(RESEARCH ARTICLE)

Food and health practices of elderly people in two communes: Antsirabe I and Andranomanelatra – Vakinankaratra Region (Madagascar)

Rotsy Natacha RAKOTOMALALA * and Valérie Lalao RAZAFINDRATOVO

Department of Food Science and Nutrition, Faculty of Science and Technology, University of Antananarivo, Madagascar.

Abstract

The elderly population represents a group at risk of nutritional problems. Therefore, it is essential that their diet be healthy and correct to maintain a good state of health. A descriptive retrospective study of food and health practices of people aged 60 and over was carried out in the urban commune of Antsirabe I and the rural commune of Andranomanelatra in the Vakinankaratra Region in Madagascar.

The results showed that seniors eat at least three times a day (morning, noon, evening). Rice was the staple food, and dried tilapia was the most consumed source of protein in rural areas (87.5%). In the two areas studied, the protein intake was insufficient in 91.7% of people, and the lipid intake was insufficient in all individuals surveyed. The majority had a medium individual dietary diversity score (68.8% in rural areas and 78.6% in urban areas). The elderly people interviewed were concerned about their health quality. However, hygiene practices regarding the treatment of drinking water and hand washing before each meal were not satisfactory. The evaluation of the nutritional status showed that 37.5% of people were underweight (BMI < 18.5) in rural areas, against 17.9% in urban areas. The factors associated with nutritional status were the level of education, the housing comfort index, the estimated monthly income, food expenditure, the individual dietary diversity score, and the average energy intake.

Keywords: Elderly; Food practices; Health practices; Antsirabe; Dietary diversity score; Nutritional status

1. Introduction

The aging of the population is one of the most determining trends shaping the demography of the 21st century, particularly in developed countries but also in developing countries. In 2019, nearly a billion people over the age of 60 had already been counted in the world, which is 13.2% of the world's population, of which 5% lived in the African region [1].

In Madagascar, 1,144,976 individuals aged 60 and over were counted during the RGPH-3 (Third General Population and Housing Census) in 2018, which is 4.5% of the population residing in Madagascar. The regions of Analamanga, Vakinankaratra and Haute Matsiatra have the highest numbers with a respective proportion of 5.6%, 5.3% and 5.1% [2].

Although most of older people are no longer part of the working population, it is essential that their diet provide them with all the nutrients necessary to maintain good health. Many studies indicate that a diversified and balanced diet reduces the occurrence and progression of several age-related diseases. Moreover, even at advanced ages, a good diet can provide beneficial effects on health and well-being. In his time, Hippocrates underlined: "Make your food your first medicine".

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* Corresponding author: Rotsy Natacha RAKOTOMALALA

The elderly population represents a group at risk of nutritional problems. Aging is accompanied by apparent physical changes (poor teeth, hair loss, distension of the skin, etc.) and physiological changes (sensory and digestive deficiencies, etc.) likely to modify dietary practices in terms of both quantity and quality. In addition, certain social, economic or health problems can compromise the well-being and quality of life of the elderly. These changes can increase the risk of malnutrition and lead to a state of undernutrition, which is characterized by significant nutritional deficiencies, and physical and psychological weakening [3].

The overall objective of this work was to determine the eating practices of people over 60 years old. The specific objectives of this study were to describe dietary practices, to estimate nutritional intakes and establish dietary diversity scores, and then to analyze some health practices of two groups of elderly people: urban and rural.

2. Material and methods

2.1. Survey materials and methods

The sample used was made up of 60 elderly people, men and women aged 60 and over, who agreed to answer the pre-established questions. Among them, thirty-two lived in the rural area and twenty-eight in the urban area.

To assess the subjects' food consumption, the 24-hour recall was used. The method consists of asking the person to describe all the foods and drinks consumed during the last 24 hours.

Three passages per person were carried out: two passages to obtain the consumptions on two weekdays and one passage to obtain those on Sunday; this in order to determine a possible difference.

2.2. Nutrition indices and scores

Developing an index consists of combining several variables, each modality of which has been assigned a score, to create a new synthetic variable. These indices are then transformed back into qualitative variables corresponding to classes or levels.

The indices created were the home comfort index (low, medium, high), the health quality and monitoring index and the hygiene practices index [4].

