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Community Health  
Saúde Coletiva

Editor  
Carla Cristina Enes

Conflict of interest

The authors declare that they have no conflicts of interest.

Received  
October 20, 2022

Final version  
February 13, 2023

Approved  
May 3, 2023

# Characterization of the dietary and sociodemographic profile of a group of Colombian vegetarian women in childbearing age during the period 2021-2022

*Caracterização do perfil alimentar e sociodemográfico de um grupo de mulheres vegetarianas colombianas em idade fértil no período 2021-2022*

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**How to cite this article:** Combariza MC, Restrepo MCL, Carvajal MA, Arroyave NZ, Restrepo MR, Velásquez SG. Characterization of the dietary and sociodemographic profile of a group of Colombian vegetarian women in childbearing age during the period 2021-2022. Rev Nutr. 2023;36:e220227. <https://doi.org/10.1590/1678-9865202336e220227>

## ABSTRACT

### Objective

To determine the dietary and sociodemographic profile of vegetarian women of childbearing age (18 and 49 years) from the Valle de Aburrá Metropolitan Area in 2021-2022

### Methods

Through an online survey, 232 vegetarian and vegan women of childbearing age (18 to 49 years) from the Valle de Aburrá Metropolitan Area were surveyed regarding their sociodemographic characteristics, amount of time following this eating pattern and, type and reason for choosing vegetarianism, physical activity, use of nutritional supplements and frequency of consumption of certain food groups. Descriptive analyses, association of variables with the type of vegetarianism and multinomial regression models were performed.

### Results

A total of 232 vegetarian women were surveyed: 60.8% were between 18 and 30 years of age and belonged mainly to the middle class. According to the type of diet, 68.1% used an ovo-lacto-vegetarian diet, 18.1% were vegan, 9.0% lacto-vegetarian and 4.8% ovo-vegetarian. Among the factors evaluated in their potential relationship with the different types of vegetarianism,



it is highlighted that vitamin B12 supplementation presents a statistically significant association when using veganism as a comparison category.

### **Conclusion**

According to the results, among young female adults the vegetarian eating style predominates, without significant differences as to the educational level, adequate levels of physical activity in most of the population; there was a higher prevalence of ovo-lacto-vegetarianism. Vitamin B12 supplementation was significantly higher in the vegan population, indicating that ovo-lacto and ovo-vegetarian populations may be at high risk of vitamin B12 deficiency.

**Keywords:** Diet, vegan. Diet, vegetarian. Nutrients. Public health. Women's health.

### **RESUMO**

#### **Objetivo**

O estudo objetivou determinar a associação entre o perfil sociodemográfico e alimentar de mulheres vegetarianas em idade fértil (18 a 49 anos) na região metropolitana de Valle de Aburrá (Colômbia) em 2021-2022.

#### **Métodos**

Por meio de um questionário online, 232 mulheres vegetarianas e veganas em idade fértil (18 a 49 anos) pertencentes à região metropolitana de Valle de Aburrá foram entrevistadas sobre suas características sociodemográficas, tempo, tipo e motivo da escolha do vegetarianismo, atividade física, consumo de suplementos nutricionais e frequência de consumo dos grupos dos alimentos. Foi realizada análise descritiva, associação das variáveis com o tipo de vegetarianismo e modelos de regressão multinomial.

#### **Resultados**

Foram entrevistadas 232 mulheres vegetarianas: 60,8% tinham entre 18 e 30 anos e pertencem principalmente à classe social média. De acordo com o tipo de dieta, 68,1% tinham uma dieta ovolactovegetariana; 18,1%, vegana; 9%, lactovegetariana; e 4,8%, ovovegetariana. Entre os fatores avaliados em sua possível relação com os diferentes tipos de vegetarianismo, destaca-se que a suplementação de vitamina B12 apresenta associação estatisticamente significativa ao ter o veganismo como categoria de comparação.

#### **Conclusão**

De acordo com os resultados, entre mulheres adultas jovens, predomina o estilo alimentar vegetariano, sem diferença significativa observada no nível de escolaridade e níveis adequados de atividade física na maioria da população; há também maior prevalência de ovolactovegetarianismo. A suplementação de vitamina B12 é significativamente maior na população vegana, indicando um alto risco de deficiência nas populações ovolacto e ovovegetarianas.

**Palavras-chave:** Dieta vegana. Dieta vegetariana. Nutrientes. Saúde pública. Saúde da mulher.

### **INTRODUCTION**

Vegetarians' eating patterns are characterized by the exclusion of meat and fish from the diet and vegans by the exclusion of all foods of animal origin; both diet categories have grown significantly in the population in recent years for different reasons, including interest in animal welfare, desire to protect the environment, lower risk of disease or as an alternative to manage underlying health conditions [1,2].

To date, statistical data of the vegetarian population are incipient, and cover limited geographical areas, especially in developed countries. According to Ipsos (2021), research on food consumption has classified the world population in groups according to the quantity and quality of protein and fat consumed: they include 73% omnivorous, 14% flexitarians (occasional consumption of chicken and fish), 5% vegetarians, 3% vegans and 3% pescatarians [3].

