



Knowledge of Vegetarian and Nonvegetarian Peruvian Dietitians about Vegetarianism at Different Stages of Life

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ABSTRACT

BACKGROUND: The vegetarian diet continues to gain recognition and popularity among people; however, few studies have considered the level of knowledge of professional dietitians about this dietary pattern.

OBJECTIVE: This study aimed to compare the level of knowledge of vegetarian and nonvegetarian Peruvian dietitians regarding vegetarianism at different life stages.

METHODS: A cross-sectional study was carried out. An online questionnaire based on the recommendations of the current dietary guidelines was administered to more than 400 registered dietitians. Of which, a total of 179 decided to participate in the study: 72 vegetarians and 107 nonvegetarians. The data were analyzed using the chi-square test, considering a significance level of 5%.

RESULTS: Women represented the largest proportion of the sample. The participants demonstrated a complete and exhaustive knowledge of the definition of vegetarian diets. Regarding the risks and benefits associated with vegetarianism, the largest proportion of those who got the correct answers were vegetarians. The percentage of correct answers selected for both groups regarding the critical nutrients were less than 50%. Only 17.6% identified the correct answer regarding the risk of eating disorders of vegetarianism.

CONCLUSIONS: Dietitians did not demonstrate complete and comprehensive knowledge of the critical nutrients of vegetarianism and lack information on the risks of eating disorders from the vegetarian diet.

KEYWORDS: Vegetarians, Vegans, Knowledgeable, Dietitians, Peru

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Introduction

The vegetarian diet has gained recognition and popularity as one of the healthiest dietary choices. The heyday of vegetarian diets is mainly related to their nutritional benefits, prevention, and treatment of certain diseases,¹⁻³ in addition to being a regime that promotes animal welfare and care for the environment.⁴ The number of people who choose vegetarianism continues to rise steadily in developed countries.⁵ It is estimated that the proportion of people who are vegetarians varies between 2% and 10%.^{6,7} In Peru, in recent years there has been a growing interest in vegetarian diets, however, there are no official data to verify this claim.⁸

Vegetarianism is more than abstaining from the consumption of meats and their derivatives, it consists of the consumption of foods of minimally processed plant origin that include fruits, vegetables, whole grains, nuts and sometimes eggs, dairy products, and honey.⁹ In addition, this regimen is characterized by different dietary patterns according to the degree of restriction or exclusion of 1 or more types of food¹⁰: (a) vegans are the most restrictive, they avoid all foods of animal origin; (b) lacto-vegetarians exclude meat, fish, and eggs, but consume milk,

milk derivatives, honey, and plenty of plant-based foods; (c) ovo-vegetarians avoid meat, fish, and dairy products, but consume eggs, honey, and a variety of plant-based foods; (d) lacto-ovo-vegetarians restrict the consumption of all types of meat, fish, and birds, however, admit the consumption of milk and dairy products (cheese, yogurt, among others), eggs, honey, and a wide variety of foods of plant origin.¹¹

Inadequate vegetarian diets increase the risk of deficiencies in critical macronutrients, and micronutrients such as protein, vitamin D, iodine, omega-3 fatty acids, vitamin B12, iron, zinc, and calcium.¹² Deficiency of critical nutrients in different life stages could have serious repercussions on the health of vegetarians in the long term, mainly causing, protein depletion, anemia, neurological diseases, increased risk of depression, and chronic non-communicable diseases throughout life.¹³ However, the Academy of Nutrition and Dietetics in an official position paper, states that well-planned vegetarian diets are appropriate at all stages of the life cycle, including pregnancy, infancy, childhood, and adolescence.¹⁴

Dietitians are health professionals, trained exclusively in food, nutrition, and dietetics. One of the roles of dietitians is to



apply practical, evidence-based nutrition and eating advice to improve the nutritional status of patients, prevent disease, and promote well-being.¹⁵ Despite the available evidence on the health benefits of vegetarian diets, however, dietitians have shown insufficient knowledge of vegetarianism.¹⁶ One study found that 23% of the dietitians surveyed demonstrated a low level of knowledge regarding the statement “the only high-quality proteins are animal proteins.”¹⁷ On the other hand, another study carried out on Canadian health care providers, including dietitians, showed that while 72% were aware of the importance of vegetarian diets in the management and control of type 2 diabetes, but less than a third recommended them to their patients,¹⁸ which evidently shows a clear lack of confidence in vegetarian diets.