The Individual Dietary Diversity Score (IDDS) aimed to assess the quality nutrition of the diet. For the individual who had consumed a food in the group, the score of 1 was assigned, otherwise the score was 0. The IDDS is the sum of all the values of food group consumed.

The classification of scoring was done according to tertiles [5].

- Low: IDDS ≤ 3
- Medium: 4 ≤ IDDS ≤ 5
- High: IDDS ≥ 6

Eight food groups were selected for the construction of the IDDS [5]:

- Group 1: starchy staples (cereals, roots and tubers)
- Group 2: legumes, nuts and seeds
- Group 3: milk and milk products
- Group 4: vitamin A rich fruits and vegetables
- Group 5: other fruits and vegetables
- Group 6: meats, fish, eggs
- Group 7: oils and fats
- Group 8: other foods

2.3. Methods for calculating macronutrient intakes

The estimated energy intake was calculated based on protein, fat and carbohydrate values, applying energy conversion factors (1 g of protein provides 4 kcal, 1 g of carbohydrate provides 4 kcal and 1 g of fat 9 kcal), according to the formula below:

$$\text{Energy (kcal)} = (\text{total protein} \times 4) + (\text{total carbohydrate} \times 4) + (\text{total fat} \times 9)$$

The energy provided by rice, which was the staple food, was calculated from the conversion of its raw weight into cooked weight (the weight of cooked rice is approximately three times its raw weight). The unit of measurement of raw rice used was the "kapoaka", which can contain 285g, and the quantity consumed per person was calculated from household consumption.

2.4. Data analysis

The data were analyzed with the Epi-info 7.1.1 software. The Chi 2 test and the Fisher test were used to analyze the dependence between two qualitative variables. The analysis of variance (ANOVA) was used for quantitative variables. The statistical significance was set at p less than or equal to 0.05.

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3. Results and discussion

3.1. Description of the study population

The average age of the sample studied was 71 ± 8.1 years. Individuals of the third age (60 to 79 years old) represented 85% and those of the fourth age (80 years and over) represented 15%.

Regarding marital status, 71.7% of the people surveyed were married and 25% were widowed.

The elderly surveyed generally had a primary (36.7%) or secondary (35%) level of education.

According to the estimate of their personal incomes, the majority earned between 300,000 and 500,000 Ariary per month in both rural and urban areas, with the respective proportions of 43.8% and 39.3%. Concerning daily expenses for food in rural areas, 28.1% spent 2,000 to 5,000 Ariary and 50% spent 5,000 to 10,000 Ariary. In urban areas, 46.4% spent 5,000 to 10,000 Ariary and 25% spent 10,000 to 15,000 Ariary (Ariary is the basic monetary unit in Madagascar).

As for the housing comfort index, 56.3% had a high index and 25% a low index in rural areas. In the urban areas, 96.4% had a high index. The housing comfort index includes the following elements: the status of the occupant, the nature of the soil, the type of lighting, the fuel, the water supply and the latrines. The low index corresponds to a value lower than 7, the medium index 8 to 9 and the high index higher than 10.

3.2. Number and types of meals

All people surveyed ate breakfast, lunch and dinner. Table 1 summarizes the foods they eat daily.

Table 1 Distribution by type of breakfast, lunch/dinner

Types of meals		Rural n = 32		Urban n = 28	
		Frequency	%	Frequency	%
Breakfast	"Vary sosoa"1 without " laoka"2	2	6.3	0	0
	"Vary sosoa" + "laoka"	27	84.4	16	57.1
	"Mofogasy3"/bread	3	9.4	12	42.9
Lunch/ dinner	"Vary maina 4/ sosoa" + "laoka"	28	87.5	26	92.9
	Corn, cassava, sweet potato	4	12.5	2	2.1

1:Rice cooked with a lot of water, of a more fluid and softer consistency than "vary maina"; 2: Rice accompaniment generally consisting of vegetables, legumes, meat, fish or shellfish, prepared in sauce or broth; 3: Sweet pancake made from rice flour cooked in a mold coated with oil; 4: Rice cooked until all the cooking water has been absorbed, firm in consistency

