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Factors Associated with Fruit and Vegetable Consumption among Adults in the Municipality of Bargny, Senegal

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Abstract

Background: Low fruit and vegetable consumption is an important health risk factor and is associated with several non-communicable diseases. **Objective:** To analyze factors associated with fruit and vegetable consumption among adults in the municipality of Bargny, Senegal. **Methods:** A descriptive cross-sectional analytical study was conducted among 323 adults aged 18 to 59 years living in Bargny. Data were collected using a structured face-to-face questionnaire covering sociodemographic characteristics, knowledge about fruits and vegetables, consumption habits, and accessibility. Data were analyzed using SPSS, and the chi-square test was used to examine associations between variables, with statistical significance set at 5%. **Results:** Seventy-five percent of participants did not recognize the importance of fruits and vegetables for health, and 67% did not know the recommended daily amount. Only 7% reported knowing a recommendation corresponding to five or more portions per day. Fruit consumption was rarely reported by 88% of participants, whereas 75% reported consuming vegetables once a day. Based on Pearson's chi-square tests of the displayed counts, fruit consumption frequency was associated with sex, monthly income, educational level, and self-reported awareness of the health importance of fruits and vegetables. No statistically significant association was observed between vegetable consumption frequency and monthly income, educational level, or self-reported awareness. **Conclusion:** These findings highlight the need to strengthen nutrition education and implement context-specific strategies to promote sufficient and regular fruit and vegetable consumption among adults in Bargny.

Keywords

Fruit Consumption, Vegetable Consumption, Nutrition Knowledge, Bargny, Senegal

1. Introduction

Vegetables and fruits play an important role in the diet because of their richness in essential nutrients, including vitamins, minerals, and dietary fiber [1]. Insufficient fruit and vegetable consumption is associated with an increased risk of non-communicable diseases, including cardiovascular diseases, stroke, certain cancers, chronic respiratory diseases, diabetes, and obesity [2]. According to the World Health Organization (WHO), low fruit and vegetable consumption is among the major risk factors for mortality worldwide, along with insufficient physical activity, tobacco use, and alcohol consumption [3].

In 2017, approximately 3.9 million deaths worldwide were attributed to insufficient fruit and vegetable consumption. This inadequacy was estimated to account for approximately 14% of deaths attributable to gastrointestinal cancers, 11% of deaths related to ischemic heart disease, and nearly 9% of deaths due to stroke [4].

The year 2021 was proclaimed the "International Year of Fruits and Vegetables" by the United Nations General Assembly. This initiative was part of the Sustainable Development Goals (SDGs) agenda for 2030 and reflected the need to promote healthy dietary practices and environmental sustainability. The Food and Agriculture Organization of the United Nations (FAO) encourages the consumption of fruits and vegetables as part of diversified and healthy diets [4].

To benefit from their nutritional advantages, particularly their fiber, vitamin, and mineral content, the World Health Organization recommends consuming at least 400 g of fruits and vegetables per person per day. Recommendations may nevertheless vary according to national nutrition policies. Despite these recommendations, actual fruit and vegetable consumption often remains below recommended levels [4].

In Senegal, risk factors for non-communicable diseases (NCDs) and the diseases associated with them are an important public health concern. Surveys conducted by the National Agency of Statistics and Demography (ANSD) in 2015 showed that approximately 24% of the Senegalese population was hypertensive and that overweight and obesity affected a substantial proportion of the population, particularly women. In addition, approximately 2.1% of the population had diabetes. These findings highlight the importance of addressing diet-related and other non-communicable disease risk factors in Senegal [5].

Located in the Rufisque Department, the municipality of Bargny is experiencing population growth and urbanization. These contextual changes may influence the local food environment and dietary practices, which reinforces the importance

of examining fruit and vegetable consumption in this setting.

