



Analysis of Nutritional Status and Major Chronic Conditions in Older Adults: A Cross Sectional Study

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background: Nutrition is an important factor in the ageing process and a significant contributor to future health. The ageing process involves physiologic changes that affect appetite, digestion and body composition. Chronic diseases and chronic conditions in the elderly population can be significantly reduced through adequate and timely nutritional intervention. Maintaining healthy behaviour like eating a balanced diet greatly contributes to reducing the risk of non-communicable diseases.

Methods: A study of 126 older adults who were admitted into various wards was selected purposively for this study. 122 were fit enough to undergo BMI measurements were included. The hospital records of respondents were looked and the fasting lipid profile, fasting blood glucose and blood pressure values were documented within the period of admission; the number of those was found to be 37, 84 and 122 respectively. The data was analyzed and inferential statistics using chi square (χ^2) was employed to determine the degree of association between the various conditions and statistical significance was set at a p value <0.05.

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Results: A great majority of respondents (44%) were retired. Half of those with obesity (50%) had elevated fasting blood glucose. Underweight was more in women ($\approx 70\%$), was highly associated with dyslipidemia (100%) and was associated highly with inadequate diet (62%).

Conclusion: Overall the study showed a no significant statistical relationship with BMI and the major chronic disorders in older adults which were diabetes mellitus, dyslipidemia and hypertension. Nutritional assessment parameters such as BMI and 24 hours dietary recall may not be enough to assess the nutritional status of older adults but remain non-invasive assessment tools that can guide the physician in management of nutritional insufficiency that can arise from chronic disorders in older adults.

Keywords: Chronic disorders; BMI; hypertension; nutrition; blood pressure.

1. INTRODUCTION

The population of elderly people worldwide is increasing as people are living longer. In 2020, there were about one billion elderly people worldwide and the number is expected to increase to 2.1 billion in 20250 [1]. People in Africa are equally living longer more than ever before, the population of elderly people put at 43 million in 2010 is expected to rise to 67 million in 2025 [2].

Nutrition is an important factor in the ageing process and a significant contributor to future health. The ageing process involves physiologic changes that affect appetite, digestion and body composition. Chronic diseases and chronic conditions in the elderly population can be significantly reduced through adequate and timely nutritional intervention [3]. Maintaining healthy behaviour like eating a balanced diet greatly contributes to reducing the risk of non-communicable diseases [1].

Malnutrition is associated with poor clinical prognosis in patients with various diseases. The fact that malnutrition has been linked to increased levels of inflammatory response, arterial classification and atherosclerosis progression raising the possibility that it a key role in the emergence of cardiovascular disease [4]. Some studies have suggested that inadequate diet is an issue among the African elderly population [5].

Obesity is excess accumulation of fat that can impair health is commonly classified based on body-mass-index (BMI). It is associated increased morbidity and mortality as well as being associated with increased prevalence of type 2 Diabetes Mellitus, hypertension and hyperlipidaemia [6] Increased glucose levels lead to formation of fatty acids which eventually result in increased lipid synthesis and then body weight

[6]. Hypertension and Diabetes Mellitus remain major causes of morbidity and mortality and are more likely to do so in elderly people compared to those of a younger age [7].

Understanding the association of nutritional status to important non-communicable diseases is necessary so as to plan interventions. This is important in Africa as non-communicable diseases like cardiac disease, cancer, diabetes mellitus are expected to play a greater role in morbidity and mortality in the continent in future [4]. Although there are various studies examining this, there has not been many studies done among the elderly in Nigeria. This study takes a look at diabetes mellitus dyslipidemia and hypertension which are three major chronic conditions routinely screened for, in relation to the nutritional status which can be assessed using the BMI and 24 hour dietary recall.

1.1 Operational Definitions

Body Mass Index (BMI) is derived from a person's weight in kilograms divided by the square of the height. Normal BMI is 18.5-24.9, underweight less than 18.5, from 30 and above overweight/obesity [8].