The approach to measuring the knowledge of professional dietitians about vegetarianism can be a useful tool to improve the quality of their work, acquire adequate knowledge about vegetarian diets, develop skills to provide adequate nutrition education and counseling to their vegetarian patients for ensuring adequate nutrient intake, and avoiding the risks of critical nutrient deficiency.^{12,19,20} To achieve this objective, 2 possible ways of education and training are essential: first, the curricular integration of vegetarianism in university curricula; second, the ongoing training opportunities for dietitians on the health benefits of vegetarian diets.¹⁷ Previous studies carried out in directors of dietary education programs show that they are in favor of teaching vegetarian and vegan nutrition, in addition, they believe that students are interested in discovering the vegetarian diet.¹⁶ In Peru, there are 24 universities accredited by the National Superintendency of Higher University Education that offer the professional program of Nutrition and Dietetics, however, only 1 integrates vegetarian nutrition in its curriculum.^{21,22}

The aim of the study was to compare the level of knowledge of vegetarian and nonvegetarian Peruvian dietitians regarding vegetarianism at different stages of life.

Materials and Methods

Design, type of research, and participants

A cross-sectional study was carried out between July 9 and October 4, 2020, applying an online survey. A questionnaire was sent to more than 400 Peruvian and foreign dietitians residing in the 3 regions of the country. The selection of the participants was done through intentional nonprobability sampling.²³ A total of 179 dietitians gave their consent to participate in the study. The invitation was made through E-mail, WhatsApp, and Facebook Messenger. An email or text message was sent accompanied by a letter inviting dietitians to participate in the study indicating the link to the questionnaire. The contacts of the dietitians were obtained from the College of Nutritionist of Peru and through the study center from which they were graduated. This letter briefly described the purpose of the study, the rights of the participants, and the confidentiality in the use of the data. Additionally, prospective

participants were informed that the survey would take 10 to 15 minutes on average. Finally, in the informed consent form, it was explained to them that they could express their desire to participate by checking the option “I wish to participate” and if not, they were free to mark the option “I do not wish to participate” and went to the closing page of the questionnaire. The study was carried out considering the criteria established in the Declaration of Helsinki and received the approval of the Research Bioethical Committee of the Universidad Peruana Unión and registered under reference number: N°00125-2020/UPeU/FCS/CIISA.

Sociodemographic characteristics, professional profile, and dietary

The collection of sociodemographic data, professional profiles, and dietary test were carried out using a registration form prepared by the researchers of the study, which comprises 8 questions, considering the following categories: sociodemographic profile (gender, origin, and gender); professional profile (degree of education, years of work experience, areas of work experience, and training on vegetarian diets in the last 5 years), and type of diet.

Knowledge questionnaire

To determine the level of knowledge of the participants, a questionnaire was used that was adapted from an instrument created and validated in a previous study.¹⁰ However, some additional elements were included, such as critical nutrients: protein, vitamin B12, iodine, vitamin D, omega 3, iron, zinc, and calcium,^{19,20} to ensure the knowledge of dietitians about these nutrients considered critical in vegetarian diets. We put the instrument to the test in our environment in a group of dietitians, who were later excluded from the study. The questionnaire comprises 24 items and covers 4 specific topics: topic 1 consisted of 2 questions (1-2) on the definition of a lacto-ovo-vegetarian and vegan diet. In topic 2, 3 questions (3-5) were considered that assess knowledge about the risks and benefits associated with vegetarian diets. Topic 3 grouped 8 questions (17-24) on the knowledge of the critical and specific nutrients of the said diets. Finally, topic 4 considered aspects such as the adoption of vegetarian diets in different stages of life, and these aspects were considered in 11 questions (6-16).

Statistical analysis

For data processing and analysis, the statistical software package SPSS, version 25 (SPSS Inc., Chicago, IL, USA) was used. The data were described using absolute frequencies and percentages. In addition, the chi-square test was used to see the difference in the sociodemographic variables (sex, age, and nationality); professional profile (educational level, years of experience, participation in a vegetarian nutrition course in the last 5 years), and nutritional knowledge among vegetarian and

Table 1. Sociodemographic data and professional profile of vegetarian and nonvegetarian dietitians.

VARIABLE	VEGETARIANS		NONVEGETARIANS		P-VALUE*
	N	%	N	%	
Sex					
Female	52	72.2	78	72.9	.921
Male	20	27.8	29	27.1	
Nationality					
Peruvian	54	75.0	101	94.4	<.001**
Foreign	18	25.0	6	5.6	
Age (years)					
20–24	7	9.7	27	25.2	.031**
25–30	31	43.1	41	38.3	
>30	34	47.2	39	36.4	
Level of education					
Bachelor's degree	50	69.4	92	86	<.001**
Postgraduate degree	22	30.6	15	14	
Work experience (years)					
<9	35	48.6	88	82.2	<.001**
10–19	18	25.0	11	10.3	
20–29	17	23.6	4	3.7	
>30	2	2.8	4	3.7	
Work experience					
Teaching and research	12	16.7	8	7.5	<.001**
Food service management	12	16.7	15	14.0	
Community nutrition	22	30.6	46	43.0	
Clinical nutrition	19	26.4	33	30.8	
Food industry and biopharmaceutical	6	8.3	0	0.0	
Sport nutrition	1	1.4	5	4.7	
Participation in a vegetarian nutrition course in the last 5 years					
Yes	37	51.4	26	24.3	<.001**
No	35	48.6	81	75.7	

*P value. The chi-square test was used to evaluate the degree of significance for the sociodemographic data and professional profile and the type of diet. P represents the probability that there is a significant difference between vegetarian and nonvegetarian dietitians in their responses. **Statistically significant.

nonvegetarian dietitians. Finally, a significance level of 5% was considered.

