad nutricional, veganismo, vegetarianismo

ABSTRACT

INTRODUCTION: Plant-based diets (PBDs) are primarily based on the consumption of plant-derived foods, with varying degrees of exclusion of animal products. These diets are recognized as dietary patterns promoting sustainability and human health. However, inadequate implementation may lead to significant nutritional deficiencies in those who adopt them. University students often choose this type of diet and may be exposed to low-quality PBDs due to multiple factors. To evaluate the factors associated with the diet quality of PBDs among health sciences students at a private university in Chile. **MATERIALS AND METHODS:** A cross-sectional descriptive study was conducted with 50 volunteers following a PBD for at least two years. Sociodemographic, attitudinal, and nutritional variables were assessed, along with a survey on consumption trends and an evaluation of healthy/unhealthy habits. **RESULTS:** The survey reached 104% of the calculated sample size, primarily encompassing female and ovo-lacto vegetarian participants. Seventy percent of volunteers demonstrated adequate healthy habits, with significantly higher scores observed among those who used omega-3 supplements (p = 0.009) and those who chose to prepare their meals (p = 0.001). Notably, weekly legume intake was positively associated with higher healthy habit scores (r=0.49; 95% CI: 0.23–0.68; p=0.000), whereas snack consumption (r=0.44; 95% CI: 0.17–0.64; p=0.001) and alcohol intake (r=0.39; 95% CI: 0.11–0.61; p=0.006) were most strongly associated with habits linked to the development of non-communicable chronic diseases **CONCLUSIONS:** Health sciences students who follow PBDs exhibit adequate diet quality in their diets, which is associated with specific attitudinal-dietary factors. These findings underscore the need to confirm these factors in larger samples to develop educational strategies and targeted interventions that facilitate the proper adoption of PBDs.

KEYWORDS: Plant-based diets; diet quality; veganism; vegetarianism.

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INTRODUCTION

Plant Based Diets (PBDs) are eating patterns that prioritize the consumption of plant-based foods (e.g., vegetables, legumes, grains, fruits, and nuts) while reducing or eliminating animal products. According to the World Health Organization, these diets are classified by the degree to which animal-based foods are excluded. A lacto-vegetarian diet excludes meat, fish, poultry, and eggs, but includes dairy products; when eggs are additionally included, it is referred to as a lacto-ovo-vegetarian diet. In contrast, if fish consumption is allowed, it is known as a pescatarian diet; if other types of meat are occasionally consumed, the diet is considered flexitarian. Finally, a vegan diet completely excludes all animal-based foods and derivatives (1).

In Western countries, these types of dietary patterns have gained popularity among adolescent and adult populations, primarily justified by ethical-animal, environmental, or health reasons (2). Building on this point, the evidence published to date indicates that when these diets are properly planned, they not only meet the requirements for all age groups (3), but they also offer cardiovascular and metabolic benefits and may even confer protection against certain types of cancer (4). However, these diets can also be associated with significant nutritional deficiencies that disrupt the body's physiological functioning. Critical nutrients in such eating patterns include omega-3 fatty acids, Vitamin B12, Vitamin D, calcium, iron, and zinc. A sustained deficit in these nutrients increases the risk of hematological, neurodegenerative, and even mental disorders (5–7). In light of this, investigating the factors that influence adherence to healthy PBDs represents a necessary area of current research.

Generally, adherence to healthy eating patterns is primarily modulated by socioeconomic factors, followed by educational, cultural, and food preference considerations (8,9). At the level of PBDs, the cost of transitioning from Western-style diets would only be affordable in high-income settings. Indeed, a 2020 report indicated that more than 1.5 billion people living under low-income conditions would not be able to access diets similar to PBDs, and that incorporating these eating patterns could significantly affect the average family per capita income, by up to 89% (10,11). Given that economic constraints pose a significant barrier, one unlikely to be resolved in the short term, it is necessary to identify and confirm other factors that may influence adherence to nutritionally adequate PBDs. This need is especially critical in at-risk populations who adopt these diets, such as university students, who typically have limited incomes and little time for planning and preparing healthy dietary regimens (12–14).