Interest in vegetarian patterns has increased exponentially worldwide. The number of vegetarians in Portugal increased by 400% in the last decade, Italy experienced an increase of

94% from 2011 to 2016 and in Canada veganism was a search trend in the year 2017. In connection with the above, the alternative proteins industry increased 3.1 billion in 2020, corresponding to 3 times more than in any year of that industry's history and in a supermarket chain in the United Kingdom, the sale of vegetarian foods increased by 500% in January 2022, compared to the same month in 2021 [4].

For Colombia, the information available regarding vegetarian practices is limited and in fact it is a subject that is not yet considered in national surveys; unofficial sources such as Portafolio magazine, report that 8% of the Colombian population is flexitarian, 4% is vegetarian and 2% is vegan [5]. According to Google Trends statistics, the interest or search for the term veganism in Colombia over time has gone from a score below 25 in 2004 to more than 80 by 2020 (100 is the maximum popularity of a term in Google Trends) [6].

Despite the benefits of veganism that have been described, some studies indicate that these eating patterns, with inadequate supervision of a Dietitian Nutritionist, can actually be deficient in macro and micronutrients such as proteins, vitamin B12, vitamin D, iron, zinc, calcium, omega 3, among others [7], generating high health risks, especially in populations such as women of childbearing age who initiate a life cycle through preconception programming since they would determine the nutritional and health conditions of their children through food, given the importance of maternal nutrition in the growth and development of children starting with the intrauterine conditions, which may predispose to the development of non-communicable chronic diseases such as obesity, diabetes, cardiovascular diseases and delays in neurodevelopment [8]. Some studies show high prevalence of malnutrition in vegan women during pregnancy due to the lack of supplementation and adequate monitoring by health professionals who are experts in the subject [9].

Due to the lack of information, it is necessary to identify and characterize this population in different regions of Colombia, which will serve as a basis for the characterization of potential nutritional deficiencies with their subsequent interventions based on the evaluation of socioeconomic and cultural conditions, motivations, and Consumption patterns. On the other hand, this population will benefit from the industry formulating new products aimed especially at satisfying that population nutritional needs; at governmental level the benefit will be the generation of new policies and projects that can promote their inclusion; and finally, there would be benefits to the health sector that would adopt protocols and the development of special treatments for that population.

To begin the characterization of one of the regions in Colombia, the present study aimed to determine the dietary and sociodemographic profile of vegetarian women of childbearing age (18 to 49 years) from the Metropolitan Area of the Aburrá Valley in the year 2021-2022.

## METHODS

Considering the procedural and ethical difficulties involved in experimental research with nutritional interventions and based on the availability of contacts linked to nutrition and health from the CES University, a cross-sectional descriptive observational study was carried out with non-probabilistic sampling, using a questionnaire with closed-ended questions as a tool for the collection of information.

This was a cross-sectional descriptive observational study carried out with 232 women aged between 18 and 49 years who experienced at least 1 year of some type of vegetarianism; they were recruited by convenience sampling during the years 2021 and 2022. This investigation was approved

by the Research Ethics Committee of the CES University and according to article 11 of Resolution 8430 of 1993 (code Ae-635, approved the 7th of May 2021), it was classified as a project without risk because there were no interventions or modifications of the participants' biological, physiological, psychological, or social variables.

The inclusion of the participants was carried out by invitations through social networks, placement in vegan restaurants and referral to nutritionists who take care of vegetarian and vegan patients. Through the invitation, the stakeholders indicated their name, telephone number, and email to later be contacted by the research group to schedule the interview date for the completion of the questionnaire. As inclusion criteria, the participants had to be women of childbearing age between 18 and 49 years of age, residents of the Valle de Aburrá Metropolitan Area, who until then had followed a lacto-vegetarian, ovo-vegetarian, ovo-lacto-vegetarian, or vegan diet for a minimum period of one year. The exclusion criteria included pregnant women or women with underlying diseases such as cancer, autoimmune diseases, kidney diseases, among others.

Upon the invitation to participate, 473 individuals signed up, of which 266 could be contacted and answered the survey questionnaire; at the closing time, one of the members of the research group, either nutritionist or a student of the last semesters of the college nutrition course, was connected online with the purpose of assisting the participant by completing the questionnaire, which was elaborated by the investigators using the Google Forms platform. In the survey, questions were asked about voluntary participation, sociodemographic data, level of physical activity, health history, characteristics of vegetarian or vegan food, consumption of dietary supplements and frequency of consumption of different foods. The answer options were: daily, weekly, monthly, occasionally or never for food groups such as dairy products, vegetables, tubers, fruits, vegetables, animal fats, vegetable fats, dried fruits, seeds, legumes, sweets, whole meal flours, refined flour, alcoholic beverages and water (Charts 1 and 2).

Jamovi version 1.6.23 software was used for the collection and review of information. The results are presented as Mean ( $M$ )  $\pm$  Standard Deviation (SD) and as a percentage of the total population.

The Chi square test was used to compare the differences between the frequencies of the comparison groups. Values  $p \leq 0.05$  were considered as statistically significant. Multinomial regression models were used to analyze the association between both the dietary profile and the sociodemographic profile with the type of vegetarianism.

