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## Under Nutrition among People Aged 60 and Over in Southern Benin

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### Abstract

The physical appearance of older people in the commune of Ouidah seems to be correlated with the economic level of the people. However, it is now clear that the nutritional status of older people is a key element for natural ageing and improved quality of life.

**Objective:** To identify the factors associated with undernutrition among people aged 60 years and over in the commune of Ouidah in southern Benin.

**Methods:** This was a cross-sectional analytical survey that took place between May and June 2020 and involved older people aged 60 and over selected by cluster sampling using a questionnaire and an interview guide. Their sociodemographic characteristics, health status, diet and the health system in their environment were explored.

**Results:** A total of 271 older people were surveyed, 69% of whom lived in rural areas. The prevalence of undernutrition was 31%. Current occupation as a farmer (OR = 53.62, 95% CI = 5.54-518.34), shopkeeper (OR = 17.24, 95% CI = 2.15-138.21), or other (OR = 16.79, 95% CI = 2.06-136.54); a rural place of residence (OR = 0.40, 95% CI = 0.21-0.76); and presence of anorexia (OR = 10.07, 95% CI = 4.61-21.96) were associated with undernutrition.

**Conclusion:** Undernutrition remains a nutritional problem affecting older people in the commune of Ouidah. Actions to improve their knowledge of healthy, balanced and diversified nutrition, and to strengthen the skills of health personnel in the area of food and nutrition for older people could reduce the prevalence of undernutrition among older people.

**Keywords:** Older People; Undernutrition; Associated Factors; Benin

## Introduction

Ageing brings new health challenges to all countries in the world and is accompanied by an increase in age-related pathologies, including undernutrition a major public health problem that can affect all older populations. However, undernutrition seems to be frequently underestimated and neglected in older subjects because its clinical manifestations are non-specific, especially at the early stage [1].

According to Food and Agriculture Organisation (FAO) estimates, 821 million people worldwide are affected by chronic food insecurity, which contributes to undernutrition and encourages overweight, which partly explains the coexistence of these different forms of malnutrition in many countries [2]. The prevalence of undernutrition is a function of frailty and physical dependence [1].

In Africa, according to a few rare studies, the prevalence of undernutrition among older people living at home varies from 13.1% to 36.1% [3]. Previous study carried out in Senegal reported that the prevalence of malnutrition among patients aged 60 years and over was estimated at 6.6% [4].

Undernutrition has important consequences. It depletes the body's reserves and increases mortality and morbidity. It is also responsible for frailty, loss of autonomy and reduced quality of life, and loss of functional and cognitive abilities. Deterioration in nutritional status leads to weight loss, muscle wasting and decreased muscle capacity (strength, tone, endurance) and causes asthenia (fatigue) in older people. These functional impairments, among others, reduce the autonomy of older people and make them more vulnerable to opportunistic infections [5].

Studies conducted in 2016 and 2017 in island of the Reunion found that five groups of factors can influence the occurrence of undernutrition in people aged 60 and over (Vincenot, 2019; Torres, 2014). These are sociodemographic and psychosocial factors (age, gender, ethnicity, social isolation, etc.), socioeconomic factors (monthly income, financial assistance, etc.), environmental factors (hygiene of the living environment, the older person's home) and behavioural factors (tobacco consumption, alcohol consumption, physical activity, etc.) [1,6].

Thus, in view of the precarious situation in which older people live, many initiatives have been taken throughout the world to promote their well-being (health, nutrition, consumption, housing, environment, family, social well-being, income security, employment and education) and their inclusion in research. The action plan adopted at the World Assembly on Ageing in Madrid is based on: older persons and the development and promotion of their health and well-being [7]. On the African continent, in addition to the African meetings on gerontology, the African Union (AU) adopted a Union Plan of Action on Ageing in 2003 [8].