The evaluation of plant-based diet (PBD) quality among university students is scarcely documented in Latin America and particularly in Chile. According to projections by the Ministry of the Environment (2018), approximately 6% of the Chilean population follows a diet free of beef, chicken, and pork (15). Specifically, publications on the vegetarian population in this South American country indicate that a substantial portion (45–70%) obtain their information about nutrition and vegetarianism from the internet or social media. They also reveal a marked lack of awareness concerning deficiencies in vitamin D (30.1–54.8%), omega-3 (24.3–31.5%), and zinc (49.0–62.7%) (16). More recently, another study reported that legume consumption among vegetarian and vegan individuals increased during social isolation, compared to those following an omnivorous diet. Moreover, their intake of this food group not only occurred more frequently and involved a greater variety of legumes but was also reflected in various types of preparations and was tied to an understanding of their nutritional benefits (17). Regarding nutrient intake in the Chilean university vegan population, we previously reported that daily protein adequacy was achieved by only 54% in a sample of 114 students (18). Additionally, it was significantly associated with the use of supplements, duration of veganism, and the preparation of home-cooked meals. This suggests that attitudinal and contextual factors may be linked to healthier PBDs and confirming this could offer valuable insights for properly guiding such dietary patterns. Accordingly, the present study aimed to evaluate the diet quality of PBDs and their associated factors among university students in the health sciences.

MATERIALS AND METHODS

A cross-sectional descriptive study was carried out on PBDs among university students from the Faculty of Medicine and Health Sciences at a private Chilean university. The sample size was calculated based on the faculty's total enrollment of 900 students (19), and it was estimated based on the National Environment and Climate Change Survey conducted by the Ministry of the Environment, in which 6% of the population reported following a PBDs (15). Considering a 95% confidence level and a 5% margin of error, a sample size of 48 students was estimated. Inclusion criteria required following a PBDs for at least two years. Additionally, individuals who claimed to follow a PBDs but had a meat intake exceeding the threshold for a flexitarian diet (i.e., consuming meat more than twice a week) were excluded, as were respondents who submitted incomplete surveys.

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This link led to a form collecting data on participants' characteristics, such as age, gender, type of vegetarian diet, age at the onset of the dietary pattern, and motivations for following the diet. The survey also inquired about the use of supplements, the source of supplement recommendations, and preferred types of meal preparation.

To assess diet quality, a validated survey for the Chilean population (published in 2014) was used, which categorizes healthy habits and habits that predispose individuals to the development of non-communicable chronic diseases (20). In this manuscript, "diet quality" refers to the healthy- and unhealthy-habit scores derived from this validated survey and their categorization based on adherence to the Chilean Dietary Guidelines. This self-administered instrument, validated via the Delphi method, consists of two parts. The first part comprises nine questions, with a total possible score ranging from 9 to 45 points. It evaluates the frequency of healthy habits, such as having breakfast, eating dinner, and consuming home-cooked meals, as well as the frequency of foods recommended by the Chilean Dietary Guidelines, including dairy products, fruits, vegetables, legumes, fish, and whole grains. Each question is scored from 1 point (does not consume) to 5 points (consumes the recommended daily/weekly portions). The higher the score, the more accurately the classification of healthy habits is reflected. The second part consists of six questions, with a total possible score ranging from 6 to 28 points. It includes foods or food groups such as sugary drinks, alcohol, fried foods, fast food, and sweets, as well as the practice of adding salt to meals without tasting them first. The scoring ranges from 1 point (does not consume) to 5 points (>X portion per day/week), and only salt consumption is scored from 1 to 3 points. In this section, higher scores indicate poorer diet quality. Additionally, both components were categorized as either healthy or unhealthy based on their adherence to the Chilean Dietary Guidelines. To avoid misinterpretation and potential systematic penalization of respondents who exclude specific food groups by definition, the scoring was adjusted for items related to fish and dairy in participants reporting a vegan dietary pattern. This adaptation aimed to prevent artificially low healthy-habit scores attributable solely to the non-consumption of foods excluded in vegan diets and to improve the interpretability of the score within this subgroup. We acknowledge that this modification departs from the original validated instrument and may introduce measurement differences when comparing vegan and non-vegan participants; therefore, results involving the vegan subgroup should be interpreted cautiously. A food frequency questionnaire was also administered to identify the intake of specific foods (21).