#### **Chart 1 – Informed consent.**

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Thank you for wishing to participate in this survey. The reason for its realization is a project that seeks to characterize the dietary and sociodemographic profile of women of childbearing age who are of legal age (18 to 49 years old vegetarians of the Metropolitan Area in 2021 - 2022). Participation in this study is voluntary; therefore, you may decide not to participate or withdraw at any time, for any reason.

It is essential that you understand this information so that your choice or decision to participate is taken freely. The data obtained will be kept confidential and its use will be restricted only to the investigation group; once the study is completed, they will be destroyed; the results obtained in this investigation are academic and professional and have no economic claim, nor is there a conflict of interest involved. They will only be presented at academic events and scientific publications, without mentioning the names of the participants.

The general objective or what is intended with this research project is: to determine the dietary and sociodemographic profile of vegetarian women of childbearing age and of legal age (18 to 49 years) in the Metropolitan Area, which will allow further studies to be carried out in the future, promote the implementation of new programs and the development of new products aimed at the vegetarian population of the city.

Your participation consists of completing this online survey that will include general information, sociodemographic data, consumption frequency, and vegetarianism characterization questionnaires.

Email address\*

Considering that participation in this study is completely voluntary, do you agree to participate?

- Yes  
 No

**Chart 2** – Dietary and sociodemographic questionnaire.

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Next, we will ask you about some sociodemographic characteristics.

1. What is your identification number? (This question is asked only for the purpose of analyzing and filtering the answers obtained)

2. What is your birth date? Month / Day / Year

3. What is your country of birth?

- Colombia
- Other: \_\_\_\_\_

4. In which district do you live?

- District 1 (Popular)
- District 2 (Santa Cruz)
- District 3 (Manrique)
- District 4 (Aranjuez)
- District 5 (Castilla)
- District 6 (12 de Octubre)
- District 7 (Robledo)
- District 8 (Villa Hermosa)
- District 9 (Buenos Aires)
- District 10 (La Candelaria)
- District 11 (Laureles-Estadio)
- District 12 (La América)
- District 13 (San Javier)
- District 14 (El Poblado)
- District 15 (Guayabal)
- District 16 (Belén)

5. How long have you been living in Medellín?

- Less than 1 year
- Between 1 and 5 years
- More than 10 years
- Since birth

6. Which phone number can we use to contact you for future investigations? \_\_\_\_\_

7. What is your current level of education?

- Primary
- Secondary
- College
- Technologist Technician
- Undergraduate
- Postgraduate
- No schooling

8. What socioeconomic stratum do you belong to?

- Stratum 1
- Stratum 2
- Stratum 3
- Stratum 4
- Stratum 5
- Stratum 6

9. Do you identify with any of the following religions?

- Christianity
- Catholicism
- Hinduism
- Judaism
- Islamism
- Buddhism
- Spiritual
- Atheist
- Other: \_\_\_\_\_

10. Do you do more than 150 minutes of physical activity per week?

- Yes
- No

11. Do you have any of these underlying conditions?

- Dyslipidemia (alterations such as: total cholesterol, triglycerides, reduced LDL and HDL cholesterol)
- Diabetes
- Hypertension
- Obesity (Body Mass Index (BMI) greater than 30 kg/m<sup>2</sup>)
- History of cardiovascular diseases (heart attack, stroke, aneurysm arterial disease of the extremities)
- Chronic kidney disease
- None of the above

12. Are you currently pregnant?

- Yes
- No

13. Are you vegetarian or vegan?

- Yes
  - No
-

**Chart 2** – Dietary and sociodemographic questionnaire.

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## Characterization of the dietary and sociodemographic profile of a group of Colombian vegetarian women in childbearing age during the period 2021-2022

14. How long have you been vegetarian or vegan?

- Less than 1 year
- Between 1 and 2 years
- Between 2 and 4 years
- More than 5 years

15. Did you choose to be a vegetarian or vegan for any of these reasons?

- It is a type of food that helps the environment
- It is a healthier diet
- Out of respect for animals
- Because you don't like meat
- Other: \_\_\_\_\_

16. What kind of vegetarianism do you identify with?

- Ovo-lacto-vegetarian (You do not eat meat, poultry or fish)
- Lacto-vegetarian (You do not eat eggs, meat, poultry or fish)
- Ovo-vegetarian (You do not eat meat, chicken, fish or dairy)
- Vegan (You do not eat meat, poultry, fish, dairy, eggs, gelatin, honey, or wear woolen clothes)
- Other: \_\_\_\_\_

17. Do you take any kind of supplement?

- Yes
- No

18. If the answer above is yes, what supplement(s) do you take? \_\_\_\_\_

19. Do you have or have you had advice from a professional on your diet?

- Yes
- No

**Consumption frequency**

Next, we'll ask you how often you eat certain food groups.