Several African countries, including Benin, have promoted the well-being and health of older people. However, the information available is only approximate [9,10]. In order to support the political decision in this area, several structures have been set up for the care of the elderly [5]. According to the two studies on the nutritional status of the elderly in the Commune of Ouidah, neither of these studies focused on dietary diversification and knowledge assessment [11,12]. Our objective is to know the factors associated with undernutrition in the elderly aged 60 years and over in our region in order to develop more specific nutritional interventions for them.

## Methods

### Study setting

The commune of Ouidah is located in the Ouidah-Kpomassé-ToriBossito (OKT) health zone in the south of the Atlantique department. It has ten arrondissements subdivided into sixty city districts and villages. The main activities carried out are: agriculture, fishing, livestock, processing of various products, trade, sand quarrying, tourism, crafts and transport. The commune of Ouidah has

six markets, two of which are daily and four periodic. It is home to the zone's hospital, the largest health facility in the health zone, and 14 health centres. The population of the municipality was 192,395 in 2019, according to a projection. People aged 60 and over accounted for 3.95% of this population (7,617) and within this group, women accounted for 58.6% [13].

### **Type of study and inclusion or exclusion criteria**

This was a cross-sectional, descriptive and analytical survey, targeting people aged 60 years and over living in the commune of Ouidah (located on the Atlantic coast in the south of Benin) and who had given their consent to participate. Anyone who met the inclusion criteria but could not freely answer the questions because of their condition was not included.

### **Sampling**

The cluster technique was chosen for sampling as it enabled broad coverage of the unit, which was the village or city district. In each unit, we were exhaustive for all persons aged 60 and over through a questionnaire. On a few occasions, we interviewed some of the carers to better understand the answers given by some of the respondents.

### **Study variables**

The dependent variable was undernutrition. It was assessed in the elderly using the MNA (Mini Nutritional Assessment) tool. This measure includes objective information (Body Mass Index, anthropometry) and anamnestic information (eating habits, autonomy of the subject) that is easy to evaluate and does not require blood sampling. It allows a non-specialist practitioner to assess the patient's nutritional status in a few minutes. It is an inexpensive tool that takes into account the whole person (social, cognitive, psychosocial and functional aspects). The MNA provides a score that reassures or alerts the patient early enough to rebalance and monitor their diet. It is broken down as follows: MNA score above 23.5 (normal); MNA score between 17 and 23.5 (risk of malnutrition) and MNA score below 17 (malnutrition). This is practically the most widely used tool. We recall that there are several other screening and assessment tools for undernutrition such as: the Nutritional Self-Assessment Checklist (NSI); the Rating Scale (RAS). In our study, however, we adopted a two-group categorisation as follows: "undernutrition if the MNA score is below 23.5" and "no undernutrition if the MNA score is above 23.5" [14].

The independent variables were those related to the older person, the health system and their environment. They were mainly: Sociodemographic, psychosocial and economic variables such as age, sex, ethnicity, marital status, place of residence, level of education, social isolation, monthly income, financial assistance and current occupation; Behavioural variables such as alcohol consumption, tobacco consumption, physical activity, eating habits, organisation of meals, dietary diversification, exposure to sunlight, personal hygiene, type of drinking water, nutritional knowledge; Biological variables: difficulty chewing, taste impairment, autonomy in taking meals, medical history, surgical history, use of medication, oral health and anorexia and the presence of illness during the last 30 days; and Environmental Variables, namely the ventilation of the older person's home and the hygiene of the living environment.

### **Data collection equipment**

This was essentially the equipment needed to take anthropometric measurements and included: an ILANIA<sup>®</sup> mechanical scale with a capacity of 120 kilograms graduated per kilogram with an accuracy of 0.1 kg to measure weight, and a SECA<sup>®</sup> portable height gauge with a capacity of 2 metres graduated per centimetre with an accuracy of 0.1 cm to measure height.

### **Statistical analysis**

The data collected was checked for completeness and consistency. They were entered using Epidata software and analysed using Stata

11 software. Descriptive statistics,  $\chi^2$  test and multivariate logistic regression were used to conduct statistical analysis.