Once the data were collected, the variables were entered into a Microsoft Excel® spreadsheet and analyzed using GraphPad Prism v.10 for Windows (San Diego, California, USA). Distributions were determined to characterize the sample, along with means, standard deviations, and 95% confidence intervals for continuous quantitative variables. To analyze significant differences in scores by group, data normality was first assessed using the Shapiro–Wilk test. Subsequently, Student's t-test or the Kolmogorov–Smirnov test was applied for dichotomous variables, and one-way ANOVA or Kruskal–Wallis was used for non-dichotomous nominal/ordinal variables, depending on data normality. Spearman's correlation was also used to determine the degree of correlation between scores and the frequency of food consumption.

Finally, it is essential to note that all volunteers provided informed consent to participate, and the entire study was conducted in accordance with the principles outlined in the Declaration of Helsinki. The study was also framed within the project approved by the Institutional Scientific Ethics Committee of Universidad Mayor (Folio 0341).

RESULTS

A total of 57 volunteers were surveyed, of whom seven were excluded because they did not meet the minimum criterion of following a PBDs for at least two years. This resulted in a final sample of 50 participants, representing 104% of the sample size calculated.

With respect to the characteristics of the sample (Table 1), the majority were female (92%), followed an ovo-lacto vegetarian diet (56%), had been on a PBDs for fewer than five years (62%), and were primarily motivated by environmental and ethical reasons (70–74%). The group of volunteers was notably homogeneous in terms of age. Pertaining to dietary and nutritional topics, most participants reported using supplements (72%), primarily vitamin B12 (62%), which was recommended by health professionals (54%). In terms of mealtimes, nearly 80% of participants reported preparing their own meals rather than purchasing them commercially (22%). Regarding dietary habits, 68–70% of the sample was classified as having adequate healthy habits, while 30–32% were categorized as having inadequate habits. When evaluating healthy habit scores (Table 2), it was observed that individuals following a pescatarian diet, adopting PBDs for health or personal preference reasons, and using vitamin B12 and D supplements scored over 30 points out of a possible 45. Comparing all the variables studied, similar scores were found based on sex, length of time following a vegetarian diet, motivations, supplementation, and supplement recommendations. We observed differences related with the age and type of supplement used, and meal preparation.

Specifically, the highest scores were observed in participants over 22 years of age compared to those younger than 22, in those who used omega-3 supplements compared to other supplements, and in those who preferred preparing their own meals rather than purchasing them commercially. However, only supplement type and meal preparation reached statistical significance ($p = 0.009$ and $p = 0.001$, respectively). Interestingly, vegans and the multivitamin participants, showed a concerning unhealthy habits score (Table 3). Nevertheless, when comparing each variable, the scores showed homogeneity across all variables studied, with no significant differences between groups.Regarding the food groups consumed by the evaluated population (Table S1), there was a high weekly intake of bread (5.5 ± 1.9), fruits (4.7 ± 2.0), vegetables (6.4 ± 1.3), and oils (5.2 ± 2.3). Conversely, potatoes (1.4 ± 0.9), cookies (1.4 ± 0.5), and alcohol (0.8 ± 0.6) were the least consumed items in this sample. When correlating the consumption trend survey results with healthy scores (Table 4a), eight foods were found to have significant positive and negative correlations, with low to moderate effect sizes. Notably, higher consumption of bread ($p = 0.029$) and meat substitutes ($p = 0.036$) was associated with lower scores for healthy dietary characteristics. In contrast, a greater intake of potatoes ($p = 0.019$), soy protein ($p = 0.016$), fish ($p = 0.036$), and milk ($p = 0.012$) was associated with higher scores among participants. Notably, legume consumption emerged as the food group most strongly associated with higher healthy habit scores ($r = 0.49$; 95% CI: 0.23–0.68; $p < 0.001$). As regards the relationship between food items and unhealthy habit scores (Table 4b), significant correlations were identified with six food items, exhibiting low to moderate effect sizes. Intake of potatoes ($p = 0.039$), meat substitutes ($p = 0.032$), and avocados ($p = 0.048$) tended to increase unhealthy scores, particularly snack consumption ($r = 0.44$; 95% CI: 0.17–0.64; $p = 0.001$) and alcohol consumption ($r = 0.39$; 95% CI: 0.11–0.61; $p = 0.006$). In contrast, a significant inverse relationship was observed between milk consumption and unhealthy scores ($r = -0.38$; 95% CI, −0.60 to −0.10; $p = 0.007$).