Most of the elderly in rural areas ate "vary sosoa" for breakfast (84.4%) and sometimes leftovers from the previous evening's dinner. "Sosoa" rice was often accompanied by "laoka", such as smoked meat, omelette, dried fish, "patsa fotsy", and soy powder. They also drank coffee. For lunch, 87.5% ate "vary maina" accompanied by leafy or other vegetables, dried fish, meat. Four seniors (12.5%) opted for roots and tubers (cassava, sweet potato) or corn cooked

with beans. In the urban areas, 57.1% ate "vary sosoa" with "laoka" in the morning compared to 42.9% who ate mofogasy / menakely (Sweet donut made from rice and wheat flour), buttered bread or brioche with cocoa or condensed milk tea or coffee. For lunch, rice accompanied by "laoka" (especially vegetables, sometimes meat) represented the majority (92.9%). Dinner was usually made up of the rest of lunch, whether in the city or in the countryside.

Sunday meals were a little different from other days, especially in urban areas; 42.8% of households prepared freshwater or seawater fish and 28.6% cooked pork or poultry meat.

Regarding snacks in the two areas, 73.4% had them on weekdays and 36.7% on Sundays. The snacks eaten by the elderly were mainly "mofogasy", vegetable soup and "mofo anana" (Salty donut made from wheat flour and watercress)

3.3. Frequency of consumption of food groups

3.3.1. Consumption for the week

The consumption for the week was based on survey results for weekdays. Figure 1 shows the consumption frequencies of the different food groups during the week.
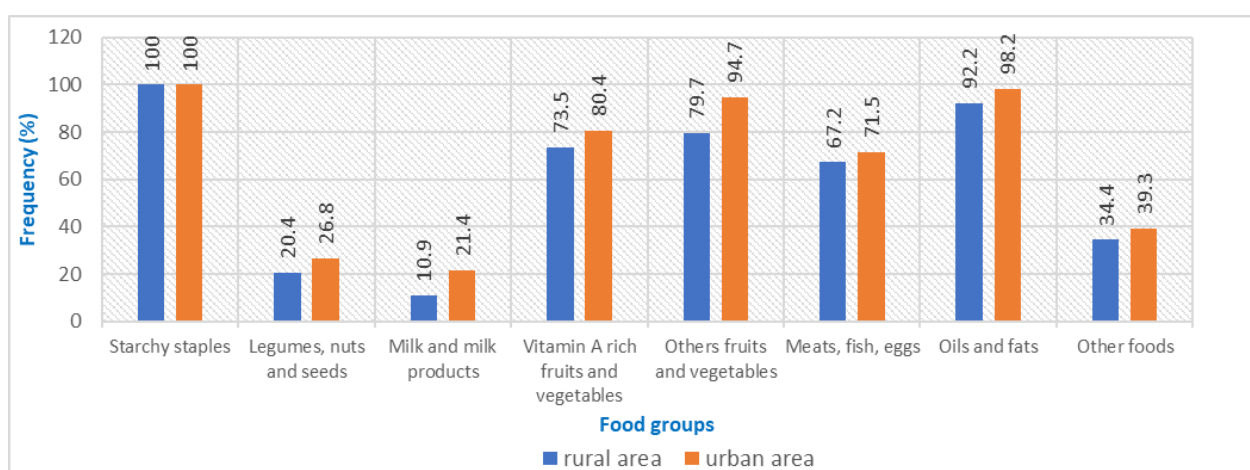

Figure 1 Frequency of consumption of food groups during the week

In rural areas, the frequencies of consumption of food groups in order of importance were: starchy staples (100%), oils and fats (92.2%), other fruits and vegetables (79.7%), vitamin A fruits and vegetables (73.5%), meat, fish and eggs (67.2%), other foods (34.4%), legumes, nuts and seeds (20.4%), and finally milk and milk products (10.9%).

In the urban areas, the frequencies of consumption of food groups were: starchy staples (100%), oils and fats (98.2%), other fruits and vegetables (94.7%), vitamin A rich fruits and vegetables (80.4%), meat, fish and eggs (71.5%), other foods (39.3%), legumes, nuts and seeds (26.8%), and finally milk and milk products (21.4%).