Results

A total of 179 registered dietitians gave their consent to participate in the study. Of which, 72 were vegetarian and 107 nonvegetarian. The results of the sample's sociodemographic

variables are shown in Table 1. Vegetarian and nonvegetarian women represented the highest proportion of the sample at 72.2% and 72.9%, respectively. Most of the participants were Peruvians. 47.2% of the vegetarian participants were older than 30 years. Regarding the level of instruction, it was observed that a higher proportion of vegetarians had a master's degree compared to nonvegetarians, and this difference was significant

(29.2% vs 12.1%, $P < .001$). The highest proportion of nonvegetarians had a work experience of less than 9 years compared to vegetarians, a significant difference was observed (82.2% vs 48.6%, $P < .001$). Community nutrition and clinical nutrition were the most represented work areas in terms of work experience (36.8% and 28.6%, respectively). The proportion of vegetarians who received training in vegetarian nutrition in the last 5 years were significantly higher than nonvegetarians (51.4% vs 24.3%, $P < .001$).

Table 2 shows the level of knowledge of vegetarians and nonvegetarian dietitians according to the correct answers. Regarding the first topic addressed in the study questionnaire, vegetarians had the highest proportion of correct answers regarding the definition of the lacto-ovo-vegetarian and vegan diet (94.4% vs 31.8%; 98.6% vs 32.7%, respectively), this difference was significant ($P < .001$). Regarding the topic of “knowledge about the risks and benefits associated with vegetarian diets,” the highest proportion of participants who obtained the highest number of correct responses for the 3 items were vegetarians (77.8% vs 57.0%; 80.6% vs 52.3%; and 93.1% vs 72.9%, respectively), showing a significant difference ($P < .001$). In relation to the topics “critical nutrients in the vegetarian diet” and “vegetarian diets in different stages of life,” vegetarian dietitians obtained the highest number of correct answers (50% vs 42% and 71.3% vs 60%, respectively), although there were no significant differences ($P = .43$ and $.28$).

Discussion

An adequate level of nutritional knowledge regarding vegetarian diets among dietitians is one of the best ways to reduce the risk of nutritional deficiencies in vegetarians and reduce possible long-term negative repercussions, avoiding protein depletion, anemia, neurological diseases, greater risk of depression, and chronic non-communicable diseases.¹³ This study compared the knowledge about vegetarianism at different stages of life between vegetarian and nonvegetarian dietitians.

According to the sociodemographic data, the results revealed that the highest proportion of professional dietitians were women. This finding is consistent with the results of similar studies.^{24,25} In Peru, registered dietitians are predominantly women and represent 94% of professionals.²⁶ The proportion of women who attend human nutrition schools has always exceeded that of men.²⁷ This reality is similar with other health professions.²⁸ Men are generally encouraged to enter or remain in the profession, which could be explained by the stereotypes, isolation, and feelings of exclusion from female-dominated dietary teams. In addition, other potential factors that could be considered as barriers for men interested in the profession, including the views of society on the profession, salary,²⁹ prestige, career growth opportunities,³⁰ gender vision toward the profession,²⁴ and the type of work that dietitians do.³¹ Fighting gender stereotypes could contribute to increasing the presence of men and making the profession more socially acceptable career option for them.³²

In this study, vegetarians had the highest proportion of correct answers regarding the definition of the lacto-ovo-vegetarian and vegan diet (94.4% and 98.6% respectively). These findings are supported by the results reported in a similar study conducted by other health professionals, in which it was evidenced that the majority of respondents (90%) correctly defined the vegan diet as one that excludes all consumption of foods of animal origin, and 79% correctly categorized a vegetarian diet as one in which individuals exclude foods such as red/white meat, fish, and poultry but do consume other animal products (including dairy and eggs).³³ The possible reason could be, at least partially, the fact that more than half (51.4% vs 24.3%) of vegetarians participated in training on the vegetarian diet in the last 5 years, which highlights the importance of continuing education in the practical exercise of the profession.¹⁰ Continuous education improves and strengthens the knowledge, skills, abilities, attitudes, and behavior of health professionals; it also improves the care and health outcomes of vegetarian patients.³⁴