20. How often do you consume full-fat dairy (whole milk, full-fat yogurt, mozzarella cheese, curd)?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never
- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

22. How often do you eat eggs?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

23. How often do you eat meat?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

24. How often do you consume greens and/or vegetables?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

25. How often do you eat fruit?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

26. How often do you eat nuts (almonds, hazelnuts, chestnuts, peanuts, macadamia nuts)?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

**Chart 2** – Dietary and sociodemographic questionnaire.

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Characterization of the dietary and sociodemographic profile of a group of Colombian vegetarian women in childbearing age during the period 2021-2022

27. How often do you eat legumes (beans, peas, chickpeas)?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

28. How often do you consume olive oil?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

29. How often do you consume other fats such as butter, other types of vegetable and animal oils?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

30. How often do you eat whole grains flour (brown rice, whole wheat flour, barley, oats)?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

31. How often do you eat sweets (desserts, cakes, sweet foods)?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

32. How often do you drink alcoholic beverages?

- From 1 to 3 times a day
- From 3 to 5 times a day
- Once a week
- 1 to 3 times a month
- Never or almost never

33. What is the number of glasses of water you drink per day?

- 2 glasses
- 4 glasses
- 6 glasses
- More than 8 glasses

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**RESULTS****Sociodemographic characterization**

From the review of the data obtained from 232 vegetarian women between the ages of 18 and 49 years, it was found that in the Aburrá Valley (Medellín, Colombia) 60.8% of the population was between 18 and 30 years old, 31% between 30 and 40 years. A total of 97.9% were born in Colombia. Regarding the educational level, 35.8% were graduates, 36.2% undergraduates and the remaining 28% postgraduates. Regarding socioeconomic class, the sample included mainly the middle class (60.7%) and 57% of the sample self-described as religious; 65.9% of the participants complied with the minimum time of physical activity recommended by the World Health Organization consisting of 150 minutes per week. Regarding the type of diet, 68.1% followed an ovo-lacto-vegetarian diet, 18.1% were vegan, 9% lacto-vegetarian and 4.8% ovo-vegetarian. Finally, concerning vitamin B12 supplementation, it was found that 60.4% of the 232 women supplemented their diet with said vitamin (Table 1) [10].

**Table 1** – Sociodemographic characteristics of the participants. Medellín, Colombia, 2021-2022.

Variable*	n	%
Age (years)		
18-30 years	141	60.8
30-40 years	72	31
41-49 years	19	8.2
Country of birth		
Brazil	1	0.4
Colombia	227	97.9
USA	1	0.4
Venezuela	3	1.3
Level of study		
Graduated	83	35.8
Undergraduate	84	36.2
Postgraduate	65	28
Social stratum		
Low	17	7.4
Medium	141	60.7
High	74	31.9
Religion		
Religious	132	57
Agnostic	50	21.5
Atheist	50	21.5
Physical activity		
Yes	153	65.9
No	79	34.1
Type of vegetarianism		
Lacto-vegetarian	21	9
Ovo-lacto-vegetarian	158	68.1
Ovo-vegetarian	11	4.8
Vegan	42	18.1
B12 supplementation		
Yes	140	60.4
No	92	39.6

Note: \*n=232.

### Association between both the dietary profile and the sociodemographic profile with the type of vegetarianism

Table 2 shows the association between both the dietary profile and the sociodemographic profile with the type of vegetarianism. Among the variables with statistically significant associations between the proportions of their categories and the type of vegetarian diet are the frequency of consumption of whole meal flours ( $p$ -value=0.008), frequency of consumption of seeds ( $p$ -value=0.002), and B12 supplementation ( $p$ -value=<0.001).

### Odds ratio adjusted for type of vegetarianism according to sociodemographic and dietary variables.

Table 3 shows the results of the multinomial regression model used to review the association between the dietary profile and the sociodemographic profile with respect to the type of diet, taking veganism as a reference. In the case of the comparison between the lacto-vegetarian and vegan diet, a statistically significant negative association was found for the B12 supplementation variable [OR adj = 0.064 (0.011-0.347)], which means that the odds of being a lacto-vegetarian who supplements with this vitamin is less than 94% of a vegan who does not supplement.

**Table 2** – Association between the dietary and sociodemographic profiles with the type of vegetarianism in the study population. Medellín, Colombia, 2021-2022.