3.3.2. Sunday food consumption

The frequency of consumption of food groups on Sundays is summarized in the Figure 2 below.
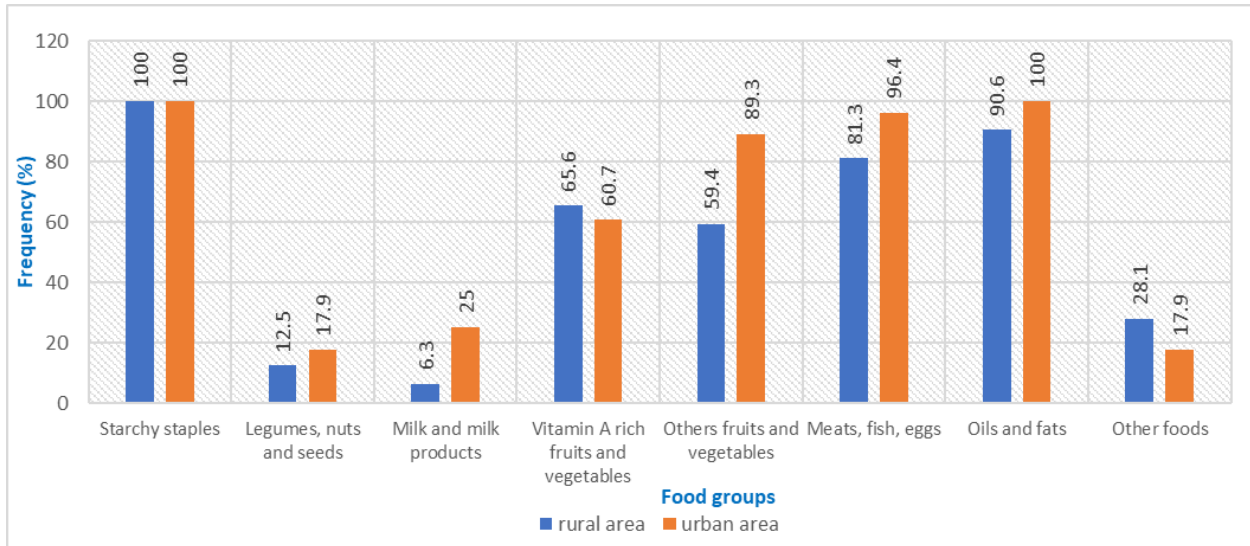
Figure 2 Frequency of consumption of food groups on Sundays

On Sundays, consumption of food groups in rural areas was as follows: starchy staples (100%), oils and fats (90.6%), meat, fish, eggs (81.3%), vitamin A rich fruits and vegetables (65.6%), other fruits and vegetables (59.4%), other foods (28.1%), legumes, nuts and seeds (12.5%), and finally milk and milk products (6.3 %).

In urban areas, the consumption of food groups was as follows: starchy staples, oils and fats (100% each), meat, fish and eggs (96.4%), other fruits and vegetables (89.3%), vitamin A rich fruits and vegetables (60.7%), milk and derivatives (25%), legumes, nuts, seeds and other foods (17.9% each).

3.4. Individual Dietary Diversity Score (IDDS)

3.4.1. IDDS for the week

The IDDS obtained during the two weekdays of the week are presented in the following Figure 3.
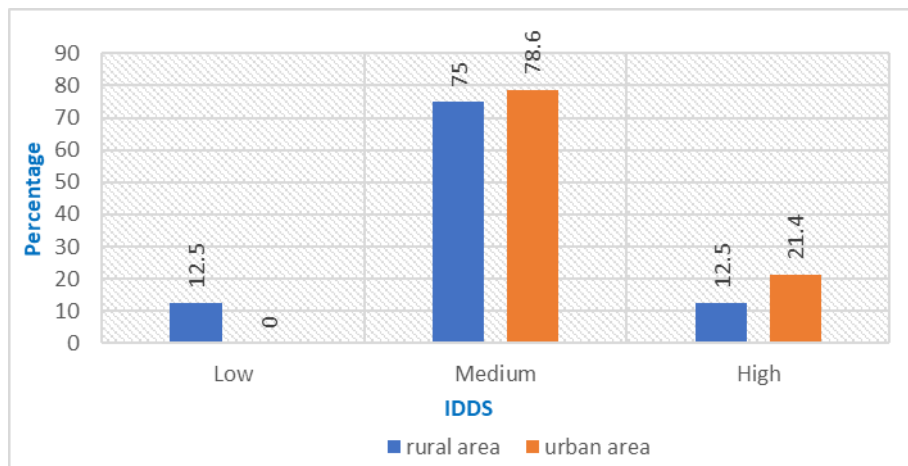

Figure 3 Weekdays IDDS

Three classes of diversity score were determined from Figure 3:

- Low: corresponding to the consumption of 3 food groups
- Medium: consumption of 4 or 5 groups
- High: consumption of 6 groups or more.