DISCUSSION

Our study focused on evaluating the diet quality of PBDs and identifying factors associated with their adequacy in health sciences university students.

As a primary outcome, it was reported that the PBDs adopted by health sciences students are largely adequate in terms of diet quality. This finding may differ from previous reports, which often report protein intake in university vegans as deficient. (18), in addition to showing a lack of knowledge about dietary sources and the consequences of deficiencies in critical nutrients (16).

Interestingly, older subjects (>22 years) showed higher healthy-habit scores than younger participants; however, this difference did not reach statistical significance and should be interpreted as a non-significant trend. Despite only 44% of the sample citing health as a motivation for following a PBDs, this is substantially higher than the 8% reported by Brignardello et al. more than a decade ago (16). This phenomenon is interesting, as animal welfare reasons consistently account for approximately 70% of the reported motivations, regardless of age group, population, or publication year in Chilean studies. However, there is a noticeable increase in the proportion of individuals in environmental circles opting for these types of diets, with more than 90% citing it as a motivation in 2020 (26). This presents a significant opportunity to promote PBDs with a planetary focus in Chile. With regard to the elements identified as factors associated with higher diet quality, we can specifically refer to the use of omega-3 and vitamin B12 supplements. This may be correlated with the health concerns expressed by the respondents, as acknowledging and consuming these supplements suggests a concern for diet quality. This is confirmed by the analysis of unhealthy habits scores, which are notably lower compared to those of the other groups. In this sense, it could be argued that the supplementation structure observed in the vegetarian/vegan population is linked to the nutritional strategies employed by this group, a finding that has already been confirmed among long-distance runners (27). Regarding the other variable significantly associated with healthier habits, the preparation of home-cooked meals for the main meals among these volunteers was identified. This finding reinforces our previous studies, where having lunch at home was strongly associated with dietary protein adequacy (18). This consistency may be linked to the idea reported by Groufh-Jacobsen et al. un 2023 (28). They observed that food literacy competencies is associated with diet quality, and vary according to the type of PBDs, compared to an omnivorous population, and assessed whether food literacy is associated with diet quality. In the multivariate regression analyses, it was reported that general nutrition knowledge, food-related skills, and vegan dietary practices were significantly associated with higher diet quality, which is consistent with our findings (28). In this regard, international evidence confirms that increasing culinary skills in university students promotes a higher frequency of home cooking and the consumption of healthier foods (29). Therefore, it would be of interest to promote the development of culinary skills in the context of adopting PBDs, which not only contribute to planetary sustainability but also to the dietary sustainability of the regimen itself. At this level, the evidence indicates that validated clinical and epidemiological instruments now exist to identify healthy vegan dietary patterns based primarily on items related to these foods and nutrients (30).