Variable	Total n (%)	Lacto-vegetarian	Ovo-lacto-vegetarian	Ovo-vegetarian	Vegan	p-value
		21 (9.0%)	158 (68.1%)	11 (4.8%)	42 (18.1%)	
<b>Level of the study</b>						
Graduate	83 (35.8)	7 (33.3)	58 (36.7)	2 (18.1)	16 (38.1)	0.764
Undergraduate	84 (36.2)	9 (42.9)	53 (33.4)	5 (45.5)	17 (40.5)	
Postgraduate	65 (28)	5 (23.8)	47 (29.7)	4 (36.4)	9 (21.3)	
<b>Socioeconomic stratum</b>						
Low	17 (7.3)	1 (4.8)	9 (5.7)	1 (9.1)	6 (14.3)	0.376
Medium	132 (56.9)	10 (47.6)	92 (58.2)	8 (72.7)	22 (52.4)	
High	83 (35.8)	10 (47.6)	57 (36.1)	2 (18.2)	14 (33.3)	
<b>Religion</b>						
Religious	132 (56.9)	14 (66.7)	88 (55.6)	7 (63.6)	23 (54.8)	0.782
Agnostic	50 (21.5)	3 (14.3)	38 (24.1)	2 (18.2)	7 (16.7)	
Atheist	50 (21.6)	4 (19)	32 (20.3)	2 (18.2)	12 (28.5)	
<b>Physical activity</b>						
Yes	153 (65.9)	17 (81)	103 (65.2)	9 (81.8)	24 (57.1)	0.185
No	79 (34.1)	4 (19)	55 (34.8)	2 (18.2)	18 (42.9)	
<b>Frequency of legumes consumption</b>						
Diary	171 (73.7)	17 (81)	109 (69)	9 (81.8)	36 (85.7)	0.117
Weekly	61 (26.3)	4 (19)	49 (31)	2 (18.2)	6 (14.3)	
<b>Frequency of whole meal flours consumption</b>						
Diary	89 (38.4)	14 (66.7)	47 (29.7)	5 (45.5)	23 (54.8)	0.008*
Weekly	106 (45.6)	5 (23.8)	82 (51.9)	5 (45.5)	14 (33.3)	
Occasional	37 (15.9)	2 (9.5)	29 (18.4)	1 (9)	5 (11.9)	
<b>Frequency of sweets consumption</b>						
Diary	111 (47.8)	7 (33.3)	81 (51.3)	7 (63.6)	16 (38.1)	0.150
Weekly	81 (35)	10 (47.7)	55 (34.8)	1 (9.1)	15 (35.7)	
Occasional	40 (17.2)	4 (19)	22 (13.9)	3 (27.3)	11 (26.2)	
<b>Frequency of fruit consumption</b>						
Diary	196 (84.5)	17 (81)	132 (83.5)	10 (90.9)	37 (88.1)	0.784
Weekly	36 (15.5)	4 (19)	26 (16.5)	1 (9.1)	5 (11.9)	
<b>Frequency of nuts consumption</b>						
Diary	119 (51.3)	13 (61.9)	75 (47.5)	8 (72.7)	23 (54.8)	0.480
Weekly	82 (35.3)	7 (33.3)	58 (36.7)	2 (18.2)	15 (35.7)	
Occasional	31 (13.4)	1 (4.8)	25 (15.8)	1 (9.1)	4 (9.5)	
<b>Frequency of seed consumption</b>						
Diary	91 (39.2)	12 (57.2)	47 (29.8)	7 (63.6)	25 (59.6)	0.002*
Weekly	86 (37.1)	5 (23.9)	65 (41.1)	2 (18.2)	14 (33.3)	
Occasional	55 (23.7)	4 (19)	46 (29.1)	2 (18.2)	3 (7.1)	
<b>Frequency of alcoholic beverages intake</b>						
Weekly	46 (19.8)	4 (19)	31 (19.6)	2 (18.2)	9 (21.4)	0.992
Occasional	157 (67.7)	15 (71.5)	108 (68.4)	7 (63.6)	27 (64.3)	
Never	29 (12.5)	2 (9.5)	19 (12)	2 (18.2)	6 (14.3)	
<b>Professional advice</b>						
Yes	153 (65.9)	15 (71.4)	102 (64.6)	8 (72.7)	28 (66.7)	0.884
No	79 (34.1)	6 (28.6)	56 (35.4)	3 (27.3)	14 (33.3)	
<b>B12 supplementation</b>						
Yes	140 (60.3)	13 (61.9)	83 (52.5)	5 (45.5)	39 (92.9)	<0.001*
No	92 (39.7)	8 (38.1)	75 (47.5)	6 (54.5)	3 (7.1)	
<b>Protein supplementation</b>						
Yes	40 (17.2)	6 (28.6)	28 (17.7)	2 (18.2)	4 (9.5)	0.299
No	192 (82.8)	15 (71.4)	130 (82.3)	9 (81.8)	38 (90.5)	
<b>Vitamin D supplementation</b>						
Yes	25 (10.8)	2 (9.5)	17 (10.8)	1 (9.1)	5 (11.9)	0.989
No	207 (89.2)	19 (90.5)	141 (89.2)	10 (90.9)	37 (88.1)	
<b>Iron supplementation</b>						
Yes	29 (12.5)	1 (4.8)	22 (13.9)	2 (18.2)	4 (9.5)	0.550
No	203 (87.5)	20 (95.2)	136 (86.1)	9 (81.8)	38 (90.5)	

Note: \*significant at  $p < 0.05$ . The p-value is based on the Chi Square test of normality.

**Table 3** – Odds ratio adjusted for the type of vegetarianism according to sociodemographic and dietary variables. Medellín, Colombia, 2021-2022.