In rural areas, 75% of people surveyed had a medium score, 12.5% a high score and 12.5% a low score. The mean IDDS obtained was 4.8 ± 1.1. In urban areas, the majority (78.6%) was classified in the medium score and 21.4% in the high score. The mean IDDS was 5.5 ± 0.9.

3.4.2. Sundays IDDS

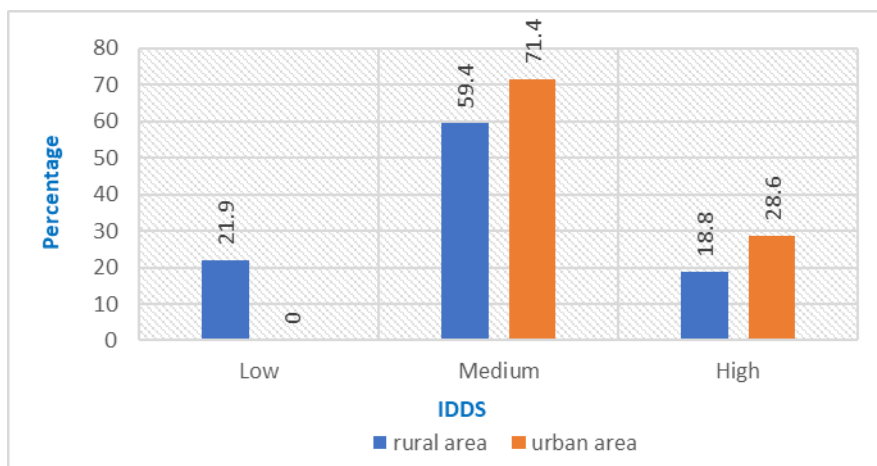Figure 4 describes the IDDS of individuals on Sundays.

Figure 4 Sundays IDDS

According to the number of food groups consumed on Sundays, the distribution in rural areas was as follows: 59.4% had a medium score, 21.9% a low score and 18.8% a high score. In the urban areas, 71.4% were classified in the medium score and 28.6% in the high score.

The mean IDDS obtained on Sundays was 4.5 ± 1.1 in rural areas and 5.2 ± 0.9 in urban areas.

3.4.3. Average IDDS obtained over three days

The results concerning the mean of the scores obtained over the three days are presented in the Figure 5 below.
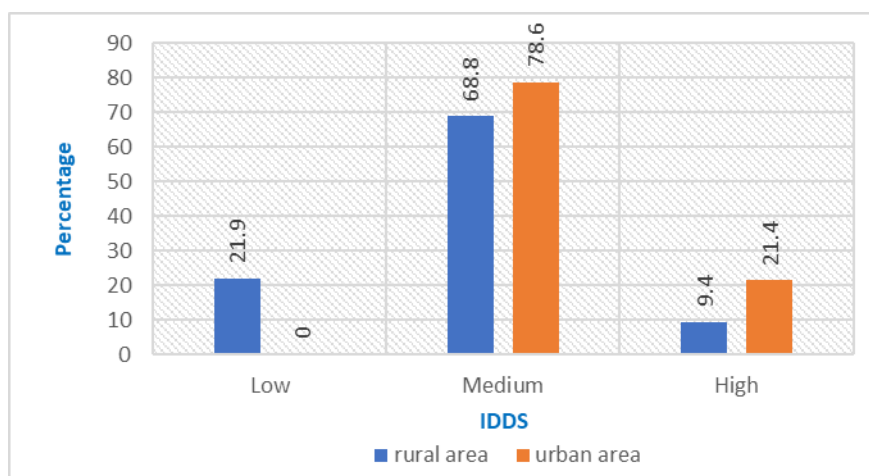

Figure 5 Average IDDS over three days

According to the average IDDS obtained during the three days, the majority of the elderly had a medium score in both rural and urban areas, with a respective proportion of 68.8% and 78.6%.

In the rural areas, 21.9% had a low score and 9.4% a high score. In the urban areas, 21.4% had a high score.

The results showed a slight difference between the IDDS of weekdays and those of Sundays. The percentage of people with a high IDDS increased on Sundays in both areas: 12.5% versus 18.8% in rural areas and 21.4% versus 28.6% in urban areas.