A bi-variate analysis of the data was performed using the Pearson Chi-2 statistical test. This allowed us to determine the associations between nutritional status and the independent variables. Associations between the independent variables and the dependent variable were also measured as the Odds Ratio (OR) and their 95% confidence interval (95% CI).

In our multivariate analysis, a logistic regression, factors associated with the nutritional status of the older people were searched after adjustment. Variables with a p-value of less than 15% in the bivariate analysis were entered into the initial logistic regression model and a stepwise top-down elimination was performed. The variables that were retained in the final model were those with a p-value of less than 5%. Effect modifying and confounding factors were searched for. The adequacy of the model was investigated using the Hosmer-Lemeshow test. The model was said to be adequate when the p-value was greater than 5%.

### **Ethical aspects**

The health and local authorities were informed about the survey in the selected villages and neighbourhoods. They gave their permission instead of an ethics committee. All targets were presented with the nature and objectives of the survey as well as the terms of participation in order to obtain their informed and written consent. At any time during the survey, targets who did not wish to participate were able to withdraw. To ensure anonymity and confidentiality, a code was assigned to each older respondent and marked on the questionnaires. Advice on diet was given to each respondent aged 60 and over.

## **Results**

### **Bivariate analysis**

A total of 271 people aged 60 years and over and 12 carers of older people were surveyed with a prevalence of undernutrition of 31%. The sociodemographic, psychosocial and economic characteristics of the older people surveyed were calculated and detailed (Table 1). Dietary and medical factors with a p-value of less than or equal to 15% in the bivariate analysis were identified (Table 2). These were anorexia, chewing difficulty, taste impairment, digestive disorders, medical history, surgical history and the presence of illness in the last 30 days. Regarding the behavioural factors (Table 3a and b), the following variables: nutritional knowledge, frequency of consumption of foods rich in protein, fibre, unsaturated fatty acids, calcium, vitamin D and vitamin A, dietary restrictions and dietary diversification had a p-value less than or equal to 15% after the bivariate analysis.

The only health system factor investigated as associated with undernutrition in people aged 60 years and over was dietary advice with OR= 1.6 (CI95%: 0.97-2.87). It was not significant.

### **Multivariate analysis**

The initial model for the multivariate analysis included all independent variables with a p-value less than or equal to 15%.

After eliminating variables with a p-value of less than 5%, three variables were retained as factors associated with undernutrition in older people in the final model. These were current occupation OR= 53.6 (CI95%: 5.5-518.3), anorexia OR= 10.1 (CI95%: 4.6-21.9) and area of residence OR=0.40 (CI95%: 0.2-0.7). Indeed, older people who were farmers had a higher risk of being malnourished compared to those who were retired when adjusting for other variables. The risk for retirees was also lower than for those who were traders or in other occupations. Similarly, those with anorexia were at greater risk of undernutrition than those without anorexia, and finally, those living in rural areas were at less risk of undernutrition than those living in urban areas. Table 4 presents the details of results obtained.