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Variables	$\beta$	Lacto-vegetarian vs vegan		$p$ -value	Ovo-lacto- vegetarian vs vegan		$p$ -value	Ovo-vegetarian vs vegan		$p$ -value			
		OR adj (95% IC)			OR adj (95% IC)			OR adj (95% IC)					
<b>Age (years)</b>													
18-30		(reference)			(reference)			(reference)					
31-40	-1.585	0.0535 (0.012-22.199)	0.099	-1.121	0.325 (0.085-1.237)	0.099	0.180	1.197 (0.114-12.522)	0.880				
41-49	-2.328	0.097 (0.006-1.362)	0.084	-2.540	0.078 (0.010-0.577)	0.012*	2.614	13.652 (0.481-386.930)	0.126				
<b>Level of the study</b>													
Graduate		(reference)			(reference)			(reference)					
Undergraduate	0.338	1.402 (0.318-6.181)	0.655	0.087	1.091 (0.383-3.107)	0.870	0.909	2.484 (0.226-27.254)	0.457				
Postgraduate	1.412	1.412 (0.476-35.376)	0.199	1.582	4.865 (1.041-22.728)	0.044*	0.514	1.672 (0.095-29.171)	0.725				
<b>Socioeconomic stratum</b>													
Low		(reference)			(reference)			(reference)					
Medium	1.623	5.068 (0.316-81.249)	0.252	1.639	5.153 (0.925-28.685)	0.061	0.794	2.212 (0.094-51.558)	0.621				
High	1.746	5.734 (0.354-92.894)	0.219	1.421	4.144 (0.714-24.042)	0.113	-0.227	0.796 (0.028-22.254)	0.893				
<b>Religion</b>													
Religious		(reference)			(reference)			(reference)					
Agnostic	-1.273	0.280 (0.045-1.732)	0.171	-0.421	0.656 (0.200-2.147)	0.486	-0.691	0.500 (0.052-4.774)	0.548				
Atheist	-1.153	0.314 (0.063-1.567)	0.158	-0.650	0.521 (0.184-1.475)	0.220	-0.729	0.482 (0.045-5.132)	0.546				
<b>Physical activity (&gt;150 min per week)</b>													
No		(reference)			(reference)			(reference)					
Yes	0.896	2.451 (0.551-10.905)	0.239	-0.024	0.961 (0.395-2.656)	0.961	1.378	3.968 (0.482-32.625)	0.200				
<b>Frequency of legumes consumption</b>													
Daily		(reference)			(reference)			(reference)					
Weekly	0.499	1.648 (0.324-8.365)	0.547	0.958	2.608 (0.861-7.896)	0.090	1.034	2.814 (0.279-28.312)	0.380				
<b>Frequency of whole meal flours consumption</b>													
Daily		(reference)			(reference)			(reference)					
Weekly	-0.815	0.442 (0.095-2.038)	0.295	0.776	2.174 (0.813-5.816)	0.122	1.299	3.667 (0.386-34.762)	0.167				
Occasional	-0.877	0.4157 (0.047-3.636)	0.428	0.406	1.502 (0.371-6.074)	0.568	-1.011	0.363 (0.013-9.817)	0.380				
<b>Frequency of sweets consumption</b>													
Daily		(reference)			(reference)			(reference)					
Weekly	0.458	1.581 (0.382-6.545)	0.527	-0.011	0.988 (0.360-2.712)	0.982	-2.950	0.052 (0.002-1103)	0.058				
Occasional	-0.361	0.696 (0.118-4.091)	0.689	-1.208	0.298 (0.089-0.993)	0.049*	-0.932	0.393 (0.049-3.117)	0.377				
<b>Frequency of fruit consumption</b>													
Daily		(reference)			(reference)			(reference)					
Weekly	1.776	5.908 (0.863-40.449)	0.070	0.596	1.816 (0.467-7.062)	0.389	0.771	2.163 (0.099-47.250)	0.624				
<b>Frequency of nuts consumption</b>													
Daily		(reference)			(reference)			(reference)					
Weekly	-0.713	0.489 (0.112-2.129)	0.341	-0.513	0.598 (0.213-1.676)	0.329	-1.662	0.189 (0.016-2.223)	0.186				
Occasional	-2.306	0.099 (0.004-2.110)	0.139	-0.898	0.407 (0.077-2.147)	0.290	0.012	1.013 (0.035-28.675)	0.994				
<b>Frequency of seed consumption</b>													
Daily		(reference)			(reference)			(reference)					
Weekly	0.105	1.110 (0.242-5.096)	0.892	0.895	2.448 (0.874-6.860)	0.088	-0.952	0.385 (0.031-4.670)	0.454				
Occasional	1.849	6.356 (0.700-57.68)	0.100	2.423	11.285 (2.260-56.337)	0.003*	1.240	3.458 (0.200-59.677)	0.393				

**Table 3** – Odds ratio adjusted for the type of vegetarianism according to sociodemographic and dietary variables. Medellín, Colombia, 2021-2022.