In this study, the participants with the highest number of correct answers regarding “knowledge about the risks and benefits associated with vegetarian diets” were vegetarian dietitians. This result is supported by findings reported in similar studies conducted in other health professionals.^{10,25} Affirms the findings found in previous research in which vegetarian participants demonstrated a higher level of nutritional knowledge than nonvegetarians about vegetarianism.³⁵⁻³⁷ The possible justification for this could be, the fact of vegetarian diets are significantly related to adequate knowledge of the health benefits of vegetarian diets.³⁸ In another study that examined a convenience sample of 64 physicians, the majority (83%) agreed that a plant-based diet is safe and promotes health, reducing the risk of developing cardiovascular disease, type 2 diabetes (79%), and some cancers (63%), in addition to preventing and treating many chronic diseases (58%).³³ It is important that professional dietitians have adequate knowledge of these aspects to properly guide those who choose vegetarianism in the different stages of life.¹⁰ Indeed, both dietitians and other health professionals have a fundamental role in nutritional education and in monitoring the nutritional status of people who follow a vegetarian diet.²⁰ Although, it was evidenced that vegetarian dietitian professionals were better informed about the risks and health benefits of vegetarian diets, however, it should also be mentioned that the proportion of nonvegetarian dietitians in our study who answered the correct answers was more than half. Therefore, it can also be speculated that nonvegetarians may be well informed about the health benefits of vegetarian diets.

Only half (50%) of the vegetarian dietitians demonstrated optimal knowledge of the potential nutritional deficiencies of vegetarian diets due to critical nutrients. When both groups were asked about critical nutrients such as iron, calcium, zinc, and fatty acids, the percentage of correct responses selected for both groups was less than 50% (35.7% and 25.2%, respectively).

Table 2. Knowledge of vegetarians and nonvegetarians dietitians according to the correct answers.

VARIABLE	CORRECT ANSWERS		VEGETARIANS		NONVEGETARIANS		P-VALUE*
	N	%	N	%	N	%	
Topic 1: Definition of a lacto-ovo-vegetarian and vegan diet							
1. Lacto-ovo-vegetarian diet	68	94.4	34	31.8			<.001**
2. Vegan diet	71	98.6	35	32.7			<.001**
Topic 2: Knowledge about the risks and benefits associated with vegetarian diets							
3. An animal-based diet provides more health benefits	56	77.8	61	57.0			<.001**
4. A vegan diet does not further reduce the risks of cardiovascular disease and diabetes	58	80.6	56	52.3			<.001**
5. Many chronic diseases are . . .	67	93.1	78	72.9			<.001**
Topic 3: Critical nutrients in the vegetarian diet							
17. Plant proteins have less bioavailability	53	73.6	88	82.2			.166
18. In the first 2 years of life, the amount of fiber must be limited	30	41.7	28	26.2			<.001**
19. Iron is a critical nutrient only for vegetarian/vegan children under 2 years of age	22	30.6	33	30.8			.968
20. The sources that meet the calcium requirements are . . .	38	52.8	21	19.6			<.001**
21. Zinc has . . .	33	45.8	39	36.4			.209
22. Vitamin D levels appear to be influenced by diet and are lower in vegetarian children	37	51.4	58	54.2			.711
23. Long-chain omega-3 fatty acid levels are . . .	18	25.0	14	13.1			<.001**
24. Critical nutrients of the vegetarian diet	57	79.2	84	78.5			.915

(Continued)

Table 2. (Continued)

VARIABLE	CORRECT ANSWERS		VEGETARIANS		NONVEGETARIANS		P-VALUE*
	N	%	N	%	N	%	
Topic 4: Vegetarian diets at different stages of life							
6. A planned vegetarian diet is nutritionally adequate during all stages of the life cycle	66	91.7	85	79.4			<.001**
7. A plant-based diet is able to satisfy the nutritional demands of an infant in the first 1000 days of life	41	56.9	38	35.5			<.001**
8. Vegetarian/vegan older adults are at higher risk of deficiency in:	64	88.9	86	80.4			.129
9. Planned vegetarian and vegan diets during pregnancy present higher risks of pregnancy difficulties and birth defects	61	84.7	67	62.6			<.001**
10. Lacto-ovo vegetarian mothers can breastfeed without supplementation	56	77.8	65	60.7			<.001**
11. Vegan mothers can breastfeed without supplementation	39	54.2	59	55.1			.898
12. Children who follow a planned vegetarian diet have an adequate energy intake similar to that of omnivorous children	67	93.1	95	88.8			.339
13. During complementary feeding, the infant must receive a sufficient amount of. . .	56	77.8	68	63.6			.043**
14. A vegetarian/vegan diet is a protective factor against infant overweight	67	93.1	84	78.5			<.001**
15. The supplemental nutrient that should not be missing for a vegetarian/vegan child is. . .	37	51.4	53	49.5			.808
16. A teenager who chooses a vegetarian diet is potentially at risk for making impulsive choices, ill-informed choices, and having an eating disorder	11	15.3	17	15.9			.912

*P value. The chi-square test was used to evaluate the degree of significance of the variables and the type of diet. P represents the probability that there is a significant difference between vegetarian and nonvegetarian dietitians in their responses. **Statistically significant.