This could be explained by the fact that some households prepare meals that differ a little from other days. Sundays were characterized above all by the consumption of foods from the group of meats, fish and eggs. In urban areas, 96.4% consumed it on Sundays compared to 71.5% on weekdays. This increase was also observed in rural areas with a value of 67.2% on weekdays and 81.3% on Sundays.

3.5. Macronutrient intake

3.5.1. The amount of staple food consumed

Rice was the food most consumed by respondents in both areas.

In rural areas, the average amount of cooked rice consumed per person per day was 1490 ± 275.9 g. The minimum was 925 g and the maximum 2025 g. Rice provided an average of 1713.7 ± 317.2 kcal per day.

In the urban areas, the people surveyed ate an average of 1114.5 ± 341.1 g of cooked rice per person per day. The minimum and maximum quantities consumed per person per day were 200 g and 1575 g respectively. Thus, rice provided an average of 1281.6 ± 392.6 kcal per day.

3.5.2. Carbohydrate intake

The recommended total carbohydrate intake is 130 grams per day [6].

The average carbohydrate intake in rural areas was 479.2 ± 85 grams per day. In urban areas, it was 378.1 ± 86.1 grams per day. Food in both areas was therefore essentially glucidic.

3.5.3. Protein intake

Recommendations for the elderly are 1 to 1.2 g/kg/day [7]. The average protein intake per day was 30.3 ± 17.9 g for the entire rural sample. In urban areas, it was 35.1 ± 15.9 g. In the study population, 91.7% of people surveyed (all age categories and in both areas) did not eat enough protein.

A study in the United Kingdom has shown that the risk of protein -energy malnutrition was around 11-19%, and has found that it was accompanied by vitamin C and D deficiencies [8]. A study in elderly people living in rural areas of southern India has shown that more than 60% of participants had low protein -energy intakes [9].

3.5.4. Lipid intake

In rural areas, the average lipid intake per person per day was 26.9 ± 13.3 g. In urban areas, the average consumption of lipids was 33.2 ± 15.6 g per person per day. It should be noted that the recommended fat intake for the elderly is 35-40% of total energy intake. The results showed that the total lipid requirements were not met in all the individuals surveyed.

3.6. Average energy intake

The energy supply was mainly constituted by rice in both rural and urban areas.

In rural areas, proteins provided an average of 125.4 ± 71.7 kcal, while lipids provided 242 ± 119.6 kcal of energy. In urban areas, proteins provided on average 140.4 ± 63.7 kcal of energy and lipids 298.6 ± 140.1 kcal.

The average energy intake of the people surveyed was 2077 ± 327.9 kcal in rural areas while it was 1774.8 ± 353.9 kcal in urban areas.

3.7. Water supply

Figure 6 shows the amount of water and beverages consumed daily by respondents.
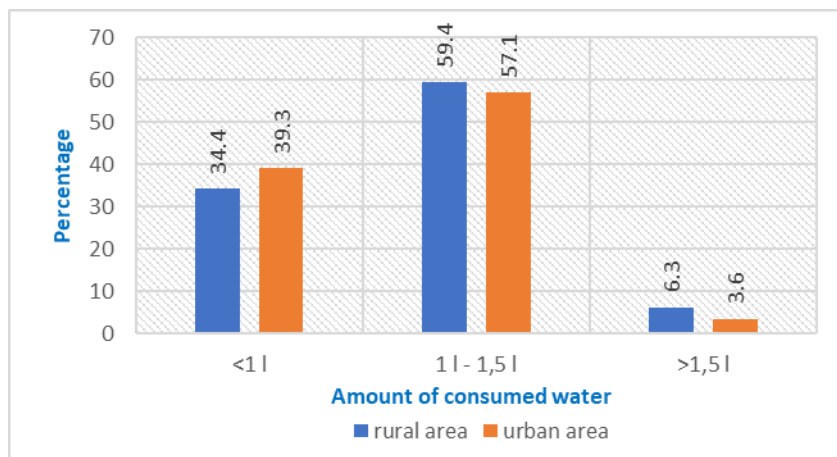
Figure 6 Distribution by amount of water and beverages consumed

Among the subjects surveyed in rural areas, 34.4% consumed less than 1 liter (l) of water per day, more than half or 59.4% consumed 1 to 1.5 l and only two people drank more than 1.5 liter per day.