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Variables	$\beta$	Lacto-vegetarian vs vegan		$p$ -value	$\beta$	Ovo-lacto- vegetarian vs vegan		$p$ -value	$\beta$	Ovo-vegetarian vs vegan		$p$ -value
		OR adj (95% IC)	OR adj (95% IC)			OR adj (95% IC)	OR adj (95% IC)			OR adj (95% IC)	OR adj (95% IC)	
Frequency of alcoholic beverages intake												
Weekly		(reference)				(reference)				(reference)		
Occasional	0.177	1.194 (0.235-6.058)	0.830	0.169		1.185 (0.385-3.642)	0.767	0.715		2.045 (0.150-27.858)	0.591	
Never	-0.250	0.778 (0.068-8.781)	0.839	0.092		1.096 (0.220-5.464)	0.910	-0.212		0.808 (0.033-19.789)	0.896	
Professional advice												
No		(reference)				(reference)				(reference)		
Yes	0.434	1.544 (0.379-6.284)	0.544	-0.182		0.833 (0.324-2.142)	0.705	0.538		1.713 (0.234-12.515)	0.595	
B12 supplementation												
No		(reference)				(reference)				(reference)		
Yes	-2.747	0.064 (0.011-0.347)	0.001*	-2.775		0.062 (0.015-0.250)	<0.001*	-3.348		0.035 (0.004-0.297)	0.002*	
Protein supplementation												
No		(reference)				(reference)				(reference)		
Yes	1.558	4.749 (0.868-25.989)	0.072	1.112		3.041 (0.755-12.245)	0.118	1.310		3.706 (0.307-44.701)	0.302	
Vitamin D supplementation												
No		(reference)				(reference)				(reference)		
Yes	-0.110	0.894 (0.100-7.972)	0.921	0.3740		1.453 (0.385-5.482)	0.581	-2.251		0.105 (0.008-13.288)	0.362	
Iron supplementation												
No		(reference)				(reference)				(reference)		
Yes	-1.023	0.359 (0.028-4.523)	0.428	0.545		1.725 (0.462-6.441)	0.417	1.084		2.959 (0.187-46.660)	0.441	

Note: \*significant at  $p<0.05$ . \*The P value is based on the Chi Square test of normality.

Likewise, when comparing the ovo-lacto-vegetarian diet with respect to the vegan one, it was found that the variables of age [OR adj = 0.078 (0.010–0.577)], frequency of sweets consumption [OR adj = 0.298 (0.089–0.993)] and vitamin B12 supplementation [OR adj = 0.062 (0.015–0.250)] presented a statistically significant negative association; while the variables of study level [OR adj = 4.865 (1.041–22.728)] and frequency of seed consumption [OR adj = 11.285 (2.260–56.337)] presented a statistically significant positive association. From the above it is highlighted that, similar to lacto-vegetarian diets, the odds for an ovo-lacto-vegetarian person who uses B12 supplement is 93% lower than a vegan person who does not use that supplement. Likewise, the odds of being ovo-lacto-vegetarian in individuals who consume sweets occasionally is 70% lower than a vegan person who consumes them occasionally. Regarding age, the odds of being an ovo-lacto-vegetarian for a person between 41 and 49 years of age is 92% lower than a person between 18 and 30 years of age.

Additionally, statistically significant positive associations were found for the variables of the study level [OR adj = 4.865 (1.041–22.728)] and frequency of seed consumption [OR adj = 4.865 (1.041–22.728)], when comparing the ovo-lacto-vegetarian and vegan diet types. Therefore, the odds of being ovo-lacto-vegetarian in people who consume seeds occasionally is 11.28 times higher than those who consume seeds daily. Finally, when comparing the ovo-vegetarian with the vegan diet, it is observed that only the B12 supplementation variable [OR adj = 0.035 (0.004–0.297)] presented a statistically significant negative association. This means that the odds of being an ovo-vegetarian who supplements with B12 is 96% lower than a vegan who does not use this vitamin supplement.

## DISCUSSION

The results of this study provide new insights into the dietary and sociodemographic profile of vegetarian women of childbearing age and of legal age in the Metropolitan Area of Medellín. Regarding the level of study, it was found that most women were undergraduates and postgraduates (84 and 83% respectively and, in terms of social class, the most prevalent was the middle class (60.7%), which is consistent with results of previous studies carried out in the city of Medellín indicating an important purchasing power in this population, which reflects in food security [11].

Regarding the dietary profile, some studies mention that people with a plant-based diet are characterized by a high consumption of fruits and vegetables [12], exceeding the average consumption of these food groups in the whole population. This is supported by the results of this study in relation to fruits, where 84.5% of the total study population consumes fruits daily, which could meet the World Health Organization intake recommendation of at least 400 grams (5 servings a day) between fruits and vegetables [13].

On the other hand, in this study, the consumption of whole grain flours was statistically significant among the different types of vegetarians, a fact similar to that of other studies that indicated that vegetarians consume more wholegrain flours than non-vegetarians [14]. This could be because wholegrain flours are a better source of fiber and other nutrients such as the B complex vitamins, iron, folic acid, selenium, potassium, and magnesium [15]. Likewise, flours are used to complement the proteins' amino acids and facilitate their digestion and absorption [16]. Other studies have found positive associations between the consumption of refined flours during pregnancy and the risk of overweight and obesity, leading to negative results regarding cardiometabolic aspects, which is why it is important to monitor this food group in women of childbearing age [17].

Regarding the consumption of sweets among vegetarians and vegans, it has been found in other studies [18-21] that such consumption tends to be low compared to omnivores. In the results of our study, it was found that, although the consumption of sweets was not statistically significant, 47.8% of the participants stated that they consumed at least 1 sweet once a day. This corroborates the statistics of the World Health Organization where it is evidenced that approximately 48% of the population consumes sweets daily, probably exceeding the World Health Organization recommendations of a maximum consumption of 25 to 45 grams of total sugars per day for an adult [22]. On the other hand, the available evidence suggests that the type and amount of carbohydrates can influence women's fertility; in this connection, it has been observed that the consumption of a diet rich in foods with a low glycemic load is associated to an improvement in fertility due to ovulation caused by better insulin sensitivity in women [23]. On the other hand, the Nutritional Evaluation Study (NuEva) carried out in Germany, found that the intake of simple carbohydrates was lower in people who ate a vegan diet compared to flexitarians and vegetarians, which supports the result obtained in this study, since when comparing the consumption of sweets between the different types of vegetarianism vs. veganism, it was found that an ovo-lacto-vegetarian diet is more likely to increase sweets consumption compared to a vegan diet [19].