Likewise, in a similar study conducted in a group of health professionals who received specialized nutrition education, more than 50% had an average or below average knowledge base in at least 5 of the 14 general nutrition topics that covered the requirements of micronutrients and macronutrients, among others.³⁹ However, in our study, to the specific multiple-choice question that asked vegetarian and nonvegetarian dietitians to identify which are the critical nutrients in the vegetarian diet (protein, vitamin D, omega-3 fatty acids, vitamin B₁₂, iron, zinc, and calcium),^{12,40} 78.8% responded to the correct answer. Properly planned vegetarian diets, considering foods that are sources of critical nutrients promote health and reduce the risk of disease. In addition, they do not represent a risk of nutritional deficiency for vegetarian patients.⁴⁰

The Academy of Nutrition and Dietetics states that well-planned vegetarian diets are appropriate at all stages of the life cycle, including pregnancy, lactation, infancy, childhood, and adolescence.¹⁴ In this study, there was no significant difference in the answers given regarding topic 4, which dealt with “vegetarian diets at different stages of life” between both groups (Table 2). Furthermore, more than half (71.3%) of professional vegetarian dietitians seemed to have adequate knowledge about the importance of a balanced and balanced vegetarian diet during the different stages of the life cycle. Similar results were reported by 183 registered dietitians.⁴¹ Additionally, a cross-sectional study found that the majority of health professionals who followed a plant-based diet appeared to have a good understanding of the main benefits of a planned vegetarian diet during various stages of the life cycle.¹⁰ However, these findings are not consistent with the results observed in similar studies conducted in other health professionals.²⁵ The possible justification for this difference could be due to the little presence of nutrition courses in the curriculum of the other health sciences majors.

Among the dietitians interviewed, less than half (17.6%) identified the correct answer regarding that adolescents who choose a vegetarian diet are at higher risk for eating disorders. Based on available data, approximately 50% (45%-54%) of patients with anorexia nervosa reported opting for a vegetarian diet.^{42,43} It has been shown that both variables are not independent, but rather, they are intertwined phenomena;^{44,45} although the order of time in which an eating disorder begins and the start of the vegetarian diet is not well established.⁴⁵ Consequently, the situations described above could be due to the fact that people choose vegetarian diets as a consequence of their eating disorders; considering that vegetarian diets are advisable in the treatment of these and, even, their inclusion, clinically, can be an important variable to consider within the preventive actions against eating pathologies.^{46,47} Therefore, emphasis is placed on conducting longitudinal studies to examine the temporal relationship of said variables or other underlying elements that may contribute to the coexistence of eating disorders and vegetarianism, to demonstrate the causal role of the vegetarian diet in the etiology of eating disorders.⁴⁷⁻⁴⁹

The health benefits of vegetarian diets are well documented. First of all, considering cardiovascular diseases, vegetarian diets have protective effects on blood cholesterol,⁵⁰ lower blood pressure,^{51,52} which means lower rates of heart disease events. Similarly, vegetarians in comparison have a lower body mass index (BMI),⁵⁰ lower fasting blood sugar,⁵³ lower risk of diabetes,⁵⁴ and obesity.⁵⁵ On the other hand, vegetarians have a lower risk of mortality from all causes,⁵⁶ although there are certain inconsistencies.⁵⁷ Regarding the evidence on the different types of cancer, although there are certain controversies with some inconsistencies between the studies,⁵⁸ however, there is evidence of a significant decrease in risks for colorectal cancers⁵⁹ and prostate (only in vegans).⁶⁰ All above is due to the fact that vegetarian diets are characterized by low energy density, increased dietary fiber, and a low amount of saturated fat.⁵⁴

The beneficial effects of the vegetarian regimen in the prevention and treatment of chronic non-communicable diseases are evident. Therefore, it is important that dietitians are adequately informed about the vegetarian dietary pattern, because they must educate vegetarian patients on the correct way to eat, to meet their macro and micronutrient requirements according to age and metabolic status, to ensure normal growth and development and prevent chronic diseases.^{12,19,20} The nutritional recommendations should be focused on the consumption of foods of minimally processed plant origin that include the consumption of a variety of fruits, vegetables, legumes, seeds, nuts, and whole grains, reducing the intake of foods of animal origin, fats and sugars added and processed carbohydrates.