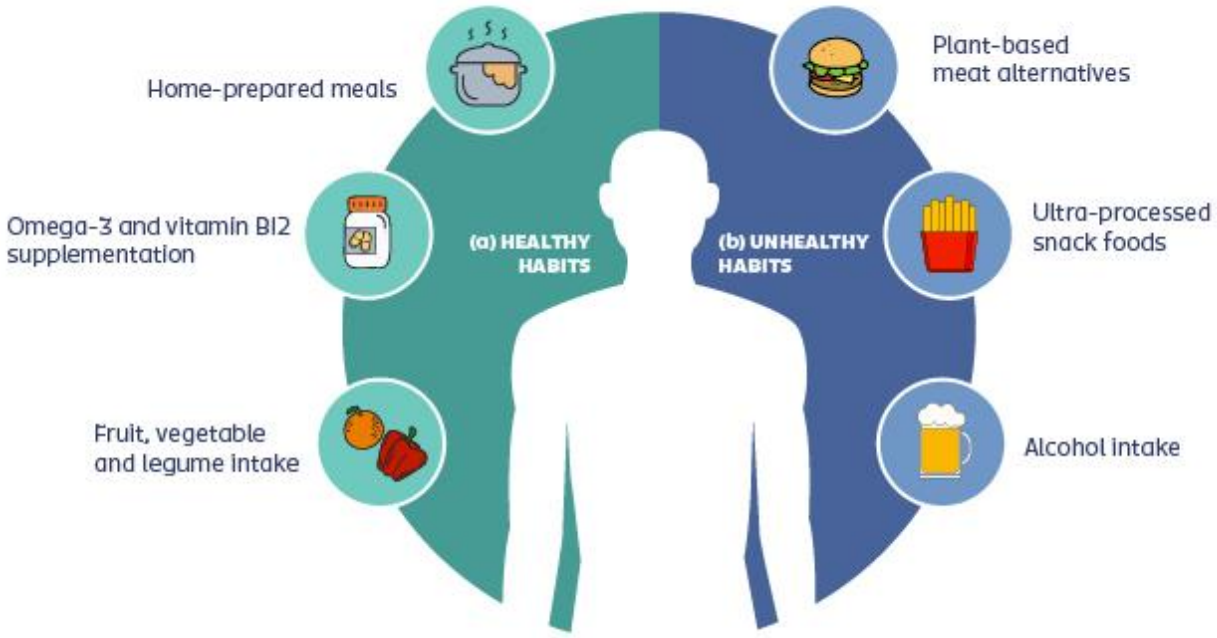

Figure 1. Food and Nutrition-Related Factors Associated with Healthy and Unhealthy Habits

When analyzing the specific dietary patterns associated with habits in the present sample, we can state that the consumption of fruits, vegetables, and legumes was directly and significantly associated to healthy habits (Figure 1a). This is consistent with the historical evidence in relation to the benefits of PBDs, which are justified by the fiber and phytochemical content of these food groups (30). Regarding its counterpart, alcohol, ultra-processed snacks, and alternative meat products are identified as the dietary components that correlated with the poorest indicators of unhealthy habits in the present sample (see Figure 1b). The evidence is robust concerning alcohol and ultra-processed snacks in the general population; indeed, alcohol has even been classified as a potential carcinogen. (31), In reference to ultra procesed foods, these have also been studied and associated with an overall increased risk of cancer (32), as well as with mood alterations (33). Particularly, the role of ultra-processed foods in PBDs is highly relevant in the context of health and sustainability, as their consumption might attenuate the recognized benefits of PBDs on both human and environmental health. Dass et al. (2024) published a study evaluating the associations of ultra-processed foods (UPF) in healthy (hPDI) and unhealthy (uPDI) diets, as well as their relationship with greenhouse gas emissions (GHG) and blue water consumption (BWC) (34). The authors concluded that the number of plant-based foods included in the diet was a more significant determinant of the relationship between diet and environmental impact than the inclusion or exclusion of ultra-processed foods.

Furthermore, PBDs would be beneficial for reducing most environmental impact indicators, regardless of whether ultra-processed foods are consumed. However, it is essential to note that these results were based on analyses of diets from the Dutch population, and the presence or absence of ultra-processed foods has a more significant impact in low- or lower-middle-income areas, as well as among populations with poorer health metrics. Considering this, it is not feasible to take a definitive stance on this matter, and further research in the area is warranted.