Some investigations have highlighted the low protein intake in dietary patterns based on protein of vegetable origin, especially in vegan patterns [24,25]. This is because foods of vegetable origin are considered a source of incomplete proteins due to their lack of one or more amino acids. However, proteins complete each other by mixing different foods of plant origin; as a general rule, grains, cereals, nuts or seeds can be consumed together with legumes to obtain a complete protein set [26]. This is where the importance of seeds comes into play. Besides providing protein quality

in this type of diet, they also provide essential fatty acids such as linoleic acid and alpha linolenic acid [27]. In the present study, a statistically significant association was identified between the consumption of seeds and the type of vegetarianism, with higher consumption in vegan women.

On the other hand, vitamin B12 deficiency is common in individuals who eat a plant-based diet in any of the vegetarianism classifications, since this vitamin is synthesized mainly by microorganisms which are found essentially in foods of animal origin [28]. Deficiency of this vitamin in women of childbearing age can increase the risk of the baby developing neural tube defects and has been associated with risk of preterm delivery and low birth weight [29]. From the results of the present study, a statistically significant difference was found regarding B12 supplementation associated with the different types of vegetarianism, which implies that the vegan population adequately uses supplements of this vitamin, unlike other types of vegetarianism. On the other hand in the Nutritional Evaluation (NuEva) Study which was carried out in Germany, it was found that the daily intake of vitamin B12 was below the recommended levels in both vegans and vegetarians [19]; this same observation was evidenced in a systematic review that evaluated studies that reviewed the intake of foods that are sources of vitamin B12 and the consumption of foods with supplementation, finding in the latter a higher vitamin B12 total intake. However, the intake of sources of vitamin B12 of vegetarians and vegans remained below the recommended nutritional level [30] yet in the present study it was found that vegan individuals had higher vitamin B12 supplementation than other vegetarians. It is important to highlight that in the case of supplementation with protein, iron, and vitamin D, no association was found with the different types of vegetarianism. Although no studies were found that compare the supplementation of these nutrients in this population group, a publication by the Austrian Pediatric and Adolescent Society found that vegans have the lowest intake of vitamin D; Vegetarians in general have a good consumption of foods that are sources of iron, although the iron has less bioavailability and in the case of protein, ovo-lacto-vegetarians receive good quality protein in their diet, unlike vegans, since they do not have all essential amino acids within the composition of their plant-based protein [31].

These patterns may not be extended to all vegetarian women. People choose their diet based on multiple aspects, including culture, emotions, traditions, availability, among other factors. These findings can provide a guide to carry out a more accurate nutritional intervention and guide the innovation of this population's products, which can satisfy nutritional requirements.

In future studies more food groups should be included as well as taking portion sizes into account to obtain more precise information. Likewise, it should be considered that food frequency may not reflect biochemical parameters; this is why it is recommended to evaluate the biochemical profile of the study population in subsequent studies. Similarly, some studies have associated this type of diet with lower body weight and consequently a lower body mass index; therefore, anthropometric follow-up is suggested in further research [32,33]. The results of this study have limitations in terms of their scope and inference because the chosen sample does not meet the criteria of representativeness in terms of size and type of sampling, due to the difficulties in accessing a population of interest that has still very low prevalence. This study may be the basis for future research since vegetarianism is within the eating and consumption trends.

## CONCLUSION

Plant-based eating practices can be part of healthy eating practices without negative effects on health, as long as there is adequate guidance from Nutrition and Dietetics professionals and a balance is maintained in the consumption of the different groups of food and also that nutritional supplementation guidelines are complied with. According to the results in the population assessed,

young adults are the ones who adopt most the vegetarian or vegan eating style, with a higher prevalence of ovo-lacto-vegetarianism regardless of significant differences in the educational level and adequate levels of physical activity. It is noteworthy that vitamin B12 supplementation is significantly higher in the vegan population, which means a high risk of vitamin B12 deficiency in ovo-lacto and ovo-vegetarian populations, because foods such as eggs and dairy products do not meet the vitamin B12 supply levels plus the fact that vegetable sources are considered as providers of pseudo vitamin B12 that lack functionality. This investigation only addresses aspects associated with consumption, but it is necessary to carry out further investigations that allow the evaluation of biochemical and anthropometric variables in this and in other population groups.

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## CONTRIBUTORS

MC COMBARIZA contributed to the study design, data analysis and interpretation. MCL RESTREPO contributed to the data collection and data search. MA CARVAJAL contributed to the data collection and analysis. NZ ARROYAVE contributed to the study design and final review. MR RESTREPO contributed to the study design. SG VELÁSQUEZ contributed to the analysis and data interpretation.