This study aimed to analyze factors associated with fruit and vegetable consumption among adults in the municipality of Bargny. More specifically, it assessed participants' knowledge of the importance of fruits and vegetables, described consumption habits, assessed perceived accessibility, and identified factors associated with consumption. Because few studies have been conducted specifically in Bargny on nutritional knowledge and dietary practices related to fruits and vegetables, this study contributes to a better understanding of consumption determinants in this local context and provides information that may support nutrition awareness and education initiatives.

2. Material and Methods

2.1. Study Design and Population

A descriptive cross-sectional analytical study was conducted among adults residing in the municipality of Bargny. The study population consisted of persons aged 18 to 59 years who permanently resided in Bargny and provided informed consent to participate.

2.2. Inclusion and Non-Inclusion Criteria

The inclusion criteria were as follows:

- aged 18 to 59 years;
- permanent resident of the municipality of Bargny;
- provided informed consent to participate in the study.

Residents of Bargny who declined to participate were not included.

2.3. Sample Size and Sampling Procedure

Sample size was determined using the Schwartz formula:

$$n = z^2 \times p \times (1-p) / d^2$$

where:

- n represents the minimum sample size;
- z is the standard normal deviate for a 95% confidence level ($z = 1.96$);
- p is the estimated population proportion ($p = 0.30$);
- d is the tolerated margin of error ($d = 0.05$).

Using these parameters, the minimum sample size was estimated at 323 participants.

The sample size was determined using the Schwartz formula, resulting in a minimum sample of 323 participants. A two-stage stratified probability sampling procedure was used. In the first stage, the 42 neighborhoods of the municipality of Bargny constituted the sampling strata, and the sample was proportionally allocated across these neighborhoods. In the second stage, households were selected using systematic sampling within the selected neighborhoods. In each selected household, one eligible adult aged 18 - 59 years was selected by simple random sampling. Eligible participants were required to be permanent residents of Bargny

and to provide informed consent. Residents who declined to participate were excluded from the study.

2.4. Data Collection

Data were collected through a structured, face-to-face questionnaire covering sociodemographic characteristics, awareness of the health benefits of fruit and vegetable consumption, frequency of consumption, and accessibility. The questionnaire was prepared in French and translated into Wolof to facilitate understanding among participants who were not proficient in French.

Fruit and vegetable consumption frequency was assessed based on participants' reported consumption during the seven days preceding the survey. Fruit consumption was classified into four response categories: "rarely," "1 - 2 times per week," "3 - 5 times per week," and "every day." For the association analyses, these responses were dichotomized into two categories: "rarely" and "often," with the latter combining the three remaining response categories. Vegetable consumption was classified into five response categories: "never," "less than 3 times per week," "3 - 5 times per week," "once a day," and "at every meal." For the association analyses, these responses were grouped into two categories: "less than 3 times per week" (including "never") and "3 or more times per week."

Participants' awareness of the health benefits of fruit and vegetable consumption was assessed using a yes/no response item. This variable reflected self-reported awareness rather than objectively assessed nutrition knowledge. A separate item explored participants' knowledge of the recommended daily intake, with four response options: "do not know," "1 - 2 portions," "3 - 4 portions," and "5 or more portions."

The questionnaire was administered while ensuring participants' anonymity and the confidentiality of the information collected. Informed consent was obtained from all participants before data collection.

2.5. Data Analysis

Data were collected using Google Forms and exported for processing. Descriptive analyses were performed using Excel 2010. For quantitative variables, the mean, standard deviation, median, minimum, and maximum values were calculated. For qualitative variables, frequencies and relative frequencies were determined and presented in tables.

Associations between categorical variables were assessed using the Pearson chi-square (χ^2) test in SPSS version 20. The p-values and test statistics reported in this revised manuscript were recalculated from the cell counts presented in the contingency tables, using the uncorrected Pearson chi-square statistic. Statistical significance was set at $p < 0.05$.

2.6. Ethical Considerations

Informed consent was obtained from all participants before data collection. Par-

ticipants were informed about the purpose of the study, and their anonymity and the confidentiality of the information collected were ensured throughout the research process. Administrative authorization to conduct the survey was obtained from the Municipality of Bargny.

3. Results

The sociodemographic characteristics of the participants are summarized in Table 1.