Limitations

This study has certain limitations that must be considered. In the first place, it is a cross-sectional study and the sample size was small, in addition, the sample was selected through an intentional non-probabilistic sampling that included only dietitian professionals, therefore, the results may not be generalized. More studies are needed to determine the knowledge of other professionals about vegetarian diets. Second, the sample had a higher proportion of female dietitians (72.5%), which also leaves the possibility of sampling bias.

Conclusions

The cross-sectional study findings shed light on the knowledge of vegetarian and nonvegetarian dietitians regarding vegetarianism at different stages of life. The findings evidenced that dietitians did not demonstrate complete and comprehensive knowledge of the critical nutrients of vegetarianism and lack information on the risks of eating disorders from the vegetarian diet. Regarding the knowledge about the risks and benefits associated with vegetarian diets, the highest proportion of those who obtained the correct answers were vegetarians. The percentage of correct answers selected for both critical nutrient groups such as iron, calcium, zinc, and fatty acids,

were less than 50% (35.7% and 25.2%, respectively). In both groups, less than half (17.6%) identified the correct answer that adolescents who choose a vegetarian diet are at higher risk of eating disorders.

Therefore, the curricular integration of vegetarianism in university study programs will be followed by continuous training of dietitians to guarantee an adequate knowledge of vegetarian nutrition to provide a better intervention and adequate educational guidance, which, in turn, it could contribute to the prevention of chronic diseases and better results regarding the care and health of vegetarian patients. Finally, this study highlights the need for future research on the knowledge and skills of dietitian professionals regarding vegetarianism.

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Author Contributions

JS and YECM: designed the study, participated in data collection, and wrote the first draft of the manuscript, DJJA: participated in the design of the study, analyzed and interpreted the data, assisted in the drafting and final writing of the manuscript. All authors read and approved the final manuscript. All authors agree with the manuscript and declare that the content has not been published in another journal.

Ethical Approval/Patient consent

The study was carried out considering the criteria established in the Declaration of Helsinki and received the approval of the Research Bioethical Committee of the Universidad Peruana Unión and registered under reference number: N°00125-2020/UPeU/FCS/CIISA.