Variables	Undernutrition Share (%)	OR	CI95%	p
<b>Gender</b>				
Male*(103)	26 (25.24)	1		
Female (168)	58 (34.52)	1.56	0.90-2.69	0.110
<b>Age</b>				
Under 70*(152)	35 (23.03)	1		
70-80 (89)	30 (33.71)	1.69	0.95-3.03	
Over 80 (30)	19 (63.33)	5.77	2.51-13.28	<b>0.000</b>
<b>Ethnicity</b>				
Fon* (182)	52 (28.57)	1		
Other (89)	32 (35.96)	1.18	0.90-1.55	0.218
<b>Marital Status</b>				
Married* (123)	27 (21.95)	1		
Divorced (148)	57 (38.51)	2.22	1.29-3.82	<b>0.004</b>
<b>Area of residence</b>				
Urban* (84)	36(42.86)	1		
Rural (187)	48(25.67)	0.46	0.26-0.79	<b>0.005</b>
<b>Education</b>				
No education (174)	72 (41.38)	12.35	2.87-53.00	<b>0.001</b>
Primary school (60)	10 (16.67)	3.2	0.72-16.96	0.120
Secondary school and above*(37)	2 (5.71)	1		
<b>Social isolation</b>				
Yes (26)	8 (30.77)	0.98	0.41-2.37	0.970
No* (245)	76 (31.02)	1		
<b>Current occupation</b>				
Retired*(25)	1 (4)	1		
Farmer (27)	11 (40.74)	16.49	1.93-140.60	<b>0.010</b>
Trader (136)	43 (31.62)	11.09	1.45-84.72	<b>0.020</b>
Other (83)	29 (34.94)	12.88	1.65-100.18	<b>0.015</b>
<b>Financial assistance</b>				
Yes* (131)	45 (34.35)	1		
No (140)	39 (27.86)	0.73	0.44-1.23	0.249
<b>Monthly income (CFA Franc)</b>				
> 40 000* (100)	17 (17)	1		
< 40 000 (136)	42 (30.88)	2.18	1.15-4.12	<b>0.016</b>
No income (35)	25 (71.43)	12.20	4.96-20.02	<b>0.000</b>

\*Reference category for comparison

**Table 1:** Sociodemographic, psychosocial and economic factors associated with undernutrition in people aged 60 years and over in the commune of Ouidah in 2020 (n=271)

Variables (n)	Undernutrition Share (%)	OR	CI95%	p
<b>Taste impairment</b>				
Yes (100)	41 (41)	2.06	1.22-3.50	<b>0.007</b>
No* (171)	43 (25.15)	1		
<b>Independence in eating</b>				
Yes*(268)	82 (30.60)	1		
No (3)	2 (66.67)	4.53	0.40-50.73	0.220
<b>Surgical history</b>				
Yes (30)	4 (13.33)	0.30	0.10-0.91	<b>0.034</b>
No* (241)	80 (33.20)	1		
<b>Medical history</b>				
Yes (156)	40 (25.64)	0.55	0.33-0.93	<b>0.027</b>
No* (115)	44 (38.26)	1		
<b>Medication use</b>				
Yes (151)	51 (33.77)	4.27	2.44-7.47	0.268
No*(120)	33 (27.50)	1		
<b>Decreased sensation of thirst</b>				
Yes (106)	29 (27.36)	0.75	0.44-1.28	0.300
No*(165)	55 (33.33)	1		
<b>Difficulty chewing</b>				
Yes (144)	52 (36.11)	1.67	0.99-2.83	<b>0.054</b>
No*(127)	32 (25.20)	1		
<b>Oral health</b>				
Yes (174)	55 (31.61)	1.08	0.36-1.85	0.770
No*(97)	29 (29.90)	1		
<b>Digestive disorders</b>				
None* (188)	50 (26.60)	1		
Nausea/vomiting (11)	9 (81.82)	12.41	2.59-59.45	<b>0.002</b>
Constipation (63)	20 (31.75)	1.28	0.68-2.38	0.431
Diarrhoea (6)	3 (50.00)	2.76	0.53-14.12	0.223
Dysphagia (3)	2 (66.67)	5.51	0.48-62.21	0.167
<b>Presence of illness in the last 30 days</b>				
Yes (128)	53 (41.41)	2.55	1.50-4.34	<b>0.001</b>
No*(143)	31 (21.68)	1		

\*Reference category for comparison

**Table 2:** Dietary and medical factors associated with undernutrition among people aged 60 and over in the commune of Ouidah in 2020 (n=271)