Table 1. Sociodemographic characteristics of participants (n = 323).

Characteristics	n	%
Age (years)		
<30	94	29
30 - 45	148	46
46 - 59	81	25
Sex		
Male	162	50.2
Female	161	49.8
Educational level		
None	89	28
Primary	139	43
Secondary	52	16
Higher	43	13
Monthly income (FCFA)		
<50,000	110	34
50,000 - 100,000	59	18.3
100,000 - 200,000	111	34.4
>200,000	43	13.3
Chronic disease		
Yes	110	34
No	213	66

The study population is aged 18 to 59 years, with a mean age of 36 years. Participants aged 30 to 45 years are the most represented group (46%), followed by those younger than 30 years (29%) and those aged 46 to 59 years (25%).

The sex distribution is relatively balanced, with 50.2% men and 49.8% women, corresponding to a sex ratio of 1.01 in favor of men.

Regarding educational level, 43% of participants have primary education, while 28% have no formal education. Participants with secondary and higher education represent 16% and 13% of the sample, respectively.

Regarding monthly income, 34.0% of participants report earning less than

50,000 FCFA per month and 34.4% report an income between 100,000 and 200,000 FCFA. Participants with an income between 50,000 and 100,000 FCFA represent 18.3% of the sample, compared with 13.3% for those earning more than 200,000 FCFA.

Finally, 34% of participants report having a chronic disease, whereas 66% do not. Hypertension and diabetes are among the main chronic conditions reported.

3.1. Participants' Knowledge of Fruits and Vegetables

Participants' self-reported awareness and knowledge of recommended daily portions are presented in Table 2.

Table 2. Participants' knowledge of fruits and vegetables.

Variable	Response	n	%
Importance for health	Yes	81	25
	No	242	75
Recommended daily amount	Do not know	216	67
	1 - 2 portions	74	23
	3 - 4 portions	10	3
	≥5 portions	23	7

The results show that 25% of participants report knowing the importance of fruits and vegetables for health, whereas 75% do not. In addition, 67% do not know the recommended daily amount. Overall, 23% report 1 - 2 portions per day, 3% report 3 - 4 portions, and 7% report five or more portions per day.

3.2. Fruit and Vegetable Consumption and Accessibility

Reported fruit and vegetable consumption frequencies, perceived accessibility, and places of purchase are summarized in Table 3.

Table 3. Frequency of fruit and vegetable consumption and accessibility.

Variable	Category	n	%
Fruit consumption	Rarely	284	88
	1 - 2 times/week	23	7
	3 - 5 times/week	6	2
	Every day	10	3
Vegetable consumption	Never	29	9
	Less than 3 times/week	10	3
	3 - 5 times/week	6	2
	Once a day	242	75
	At every meal	36	11

Continued

Accessibility	Yes	313	97
	No	10	3
Place of purchase	Local market	313	96.9
	Street vendor	31	9.6
	Supermarket	16	5.0
	Personal garden	1	0.3

Fruit consumption is low in the study population. Specifically, 88% of participants report rarely consuming fruit, 7% once or twice per week, 2% three to five times per week, and only 3% daily. For vegetables, 9% report never consuming them, 3% less than three times per week, 2% three to five times per week, 75% once per day, and 11% at every meal. In addition, 97% report easy access to fruits and vegetables, compared with 3% reporting access difficulties.

The local market is the main reported source of supply (96.9%), followed by street vendors (9.6%), supermarkets (5.0%), and personal gardens (0.3%).

3.3. Factors Associated with Fruit Consumption

Frequent fruit consumption was reported by 26 of 161 women (16.1%) and 13 of 162 men (8.0%). The uncorrected Pearson chi-square test showed an association between sex and fruit consumption ($\chi^2(1) = 5.020$, $p = 0.025$).

The association between fruit consumption frequency and monthly income is presented in Table 4.

Table 4. Frequency of fruit consumption according to monthly income.