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REFERENCES

- Dinu M, Abbate R, Gensini G, Casini A, Sofi F. Vegetarian, vegan diets and multiple health outcomes: a systematic review with meta-analysis of observational studies. *Crit Rev Food Sci Nutr*. 2017;57(17):3640-3649.
- Nebi J, Schuchardt JP, Wasserfurth P, et al. Characterization, dietary habits and nutritional intake of omnivorous, lacto-ovo vegetarian and vegan runners - a pilot study. *BMC Nutr*. 2019;5(1):51.
- Fehér A, Gazdecki M, Véha M, Szakály M, Szakály Z. A comprehensive review of the benefits of and the barriers to the switch to a plant-based diet. *Sustain*. 2020;12(10):1-18.
- Hopwood CJ, Bleidorn W, Schwaba T, Chen S. Health, environmental, and animal rights motives for vegetarian eating. *PLoS One*. 2020;15(4):20-24.
- McGirr C, McEvoy CT, Woodside J V. Vegetarian and vegan diets: weighing the claims. In: *Nutrition Guide for Physicians and Related Healthcare Professionals*. Springer International Publishing; 2017:203-212.
- McEvoy C, Temple N, Woodside J. Vegetarian diets, low-meat diets and health: a review. *Public Health Nutr*. 2012;15(12):2287-2294.
- Allès B, Baudry J, Méjean C, et al. Comparison of sociodemographic and nutritional characteristics between self-reported vegetarians, vegans, and meat-eaters from the nutrinet-santé study. *Nutrients*. 2017;9(9):1023.
- Córdova C. *Identidad y posicionamiento en la organización vegana: La Revolución de la Cuchara*. Universidad Nacional Mayor de San Marcos; 2016.
- Marsh K, Zeuschner C, Saunders A. Health implications of a vegetarian diet: a review. *Am J Lifestyle Med*. 2012;6(3):250-267.
- Bettinelli ME, Bezze E, Morasca L, et al. Knowledge of health professionals regarding vegetarian diets from pregnancy to adolescence: an observational study. *Nutrients*. 2019;11(5):3-11.
- Le LT, Sabaté J. Beyond meatless, the health effects of vegan diets: findings from the Adventist cohorts. *Nutrients*. 2014;6(6):2131-2147.
- Sebastiani G, Barbero AH, Borrás-Novet C, et al. The effects of vegetarian and vegan diet during pregnancy on the health of mothers and offspring. *Nutrients*. 2019;11(3):1-29.
- Gibson RS, Heath A-LM, Szymlek-Gay EA. Is iron and zinc nutrition a concern for vegetarian infants and young children in industrialized countries? *Am J Clin Nutr*. 2014;100(suppl_1):459S-468S.
- Melina V, Craig W, Levin S. Position of the academy of nutrition and dietetics: vegetarian diets. *J Acad Nutr Diet*. 2016;116(12):1970-1980.
- Teasdale SB, Latimer G, Byron A, et al. Expanding collaborative care: integrating the role of dietitians and nutrition interventions in services for people with mental illness. *Australas Psychiatry*. 2018;26(1):47-49.
- Hawkins IW, Mangels AR, Goldman R, Wood RJ. Dietetics program directors in the United States support teaching vegetarian and vegan nutrition and half connect vegetarian and vegan diets to environmental impact. *Front Nutr*. 2019;6:123.
- Hughes GJ, Kress KS, Armbrrecht ES, Mukherjea R, Mattfeldt-Beman M. Initial investigation of dietitian perception of plant-based protein quality. *Food Sci Nutr*. 2014;2(4):371-379.
- Lee V, McKay T, Arden CI. Awareness and perception of plant-based diets for the treatment and management of type 2 diabetes in a community education clinic: a pilot study. *J Nutr Metab*. 2015;2015:1-6.
- Sobiecki JG, Appleby PN, Bradbury KE, Key TJ. High compliance with dietary recommendations in a cohort of meat eaters, fish eaters, vegetarians, and vegans: results from the European prospective investigation into cancer and nutrition-Oxford study. *Nutr Res*. 2016;36(5):464-477.
- Richter M, Boeing H, Grünewald-Funk D, et al. Vegan diet position of the German Nutrition Society (DGE). *Ernaehrungs Umschau Int*. 2016;63:92-102.
- Superintendencia Nacional de Educación Superior Universitaria. Sistema de Información Universitaria. SUNEDU. Accessed December 6, 2020. <http://tuni.pe/>
- Universidad Peruana Unión. Escuela profesional de Nutrición Humana - FSalud. Accessed December 6, 2020. <https://www.upeu.edu.pe/fsalud/nutricion/>
- Otzen T, Manterola C. Técnicas de Muestreo sobre una Población a Estudio. *Int J Morphol*. 2017;35(1):227-232.
- Lordly D. Students' perceptions of males: entering the dietetic profession. *Can J Diet Pract Res*. 2012;73(3):111-116.
- Hamiel U, Landau N, Eshel Fuhrer A, Shalem T, Goldman M. The knowledge and attitudes of pediatricians in Israel towards vegetarianism. *J Pediatr Gastroenterol Nutr*. 2020;71(1):119-124.
- Colegio de Nutricionista del Perú. *Comunicado No. 012 CEN-2018-2019 CNP*, Lima, Perú; 2019. https://cnp.org.pe/wp-content/uploads/2019/04/ilovepdf_merged-2.pdf
- Gheller BJF, Joy P, Lordly D. A qualitative study exploring the experience of the male dietitian from student to professional. *Can J Diet Pract Res*. 2018; 79(2):55-59.
- Chang JC, Odrobina MR, McIntyre-Seltman K. The effect of student gender on the obstetrics and gynecology clerkship experience. *J Women's Heal*. 2010; 19(1):87-92.
- Greenwald HP, Davis RA. Minority recruitment and retention in dietetics: issues and interventions. *J Am Diet Assoc*. 2000;100(8):961-966.
- Pollard P, Taylor M, Daher N. Gender-based wage differentials among registered dietitians. *Health Care Manag (Frederick)*. 2007;26(1):52-63.
- Gheller B, Lordly D. Males in dietetics, what can be learned from the nursing profession? A narrative review of the literature. *Can J Diet Pract Res*. 2015; 76(4):166-171.
- Joy P, Gheller B, Lordly D. Men who are dietitians: deconstructing gender within the profession to inform recruitment. *Can J Diet Pract Res*. 2019; 80(4):209-212.
- Krause AJ, Williams KA. Understanding and adopting plant-based nutrition: a survey of medical providers. *Am J Lifestyle Med*. 2019;13(3):312-318.
- Filipe HP, Silva ED, Stulting AA, Golnik KC. Continuing professional development: best practices. *Middle East Afr J Ophthalmol*. 2014;21(2):134-141.
- Demay TD, Nnakwe N, Yu U-J, Schumacher J. Examination of nutrition knowledge, attitude, and dietary behaviors of college student vegetarians, semi-vegetarians, and non-vegetarians. *Sci J Food Sci Nutr*. 2019;5(1):006-014.