Variables	Undernutrition Share (%)	OR	CI95%	p
<b>Tobacco consumption</b>				
Yes (9)	2 (22.22)	0.26	0.12-3.08	0.566
No* (262)	82 (31.30)	1		
<b>Alcohol consumption</b>				
Yes (213)	62 (29.11)	0.67	0.36-1.23	0.199
No*(58)	22 (37.93)	1		
<b>Sun exposure</b>				
Rarely (111)	37 (33.33)	1.66	0.61-4.50	0.314
Often (134)	41 (30.60)	1.46	0.54-3.92	0.443
Every day* (26)	6 (23.08)	1		
<b>Meal organisation</b>				
3 meals per day*(215)	70 (32.56)	1		
Less than 3 meals per day (56)	14 (25.00)	0.69	0.33-1.34	0.278
<b>Physical activity</b>				
Not very active*(107)	33 (30.84)	1		
Sedentary (164)	51 (31.10)	1.01	0.59-1.71	0.964
<b>Dietary restrictions</b>				
Yes (104)	52 (50.00)	4.15	2.41-7.16	<b>0.000</b>
No*(165)	32 (19.39)	1		
<b>Dietary diversity</b>				
Acceptable diet *(152)	35 (23.03)	1		
Moderately acceptable diet (89)	30 (33.71)	1.69	0.95-3.03	0.073
Limited diet (30)	19 (63.33)	5.77	2.51-13.28	<b>0.000</b>
<b>Anorexia</b>				
Yes (164)	74 (45.12)	7.97	3.88-16.38	<b>0.000</b>
No*(107)	10 (9.35)	1		
<b>Advice on feeding older people</b>				
Yes*(110)	27 (24.55)	1		
No (159)	56 (35.22)	1.6	0.97-2.87	<b>0.064</b>
<b>Nutritional knowledge</b>				
Low (106)	32 (30.19)	0.93	0.55-1.59	0.818
High* (165)	52 (31.52)	1		
<b>Hand washing</b>				
Yes* (233)	76 (32.62)	1		
No (38)	8 (21.05)	0.55	0.24-1.25	0.157
<b>Type of drinking water</b>				
SONEB* (214)	69 (32.24)	1		
Borehole (37)	13 (35.14)	1.13	0.54-2.36	0.729
Well (20)	2 (10.00)	0.23	0.05-1.03	0.055

\*Reference category for comparison

**Table 3a:** Behavioural factors associated with undernutrition among people aged 60 and over in the commune of Ouidah in 2020 (n=271)

Variables	Undernutrition Share (%)	OR	CI95%	p
<b>Frequency of consumption of protein-rich foods</b>				
Rarely (3)	1 (33.33)	0.86	0.07-9.66	0.904
Several times a month (21)	6 (28.57)	0.68	0.25-1.85	0.461
Several times a week (51)	5 (9.80)	0.18	0.07-0.49	0.461
Every day (196)	72 (36.73)	1		
<b>Frequency of consumption of foods rich in carbohydrates</b>				
Rarely (5)	3 (60.00)	3.46	0.56-21.12	0.178
Several times a month (4)	2 (50.00)	2.30	0.31-16.67	0.407
Several times a week (4)	1 (25.00)	0.76	0.07-7.51	0.821
Every day* (258)	78 (30.23)	1		
<b>Frequency of consumption of fibre-rich foods</b>				
Rarely (22)	10 (45.45)	1.98	0.78-5.03	0.148
Several times a month (40)	19 (47.50)	2.15	1.02-4.51	0.042
Several times a week (94)	21 (22.34)	0.68	0.36-1.28	0.239
Every day (115)	34 (29.57)	1		
<b>Frequency of consumption of calcium-rich foods</b>				
Rarely (116)	57 (49.14)	7.60	3.34-17.28	<b>0.000</b>
Several times a month (84)	19 (22.62)	2.30	0.93-5.63	0.068
Every day (71)	8 (11.27)	1		
<b>Frequency of consumption of foods rich in vitamin D</b>				
Rarely (62)	9 (14.52)	0.22	0.10-0.48	<b>0.000</b>
Several times a month (58)	10 (17.24)	0.02	0.12-0.58	<b>0.001</b>
Every day (151)	65 (43.05)	1		
<b>Frequency of consumption of foods rich in vitamin A</b>				
Rarely (53)	9 (16.98)	0.31	0.14-0.67	<b>0.003</b>
Several times a month (57)	11 (19.30)	0.36	0.17-0.75	<b>0.006</b>
Every day (161)	64 (39.75)	1		
<b>Frequency of consumption of foods rich in unsaturated fatty acids</b>				
Rarely (76)	12 (15.79)	0.21	0.10-0.08	<b>0.000</b>
Several times a month (61)	9 (14.75)	0.19	0.08-0.42	<b>0.000</b>
Every day (134)	63 (47.01)	1		