Monthly income	Rarely n (%)	Often n (%)	Total
<50,000 FCFA	97 (88%)	13 (12%)	110
50,000 - 100,000 FCFA	54 (92%)	5 (8%)	59
100,000 - 200,000 FCFA	105 (95%)	6 (5%)	111
>200,000 FCFA	28 (65%)	15 (35%)	43
Total	284 (88%)	39 (12%)	323

Fruit consumption frequency varies according to monthly income. Among participants earning more than 200,000 FCFA, 35% report frequent fruit consumption. This proportion is 12% among those earning less than 50,000 FCFA, 8% among those earning 50,000 - 100,000 FCFA, and 5% among those earning 100,000 - 200,000 FCFA.

The association between fruit consumption frequency and monthly income was statistically significant (Pearson $\chi^2(3) = 26.450$, $p < 0.001$).

The association between fruit consumption frequency and self-reported awareness is presented in Table 5.

Table 5. Frequency of fruit consumption according to knowledge level.

Knowledge level	Rarely n (%)	Often n (%)	Total
No or do not know	226 (93%)	16 (7%)	242
Yes	58 (72%)	23 (28%)	81
Total	284 (88%)	39 (12%)	323

Fruit consumption frequency was significantly associated with self-reported awareness of the importance of fruits and vegetables (Pearson $\chi^2(1) = 27.125$, $p < 0.001$). Among participants who reported knowing the importance of fruits and vegetables, 28% consumed fruit frequently, compared with 7% among those who did not know or were unsure.

The association between fruit consumption frequency and educational level is presented in Table 6.

Table 6. Frequency of fruit consumption according to educational level.

Educational level	Rarely n (%)	Often n (%)	Total
None	88 (99%)	1 (1%)	89
Primary	132 (95%)	7 (5%)	139
Secondary	45 (87%)	7 (13%)	52
Higher	19 (44%)	24 (56%)	43
Total	284 (88%)	39 (12%)	323

Fruit consumption frequency varied according to educational level. The proportion reporting frequent fruit consumption was 1% among those with no formal education, 5% among those with primary education, 13% among those with secondary education, and 56% among those with higher education. This association was statistically significant (Pearson $\chi^2(3) = 94.122$, $p < 0.001$).

3.4. Factors Associated with Vegetable Consumption

The association between vegetable consumption frequency and monthly income is presented in Table 7.

Table 7. Frequency of vegetable consumption according to monthly income.

Monthly income	<3 times/week n (%)	≥3 times/week n (%)	Total
<50,000 FCFA	13 (12%)	97 (88%)	110
50,000 - 100,000 FCFA	9 (15%)	50 (85%)	59
100,000 - 200,000 FCFA	13 (12%)	98 (88%)	111
>200,000 FCFA	5 (12%)	38 (88%)	43
Total	40 (12%)	283 (88%)	323

Most participants reported consuming vegetables at least three times per week,

regardless of income category. This proportion was 88% among those earning less than 50,000 FCFA, 85% among those earning 50,000 - 100,000 FCFA, 88% among those earning 100,000 - 200,000 FCFA, and 88% among those earning more than 200,000 FCFA. The association between vegetable consumption frequency and monthly income was not statistically significant (Pearson $\chi^2(3) = 0.549$, $p = 0.908$).

The association between vegetable consumption frequency and educational level is presented in Table 8.

Table 8. Frequency of vegetable consumption according to educational level.

Educational level	<3 times/week n (%)	≥3 times/week n (%)	Total
None	10 (11%)	79 (89%)	89
Primary	13 (9%)	126 (91%)	139
Secondary	7 (13%)	45 (87%)	52
Higher	10 (23%)	33 (77%)	43
Total	40 (12%)	283 (88%)	323

Vegetable consumption frequency does not vary significantly by educational level. The proportion reporting vegetable consumption at least three times per week is 89% among those with no formal education, 91% among those with primary education, 87% among those with secondary education, and 77% among those with higher education.

No statistically significant association was observed between educational level and vegetable consumption frequency (Pearson $\chi^2(3) = 6.025$, $p = 0.110$).