In urban areas, 39.3% consumed less than 1 l of water per day, 57.1% drank 1 l to 1.5 l.

According to Ferry *et al.* in 2007 [10], it is necessary to provide 35 to 45 ml of water/kg/d, that is around 2.5 l of water intake per day, to a 60 kg person (through drinks and food). The results of this study showed, however, that only 28.3% of the people surveyed drank enough water. Yet, water contributes a lot to maintaining good health.

3.8. Health monitoring quality index

The health monitoring quality index included the person's state of health during the survey, the person seeking recourse in the event of illness, medical monitoring, the consumption of nutritional supplements or vitamins, and the vaccination status against Covid- 19.

A low quality index corresponds to a value less than 4, a medium index has a value ranging from 5 to 6 and a high index is greater than 7. Table 2 summarizes the data on the health quality index.

Table 2 Distribution according to the level of health quality index and by place of residence

Sanitary quality index	Rural n = 32		Urban n = 28	
	Frequency	%	Frequency	%
Low	6	18.8	2	7.1
Medium	5	15.6	7	25
High	21	65.6	19	67.9

In the rural areas, 65.6% had a high index level, 18.8% a low index and 15.6% a medium index. In the urban areas of Antsirabe, 67.9% had a high index, 25% a medium index and 7.1% had a low index.

3.9. Hygiene Practices Index

The hygiene practices index included treating drinking water (boiling) and hands washing before each meal. A low hygiene practice index corresponded to a value below 3, a medium index 4 to 5 and a high index 6. Table 3 presents the distribution according to the hygiene practices index, by environment residence.

Table 3 Distribution according to the hygiene practices index, by place of residence

| Hygiene Practices Index	Rural n = 32		Urban n = 28	
	Frequency	%	Frequency	%
Low	10	31.3	2	7.1
Medium	15	46.9	13	46.4
High	7	21.9	13	46.4

In the rural areas, the percentages of people who had a low and medium hygiene practices index were 31.3% and 46.9% respectively. Those with a high index represented 21.9%. In the urban areas, the percentages of people surveyed who had a medium and high index were identical: 46.4%. Two participants or 7.1% had a low index.

3.10. Nutritional status

The evaluation of the nutritional status was based on the calculation of the Body Mass Index (BMI). According to the WHO criteria, nutritional status is defined as follows:

- <18.5: underweight
- $18.5 \leq BMI \leq 25$: normal weight
- $25 \leq BMI < 30$: overweight
- $BMI \geq 30$: obesity

The data obtained concerning nutritional status according to BMI are summarized in the following Figure 7.
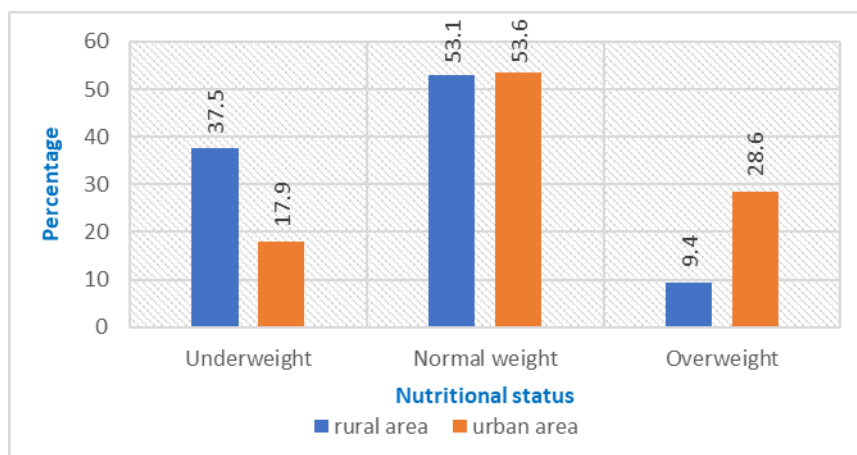
Figure 7 Nutritional status of the elderly by place of residence

According to Figure 7, 3 types of nutritional status can be distinguished among the individuals making up the study population: underweight, normal weight and overweight.