\*Reference category for comparison

**Table 3b:** Behavioural factors associated with undernutrition among people aged 60 and over in the commune of Ouidah in 2020. Bivariate analysis (n=271)

Factors	OR	CI95%	p-value
<b>Current occupation</b>			
Retired*	1		
Farmer	53.62	5.54-518.34	0.001
Tradesman	17.24	2.15-138.21	0.007
Other	16.79	2.06-136.54	0.008
<b>Area of residence</b>			
Urban*	1		
Rural	0.40	0.21-0.76	0.005
<b>Anorexia</b>			
Yes	10.07	4.61-21.96	0.000
No*	1		

\*Reference category for comparison

**Table 4:** Logistic regression. Final model. Factors associated with undernutrition among the elderly in May 2020 in the commune of Ouidah (n=271)

## Discussions

### Achievement of objectives

The main issues are the extent to which the objectives of the study were achieved, the quality and validity of the results and the comparison of the results obtained. Our objective was to study the factors associated with undernutrition among people aged 60 years and over in the commune of Ouidah in southern Benin in 2020. We were able to determine the prevalence (31%) and investigate the factors associated with it. We consider that the objectives of the study were achieved.

### Quality and validity of results

The data were obtained from a cross-sectional survey, using two-stage cluster sampling based on the list of villages/neighbourhoods in the commune of Ouidah and the expected number of older people per cluster unit. The ease of use of the short version of the MNA test was preferred for its scientific validation and performance. It is commonly used in practice in urban areas, hospitals and institutions for older people. The combination of qualified dietitians and community relays facilitated data collection because of their command of the languages spoken in the area. All of these arrangements ensured the quality of the data.

### Prevalence of undernutrition in people aged 60 and over

We obtained 31% undernutrition among the people aged 60 and over surveyed. This is higher than that obtained in a study conducted by Sissoko (2014) specifically in the city of Ouidah, which was 12.1% [12]. This discrepancy could be justified by the difference in scope of the study, as ours was conducted in both urban and rural areas in the commune of Ouidah. In addition, it had been shown that older people living in rural areas were more undernourished than those living in urban areas [1]. The present result shows that undernutrition remains a nutritional problem affecting older people in Benin. Other studies have found higher prevalence than ours. A study by Hien et al. in Burkina Faso (2012) found a prevalence of 39.2% [15]. The discrepancy between this prevalence and our result could be due to the fact that our study did not just focus on older people with multimorbidity, which was a real factor associated with the risk of undernutrition. Another study by Jesus et al. (France, 2012) found a prevalence of 53.3% [16], but included subjects with dementia. In our study, we did not use a scale that could assess the level of cognition and conclude about dementia in our respondents.

## Factors associated with undernutrition

### Current occupation

Current occupation was significantly associated with undernutrition among the older people in our survey ( $p=0.001$ ). Farmers ( $p=0.001$ ), shopkeepers ( $p=0.007$ ) and other occupations ( $p=0.008$ ) were more likely to be undernourished than retirees. Since the risk was higher among farmers because those in our regions who are mostly rural do not consume their production in a balanced way, we expect a better nutritional status among retired older people because they would have pensions, access to health care, health information and an almost perfect diet.