Among the strengths of this study, it is noteworthy that a significant number of subjects were surveyed, representing the population of the Faculty of Medicine and Health Sciences at Universidad Mayor, and that validated instruments were employed for data collection in this population group (20). Moreover, this report represents one of the few initiatives developed in Chile and Latin America, gathering specific and critical information to promote healthy and sustainable PBDs. This topic represents a principle that should be widely disseminated, given that most existing information on this subject originates from the United States and Western Europe. Although climate change will affect the global population in a transversal manner, strategies to promote planetary diets must address regional needs and guidelines to ensure their successful dissemination and local adoption. Evidence varies, indicating that in local and specific contexts, both food choice behaviors and the diet quality accessed differ across countries and regions worldwide (35–37).

Table 1. Sample Characterization. Data are presented as number of participants (n) and percentage (%).

	n (%)		n (%)
Sex		Supplementation use	
Male	4 (8.0)	*Yes*	36 (72.0)
Female	46 (92.0)	*No*	14 (28.0)
Age		Suplements consulting	
< 22	25 (50.0)	*Healths professionals*	27 (54.0)
> 22	25 (50.0)	*Others*	23 (46.0)
Diet pattern		Suplements	
Flexitarian	3 (6.0)	*Iron*	8 (16.0)
Pescetarian	9 (18.0)	*Multivitaminics*	1 (2.0)
Ovo-lacto vegetarian	28 (56.0)	*Omega 3*	4 (8.0)
Vegan	10 (20.0)	*Vitamin B12*	31 (62.0)
		Vitamin D	8 (16.0)
Vegetarian time			
< 5 years	31 (62.0)	Meal preparations	
> 5 years	19 (38.0)	*Self-prepared meals*	39 (78.0)
		Commercially prepared meals	11 (22.0)
Reasons for vegetarianism			
Ethical reasons	37 (74.0)	Healthy habits	
Health-related reasons	22 (44.0)	*Adequate*	35 (70.0)
Environmental reasons	35 (70.0)	*Inadequate*	15 (30.0)
Personal preferences	18 (36.0)		
		Unhealthy habits	
		Adequate	34 (68.0)
		Inadequate	16 (32.0)

Table 2. Comparison of healthy habits points by sociodemographic and dietary factors. Values are expressed as mean (SD) for each category and a 95% confidence interval (CI 95%). Group comparisons were performed using Student's t-test and were considered statistically significant when $p<0.05$. Differences were observed according to type of supplement consumed ($p = 0.009$) and meal preparation modality ($p = 0.001$). No other comparisons reached significance ($p > 0.05$).

	Mean (SD)	CI 95%	p value		Mean (SD)	CI 95%	p value
Sex				Supplementation use			
Female	28.0 (4.7)	26.6 to 29.4	0.789	*Yes*	27.8 (4.7)	26.3 to 29.4	0.771
Male	27.0 (7.1)	15.8 to 38.3		*No*	28.3 (5.5)	25.1 to 31.5	
Age				Suplements consulting			
< 22	26.8 (4.5)	24.9 to 28.6	0.090	*Healths professionals*	28.2 (4.3)	26.5 to 30.0	0.683
> 22	29.1 (5.0)	27.1 to 31.1		*Others*	27.7 (5.6)	25.3 to 30.1	
Diet pattern				Suplements			
Flexitarian	28.7 (11.7)	-0.44 to 57.8	0.269	*Iron*	28.3 (3.0)	25.7 to 30.8	0.009
Pescetarian	30.4 (3.5)	27.8 to 33.1		*Multivitaminics*	24.0 (0.0)	N/A	
Ovo-lacto vegetarian	27.2 (4.5)	25.5 to 29.0		*Omega 3*	34.8 (2.6)	30.6 to 38.9	
Vegan	27.6 (4.1)	24.7 to 30.5		*Vitamin B12*	27.3 (4.5)	25.7 to 29.0	
				Vitamin D	31.1 (3.1)	28.5 to 33.8	
Vegetarian time							
< 5 years	28.0 (5.4)	26.0 to 30.0	0.941	Meal preparations			
> 5 years	27.9 (4.0)	26.0 to 29.8		*Self-prepared meals*	29.1 (4.6)	27.6 to 30.6	0.001
				Commercially prepared meals	23.8 (3.1)	21.7 to 25.9	
Reasons for vegetarianism							
Ethical reasons	28.5 (4.8)	26.9 to 30.1	0.752				
Health-related reasons	29.7 (5.1)	27.4 to 31.9					
Environmental reasons	28.4 (4.8)	26.7 to 30.1					
Personal preferences	29.3 (6.0)	26.4 to 32.3					