In the rural areas, 53.1% had a normal status, 37.5% were underweight and 9.4% were overweight. In the urban areas, 53.6% had a normal status and 28.5% were overweight. The prevalence of malnutrition was 17.9%. The mean BMI was 21.2 ± 3.8 kg/m ^{2}.

3.11. Statistical association

Table 4 Relationship between some variables studied and nutritional status

Variables studied	Nutritional status		p-value
	Rural areas	**Urban areas**	
Marital status	0.06		
Level of education	0.03		
Home comfort index	0.0005	1	
Personal income	0.049	0.21	p-value
Food expenses	0.04	0.66	
Mean IDDS	0.002	1	
Energy intake	0.02	0.048	
Sanitary quality index	0.35	0.3	
Hygiene Practices Index	0.08	0.72	

No significant relationship was observed between marital status and nutritional status (p=0.06). This could be explained by the fact that it is the intake itself that defines the nutritional status and not the fact of being married or widowed. However, Brownie [11] showed in 2006 that marital status is more likely to be an indicator of poor nutritional status than advanced age. Social interaction at mealtimes might influence food intake in the elderly. In addition, Sally's study in the United Kingdom in 1995 [12] showed that psychosocial factors (such as the loss of a spouse or friends) constitute risk factors for the reduction of appetite, decreased food intake and weight loss.

The level of education has a significant influence on nutritional status (p=0.03). People with less education often have difficulty understanding the relationship between nutrition and health. They do not care about food diversification. Moreover, economically, older people with a higher level of education have more opportunities to buy healthy foods and thus have the opportunity to have a diversified diet [13].

The housing comfort index includes the following elements: the status of the occupant, the nature of the soil, the type of lighting, the fuel, the water supply and the latrines. In rural areas, the housing comfort index had a significant relationship with nutritional status (p=0.0005). The results showed that 43.8% had a medium and low comfort index against 3.6% in urban areas. Living in a house with no amenities could be a sign of low income, which is a factor limiting food expenditure and thus has an impact on the nutritional status.

The income and food expenditure had an influence on the nutritional status in rural areas with respective values of p=0.049 and p=0.04. The importance of income has emerged in some studies in Ivory Coast showing that income is a major marker of financial accessibility to food [13]. It should be considered that the weight of the budget devoted to food is directly linked to the household's financial availability [13]. Other studies in Bangladesh have shown that poverty is a predictor of poor health and that undernutrition is common among older people living on low incomes [14]. Economic vulnerability is an obstacle to meeting nutritional recommendations and maintaining good nutritional status among the elderly.

The individual three-day dietary diversity score had a significant relationship with the rural nutritional status (p=0.002). It could be said that low dietary diversity promotes the prevalence of malnutrition. Nevertheless, a higher dietary diversity is no guarantee of satisfying needs if the quantities consumed are low compared with dietary recommendations.

A significant relationship was observed between the energy intake and the nutritional status (p=0.02 in rural areas and p=0.048 in urban areas). The results showed that the energy intake was higher in rural areas and that the energy spent was not covered by the intake even if these individuals ate a lot of rice, which was the staple food.

The health quality index did not have any statistically significant influence on the nutritional status of the elderly in both rural and urban areas (p=0.35 in rural areas and p=0.3 in urban areas). According to the results, 83.3% consulted a doctor in case of illness and 71.7% of subjects had received the vaccine against Covid-19.

As for the index of hygiene practices, no significant relationship with nutritional status was observed: p=0.08 in rural areas and p=0.72 in urban areas. According to the results, good practices were more or less respected by the people surveyed. Indeed, 65.5% of them regularly treat drinking water in rural areas against 89.3% in urban areas.

4. Conclusion

To conclude, this study made it possible to have an overview of the eating habits of some elderly people, both in quantity and quality, in two municipalities in the Vakinankaratra Region in Madagascar. All the elderly people surveyed ate at least three times a day. Cereals and tubers were the most consumed energy foods. Locally available vegetables were generally used as an accompaniment to the staple food, or "laoka". The consumption of protein and lipid sources was insufficient. In addition, foods from the group of legumes, nuts and seeds, and those from milk and milk products were poorly consumed in both rural and urban areas. The prevalence of malnutrition was quite worrying because intakes did not meet recommended requirements in terms of both quantity and quality.

Compliance with ethical standards

Acknowledgments

Disclosure of conflict of interest

The authors have not declared any conflict of interests.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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