The association between vegetable consumption frequency and self-reported awareness is presented in Table 9.

Table 9. Frequency of vegetable consumption according to knowledge level.

Knowledge level	<3 times/week n (%)	≥3 times/week n (%)	Total
No or do not know	26 (11%)	216 (89%)	242
Yes	14 (17%)	67 (83%)	81
Total	40 (12%)	283 (88%)	323

The analysis did not show a statistically significant association between self-reported awareness and vegetable consumption frequency (Pearson $\chi^2(1) = 2.392$, $p = 0.122$).

The main factors reported as limiting fruit and vegetable consumption are summarized in Table 10.

Table 10. Factors limiting fruit and vegetable consumption.

Factors	Frequency (%)
Family food habits	88
High cost	86

Continued

Lack of information	72
Personal preferences	65
Lack of time	6
Access difficulties	4

The main constraints reported by participants are family food habits (88%), the high cost of fruits and vegetables (86%), lack of information about their nutritional benefits (72%), and personal preferences (65%). In contrast, lack of time (6%) and access difficulties (4%) are reported much less frequently.

4. Discussion

The present study highlights a low frequency of fruit consumption among adults in Bargny, whereas vegetable consumption is substantially more frequent. It also shows a marked gap between nutrition knowledge and reported practices. Three quarters of participants did not report knowing the importance of fruits and vegetables for health, 67% did not know the recommended daily amount, and only 7% reported knowing a recommendation corresponding to five or more portions per day. These findings indicate that the low consumption observed in Bargny is occurring in a context in which basic information about the nutritional importance and recommended intake of fruits and vegetables remains insufficient.

The level of knowledge observed in Bargny appears lower than that reported in other student or adult populations. N'guessan *et al.* reported that most students knew the number of fruits and vegetables recommended per day, while Koussoh *et al.* also reported a relatively high level of knowledge about their health benefits [6] [7]. The difference may partly be related to the characteristics of the populations studied, particularly age, educational level, and study setting. In Bargny, 28% of participants had no formal education and 43% had only primary education, which may limit exposure to formal nutrition information. The gap between knowledge and practice also suggests that information alone may not be sufficient to modify food consumption and that economic, social, and cultural determinants should be considered simultaneously.

Fruit consumption was particularly low. Eighty-eight percent of participants reported rarely consuming fruit and only 3% reported daily consumption. These results are lower than those reported in some African populations. The original literature reviewed for this study indicates, for example, that higher frequencies of fruit consumption have been observed in other African settings [8] [9]. The difference may reflect variations in food environments, income, cultural practices, availability of affordable fruits, and the characteristics of the populations surveyed. Importantly, the present study assessed frequency of consumption rather than quantities consumed; therefore, the results should not be interpreted as a direct estimate of dietary adequacy.

Fruit consumption was significantly associated with monthly income, educa-

tional level, and knowledge. The proportion reporting frequent fruit consumption was particularly high among participants with higher education and among those earning more than 200,000 FCFA per month. The educational gradient is consistent with findings reported by Kerekou *et al.*, who observed an association between educational level and insufficient fruit and vegetable consumption [10]. Conversely, Drabo *et al.* did not find a significant association with educational level [11], illustrating that the relationship may vary according to context. The income association observed in Bargny is also compatible with the economic constraints reported by participants, particularly the high cost of fruits and vegetables, which was cited by 86% of respondents. However, the income pattern was not progressive across all categories, so the association should be interpreted as a statistical relationship rather than evidence that fruit consumption increases continuously with income.

The association observed between sex and fruit consumption suggests that gender-related differences may play a role in reported dietary practices. Differences in food purchasing, household food preparation, or personal food choices could contribute to this pattern; however, these mechanisms were not directly investigated in the present study and should therefore be considered hypotheses.