36. Shickle D, Lewis PA, Charny M, Farrow S. Differences in health, knowledge and attitudes between vegetarians and meat eaters in a random population sample. *J R Soc Med.* 1989;82(1):18-20.
37. Leonard AJ, Chalmers KA, Collins CE, Patterson AJ. The effect of nutrition knowledge and dietary iron intake on iron status in young women. *Appetite.* 2014;81:225-231.
38. Corrin T, Papadopoulos A. Understanding the attitudes and perceptions of vegetarian and plant-based diets to shape future health promotion programs. *Appetite.* 2017;109(1):40-47.
39. Raman M, Violato C, Coderre S. How much do gastroenterology fellows know about nutrition? *J Clin Gastroenterol.* 2009;43(6):559-564.
40. Craig WJ. Nutrition concerns and health effects of vegetarian diets. *Nutr Clin Pract.* 2010;25(6):613-620.
41. Duncan K, Bergman EA. Knowledge and attitudes of registered dietitians concerning vegetarian diets. *Nutr Res.* 1999;19(12):1741-1748.
42. Kadambari R, Cowers S, Crisp A. Some correlates of vegetarianism in anorexia nervosa. *Int J Eat Disord.* 1986;5(3):539-544.
43. O'Connor MA, Touyz SW, Dunn SM, Beumont PJV. Vegetarianism in anorexia nervosa? A review of 116 consecutive cases. *Med J Aust.* 1987;147(11-12):540-542.
44. Lindeman M, Stark K, Latvala K. Vegetarianism and eating-disordered thinking. *Eat Disord.* 2000;8(2):157-165.
45. Bardone-Cone AM, Fitzsimmons-Craft EE, Harney MB, et al. The inter-relationships between vegetarianism and eating disorders among females. *J Acad Nutr Diet.* 2012;112(8):1247-1252.
46. Beezhold B, Johnston C. Restriction of meat, fish, and poultry in omnivores improves mood: a pilot randomized controlled trial. *Nutr J.* 2012;11(1):1-5.
47. Zuromski KL, Witte TK, Smith AR, et al. Increased prevalence of vegetarianism among women with eating pathology. *Eat Behav.* 2015;19:24-27.
48. Baş M, Karabudak E, Kiziltan G. Vegetarianism and eating disorders: association between eating attitudes and other psychological factors among Turkish adolescents. *Appetite.* 2005;44(3):309-315.
49. Klopp SA, Heiss CJ, Smith HS. Self-reported vegetarianism may be a marker for college women at risk for disordered eating. *J Am Diet Assoc.* 2003;103(6):745-747.
50. Saintila J, Lozano TE, Ruiz PG, White M, Huancahuire-Vega S. Health-related quality of life, blood pressure, and biochemical and anthropometric profile in vegetarians and nonvegetarians. *J Nutr Metab.* 2020;2020:1-8.
51. Pettersen B, Anousheh R, Fan J, Jaceldo S, Fraser G. Vegetarian diets and blood pressure among white subjects: results from the adventist health study-2 (AHS-2). *Public Health Nutr.* 2012;15(10):1909-1916.
52. Yokoyama Y, Tsubota K, Watanabe M. Effects of vegetarian diets on blood pressure. *Nutr Diet Suppl.* 2016;8:57.
53. Tonstad S, Stewart K, Oda K, Batech M, Herring R, Fraser G. Vegetarian diets and incidence of diabetes in the adventist health study-2. *Nutr Metab Cardiovasc Dis.* 2013;23(4):292-299.
54. Chen Z, Zuurmond MG, van der Schaft N, et al. Plant versus animal based diets and insulin resistance, prediabetes and type 2 diabetes: the Rotterdam study. *Eur J Epidemiol.* 2018;33(9):883-893.
55. Rosell M, Appleby P, Spencer E, Key T. Weight gain over 5 years in 21,966 meat-eating, fish-eating, vegetarian, and vegan men and women in EPIC-Oxford. *Int J Obes.* 2006;30(9):1389-1396.
56. Orlich M, Singh P, Sabate J, et al. Vegetarian dietary patterns and mortality in adventist health study 2. *JAMA Intern Med.* 2014;173(13):1230-1238.
57. Key TJ, Appleby PN, Spencer EA, Travis RC, Roddam AW, Allen NE. Mortality in British vegetarians: results from the European prospective investigation into cancer and nutrition (EPIC-Oxford). *Am J Clin Nutr.* 2009;89(5):1613S-1619S.
58. Fraser GE. The vegetarian advantage: its potential for the health of our planet, our livestock, and our neighbors! *Forsch Komplementarmed.* 2016;23(2):66-68.
59. Orlich MJ, Singh PN, Sabaté J, et al. Vegetarian dietary patterns and the risk of colorectal cancers. *JAMA Intern Med.* 2015;175(5):767-776.
60. Tantamango-Bartley Y, Knutsen SF, Knutsen R, et al. Are strict vegetarians protected against prostate cancer? *Am J Clin Nutr.* 2016;103(1):153-160.