Table 3. Comparison of unhealthy habits points by sociodemographic and dietary factors. Values are expressed as mean (SD) for each category and a 95% confidence interval (CI 95%). Group comparisons were performed using Student's t-test and were considered statistically significant when $p<0.05$. No statistically significant differences were observed between groups.

	Mean (SD)	CI 95%	p value		Mean (SD)	CI 95%	p value
Sex				Supplementation use			
Male	11.7 (2.9)	7.2 to 16.3	0.999	*Yes*	12.0 (2.5)	11.1 to 12.9	0.563
Female	11.9 (2.3)	11.2 to 12.6		*No*	11.6 (1.6)	10.6 to 12.5	
Age				Suplements consulting			
< 22	11.9 (2.5)	10.8 to 12.9	0.999	*Healths professionals*	12.3 (2.3)	11.3 to 13.2	0.213
> 22	11.9 (2.1)	11.0 to 12.8		*Others*	11.4 (2.2)	10.5 to 12.4	
Diet pattern				Suplements			
Flexitarian	11.3 (2.3)	5.6 to 17.1	0.313	*Iron*	12.6 (3.0)	10.1 to 15.1	0.643
Pescetarian	11.6 (1.9)	10.1 to 13.0		*Multivitaminics*	16.0 (0.0)	N/A	
Ovo-lacto vegetarian	11.54 (2.2)	10.7 to 12.4		*Omega 3*	12.2 (3.7)	6.4 to 18.1	
Vegan	13.3 (2.7)	11.3 to 15.3		*Vitamin B12*	12.2 (2.5)	11.3 to 13.1	
				Vitamin D	11.6 (3.4)	8.8 to 14.5	
Vegetarian time							
< 5 years	11.9 (1.7)	11.2 to 12.5	0.972	Meal preparations			
> 5 years	11.9 (3.1)	10.4 to 13.4		*Self-prepared meals*	11.9 (2.4)	11.1 to 12.7	0.963
				Commercially prepared meals	11.9 (2.0)	10.5 to 13.3	
Reasons for vegetarianism							
Ethical reasons	11.9 (2.6)	11.1 to 12.8	0.746				
Health-related reasons	11.7 (2.5)	10.6 to 12.8					
Environmental reasons	12.0 (2.3)	11.2 to 12.8					
Personal preferences	11.3 (2.4)	10.1 to 12.5					

Table 4. Correlation between healthy/unhealthy habit scores and food groups intake. *Values are presented as the correlation coefficient with 95% confidence intervals and corresponding p values.* Spearman's correlation was used to determine the degree of correlation between scores and the frequency of food consumption. *Asterisks indicate statistical significance levels: p<0.05 (*), p<0.01(**) and p<0.001(***).*