### Area of residence

An association was found between area of residence and undernutrition ( $p=0.005$ ). Older people living in rural areas were less at risk of undernutrition than those living in urban areas. This was previously reported by Torres (2014) who found an association between area of residence and undernutrition [1]. This could be explained by access to fresh, varied and more nutritious products from agriculture (fruit, fresh vegetables) and fishing. There is also more mutual aid and frequent visits between older people in rural areas than in urban areas. Indeed, because of the lack of social links, an older person no longer sees the point of eating as much since he or she does it alone and no longer has any incentive or enjoyment in doing so, which subsequently leads to a loss of appetite.

### Anorexia

Anorexia was associated with undernutrition in older people ( $p=0.000$ ). In the presence of anorexia, they had a 10.7-fold risk of being undernourished. This is similar to the results reported by Torres (2014) who found the same association [1]. It is possible that an increase in satiety signals from the digestive tract, an increase in circulating levels of leptin and a decrease in the action of opioids involved in the positive regulation of appetite justify this association. Elevated levels of anorectic signals such as leptin in older subjects contribute to prolonged satiety and inhibition of hunger [17]. The threshold for taste detection, “the sense of discerning the flavour of food”, is increased. The cause of the loss of taste is complex; hypotheses include a reduction in the number of taste buds and a decrease in the functionality of receptors in the cell membrane involved in taste sensation. This impairment of the senses may affect appetite regulation by inducing a decrease in the pleasure of eating and frustration at mealtimes.

### Marital status

Our final model did not find an association between marital status and undernutrition, although this association was found in the univariate analysis ( $p=0.004$ ). We estimated that older widows/widowers have a 2.22 times greater risk of being undernourished. This could be explained by the fact that older people, upon the loss of their spouse, enter a state of depression that leads to a loss of appetite. Indeed, these people are confronted with a change in their eating habits. Widowhood leads to a reduction in the quantities prepared and consumed or to the elimination of certain dishes traditionally eaten by the couple. This seems to be confirmed by the results reported by Boulos et al. (2013) in Lebanon [18].

### Age

It was assumed during this survey that age would be associated with undernutrition in older people. But no association was found; contrary to the results reported by Coumé (2014), Boulos (2013) and Vanderwee (2010) [4,18,19]. This could be due to the fact that our study population was predominantly made up of people aged 60 to 70 years, whereas the risk of undernutrition increased with ages above this interval.

### **Presence of illness**

None of our results found an association between the presence of illness and undernutrition in people aged 60 years and older. Vincenot (2017) in La Réunion had identified the presence of illness as a risk factor for undernutrition in older people [6], assessed over a period of 6 months prior to the study. This differs from ours which assessed for the presence of illness over a period of one month prior to the study. This could explain the difference in results observed.

### **Meal organisation and dietary diversity**

Dietary diversity and number of meals were not associated with undernutrition in the older people in the present study. These two factors had been found in the study by Accrombessi (2017) in the commune of Djidja in Benin [5]. The criteria might not be the same in both cases. Fewer than three meals a day and dietary diversity were factors associated with undernutrition in older people. This difference in results could be explained by the low proportion of older people having less than three meals per day (20.66% vs. 78.4%), and of those with a low dietary diversity score (11.07% vs. 33.1%). It had also been reported by Rouvray et al. (2014) in the results of a survey conducted in Central Africa that fewer than three meals a day was an associated factor [20].

## **Conclusion**

Undernutrition is a common nutritional problem among older people in Benin. In addition to the factors highlighted, the lack of health worker training on nutritional counselling for older people seems to play an important role. These factors can be avoided through joint action by the competent authorities at various levels to make the geriatric centre in the town of Ouidah operational and to strengthen the skills of health workers and community relays by organising continuous training on the food guide for older people.

## **Ethical Norms**

The article submitted is the result of a clear study and complies with and respects fundamental ethical principles such as respect for the dignity and freedom of persons, respect for the principle of beneficence and non-maleficence.

## **Contributions from the Authors**

All authors actively participated in the writing and editing of the article. All the authors read and approved the final version of the manuscript.

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