Vegetable consumption was considerably more frequent than fruit consumption. Seventy-five percent of participants reported consuming vegetables once per day and 11% at every meal, suggesting that vegetables occupy a more regular place in the usual diet. This observation is consistent with the literature reviewed in the study, in which vegetable consumption was generally more frequent than fruit consumption in several populations [6] [8]. The difference may partly reflect the incorporation of vegetables into traditional dishes and mixed meals, whereas fruits may more often be consumed as complementary or separate foods. However, this interpretation remains a hypothesis because the study did not directly measure the contribution of specific traditional dishes to vegetable intake.

No statistically significant association was observed between vegetable consumption frequency and monthly income ($p = 0.908$). The proportions were very similar across income groups: 88%, 85%, 88%, and 88% reported consuming vegetables at least three times per week across the four income categories. No significant association was observed with educational level ($p = 0.110$) or self-reported awareness ($p = 0.122$). This pattern suggests that vegetables may be more deeply integrated into routine meals and may consequently be less sensitive to differences in education or nutrition awareness.

Accessibility does not appear to be the principal geographic constraint in Bargny. Ninety-seven percent of participants reported easy access to fruits and vegetables, and the local market was the main reported source of supply (96.9%). Nevertheless, 86% cited high cost as a limiting factor. This apparent coexistence of physical availability and economic constraint is important: the presence of food in the local environment does not necessarily mean that it is affordable or regularly consumed. The predominance of family food habits (88%), lack of information (72%), and personal preferences (65%) further indicates that consumption

is shaped by a combination of economic, social, informational, and individual determinants rather than by physical access alone.

These findings have practical implications for nutrition interventions in Bargny. Actions focused only on awareness of the health benefits of fruits and vegetables may have limited effects if they do not address household food habits and affordability. Nutrition education should therefore be combined with context-specific approaches that involve families, promote practical ways of incorporating fruits and vegetables into everyday meals, and consider the economic accessibility of these foods. The promotion of locally available and affordable fruits and vegetables may be particularly relevant in a peri-urban setting such as Bargny. Such strategies are consistent with the study's identification of family habits, cost, lack of information, and preferences as the main reported barriers.

The interpretation of these findings should nevertheless consider the limitations of the study. Its cross-sectional design does not allow causal relationships to be established. In addition, consumption frequency, accessibility, and limiting factors were self-reported and may be subject to recall or reporting bias. The questionnaire did not quantify the actual gram amounts consumed, nor did it assess seasonal variation in fruit availability and consumption. Consequently, the results describe reported frequencies and perceptions rather than precise measures of dietary intake. Despite these limitations, the study provides locally relevant evidence on the factors associated with fruit and vegetable consumption among adults in Bargny and may serve as a basis for future longitudinal or intervention studies.

5. Conclusions

This study highlights a low frequency of fruit consumption among adults in the municipality of Bargny, whereas vegetable consumption is more frequent. Knowledge about the benefits of fruits and vegetables and recommendations for daily consumption also remains low.

Fruit consumption frequency was significantly associated with sex, monthly income, educational level, and self-reported awareness of the health importance of fruits and vegetables. No statistically significant association was observed between vegetable consumption frequency and monthly income, educational level, or self-reported awareness.

Although most participants report easy access to fruits and vegetables, family food habits, high cost, lack of information, and personal preferences are among the main reported constraints. Improving fruit and vegetable consumption in Bargny may therefore require an integrated approach combining nutrition education, attention to local dietary practices, and measures that improve economic access to nutritious foods.

Further studies, particularly longitudinal or intervention studies, would be useful to better understand determinants of fruit and vegetable consumption and to evaluate the effectiveness of strategies aimed at improving consumption among adults.

Ethics Approval and Consent to Participate

Informed consent was obtained from each participant before participation. Participant anonymity and confidentiality were preserved. Authorization to conduct the survey was granted by the Municipality of Bargny.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request, subject to the protection of participants' confidentiality.

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Author Contributions

Marie Astou NDIAYE contributed to the data collection, data organization, interpretation of the findings, and drafting of the manuscript. Ameth DIAGNE contributed to the methodological supervision of the study, review and interpretation of the results, critical revision of the manuscript, and final approval of the version to be published. Both authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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