	Rice	**Pasta**	**Potatoes**	**Bread**	**Fruits**	**Vegetables**
	0,149	-0,177	0,332*	-0,310*	0,468***	0,081
	-0,143 to 0,418	-0,441 to 0,115	0,050 to 0,564	-0,547 to -0,026	0,210 to 0,665	-0,210 to 0,358
	Eggs	**Legumes**	**Soy protein**	**Meat Substitutes**	**Fish**	**Milk**
	0,224	0,485***	0,339*	-0,298*	0,298*	0,352*
(a) Healthy habits	-0,066 to 0,479	0,231 to 0,677	0,058 to 0,569	-0,538 to -0,013	0,012 to 0,538	0,073 to 0,580
	Yogurth	**Cheese**	**Milk Substitutes**	**Nuts**	**Avocado**	**Oils**
	0,043	0,186	0,126	0,176	0,174	-0,114
	-0,246 to 0,325	-0,105 to 0,449	-0,166 to 0,398	-0,116 to 0,440	-0,118 to 0,438	-0,388 to 0,178
	Snacks	**Cookies**	**Alcohol**			
	-0,117	-0,018	0,007			
	-0,390 to 0,175	-0,309 to 0,275	-0,279 to 0,293			
	Rice	**Pasta**	**Potatoes**	**Bread**	**Fruits**	**Vegetables**
	-0,029	0,258	0,293*	0,056	-0,036	-0,079
	-0,313 to 0,259	-0,031 to 0,506	0,008 to 0,535	-0,233 to 0,337	-0,319 to 0,253	-0,357 to 0,212
	Eggs	**Legumes**	**Soy protein**	**Meat Substitutes**	**Fish**	**Milk**
	-0,210	0,096	-0,020	0,305*	-0,170	-0,376**
(b) Unhealthy habits	-0,468 to 0,080	-0,195 to 0,372	-0,304 to 0,268	0,020 to 0,543	-0,435 to 0,121	-0,598 to -0,101
	Yogurth	**Cheese**	**Milk Substitutes**	**Nuts**	**Avocado**	**Oils**
	0,024	-0,161	0,259	0,089	0,281*	0,040
	-0,264 to 0,308	-0,428 to 0,131	-0,029 to 0,508	-0,202 to 0,366	-0,006 to 0,525	-0,249 to 0,323
	Snacks	**Cookies**	**Alcohol**			
	0,439**	0,028	0,387**			
	0,174 to 0,644	-0,266 to 0,317	0,114 to 0,606			

Regarding the limitations, the study relied on a voluntary convenience sample recruited through an online survey, which may have introduced self-selection bias, as participants with greater interest in nutrition or plant-based diets could have been more likely to respond. In addition, dietary habits, motivations, and supplement use were self-reported, and therefore subject to recall error and social desirability bias. The sample was restricted to health sciences university students from a single private institution and was predominantly female, which limits the representativeness of the findings and their generalizability to other academic programs and to the general Chilean university student population. Accordingly, it is possible that diet quality and related behaviors in broader university student populations may differ from those observed in this work (39,40). Finally, the cross-sectional design precludes causal inference. Future studies should use larger and more diverse samples (including other academic fields and regions) and, when feasible, incorporate objective measures of dietary intake to corroborate self-reported information.
Finally, it is essential to note that the sustainability benefits of PBDs are only practical if they also promote human health; therefore, their promotion and adoption must be carried out responsibly and conscientiously. The emergence of unhealthy PBDs underscores the need to continue such research and deepen our understanding of how sustainability can be achieved at the personnel, population, and global levels.

CONCLUSION

In this sample of health sciences university students following plant-based diets, diet quality scores suggested generally adequate dietary habits, and higher healthy-habit scores were associated with greater intake of fruits, vegetables, and legumes. Supplement use and home-prepared meals were also associated with higher scores. These associations should be interpreted cautiously given the cross-sectional design, the voluntary nature of participation, the use of self-reported measures, and the limited generalizability of a health sciences sample from a single institution. Replication in larger and more diverse Chilean samples, ideally including objective dietary assessment, is warranted to confirm these findings.

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AUTHORS CONTRIBUTION

Conceptualization, CS, MB, CF, LT, FL, CL; Methodology, DG; Software, MLR; Validation, DG; Formal analysis, MLR; Investigation, CS, MB, CF, LT, FL, CL; Data curation, MLR; Writing – original draft preparation, CS, MB, CF, LT, FL, CL; Writing – review and editing, MLR & DG; Visualization, CS; Supervision, DG.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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DATA AVAILABILITY STATEMENT

The databases can be requested from the corresponding author via email.

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