Diabetes Mellitus is defined as a random venous plasma glucose concentration equal to or more than 11.01mmol/L or fasting plasma glucose concentration equal to more than 7.0mmol/L or two hour plasma glucose concentration equal to or more than 11.1mmol/L after 75g anhydrous glucose in an oral glucose tolerance test (OGTT).

Hypertension is diagnosed if when blood pressure is measured on two different days, systolic blood pressure readings is equal to or more than 140mmHg and/or diastolic is equal to or more than 90mmol/L⁸.

Optimal lipid levels

- Total Cholesterol.....about 150mg/dl
- LDLcholesterol....about 100mg/dl
- HDL cholesterol....40mg
- Triglycerides.....less than 150mg/dl [9].

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in University of Port Harcourt Teaching Hospital (UPTH), Alakahia, Rivers State. The hospital is a 700 bed tertiary hospital located in outer fringes of Port Harcourt the capital city of Rivers State, Nigeria [10]. The hospital has several units dedicated to various medical specialties and serves as a referral center to other facilities in the state and other states in the South-South region of Nigeria. It treats well over 400, 000 out patients annually and is a site for training medical students, medical residents and other health workers [8].

2.2 Study Population

This consisted of patients older than sixty years who were admitted into the wards after initial presentation at the clinic or at the accident and emergency unit.

2.3 Sample and Sampling

A purposive sampling of 126 elderly patients from various wards of the hospital was recruited into the study over a 3-month period. Only 122 of these were fit to have their height and weights measured were selected for the study. BMI was calculated as weight (kg)/ height (m²). The WHO classification was used as follows underweight< 18.5kg/m², normal 18.5-4.9kg/m², overweight 25.0-29.9kg/m² and obesity > 30kg/m².

2.4 Data Collection

The participants' biodata was collected including their occupation. The participants' 24-hour dietary recall was recorded compared with reference intake and the diets judged adequate or inadequate. A corresponding look at the lipid profile, fasting blood sugar and blood pressure measurements in their hospital records which was essential as classifying patients who had dyslipidemia, diabetes mellitus and hypertension were carried out and values were noted. Abnormal lipid was defined as any value of either cholesterol > 240mg/dl, triglycerides > 200mg/dl,

low density lipoproteins (LDL) > 160mg/dl and high density lipoprotein < 40mg/dl for men and < 50mg/dl for women. Elevated fasting blood glucose was defined as >7.1mmol/l on two different readings at least 24 hours apart. Blood pressure ≥ 140/90mmHg was defined as hypertension. The weight was taking using Hanson weighing scale and the height was measured using a collapsible Leicester Height Measure Seca stadiometer following the necessary standardized protocols.

2.5 Data Analysis

Data was cleaned, coded and subsequently entered into Microsoft Excel 2010 sheet. The data was analyzed and inferential statistics using chi square (Σ²) was employed to determine the degree of association between the various conditions and statistical significance was set at a p value <0.05. Those with abnormal lipid level, elevated fasting blood glucose and elevated blood pressure were further analyzed in relation to the total number in each category of BMI. The data was presented using tables for better visualization.

3. RESULTS

Table 1 shows the occupational distribution of the participants. About 36% of them are retired, 20.5% are fishermen or farmers and 15.6% are traders.

Table 1. Occupation of respondents (N=122)

Occupation	Number (%)
Retired	44(36.1)
Farming/ fishing	25(20.5)
Trader/Business	19(15.6)
Housewife	11(9.0)
Mechanic/Technician	4(3.3)
Security Personnel	3(2.5)
Engineer	2(1.6)
Medical Doctor	2(1.6)
Civil Servant(Administrators)	2(1.6)
Others	10(8.2.)
Total	122(100)

Table 2 of those with elevated fasting blood glucose, 50% of them were of normal weight. About 50% of those obese had elevated blood sugar. As shown in Table 3, 53.8% of those with abnormal lipid profile were overweight and all those underweight that their lipid profiles done had abnormal lipid profiles. There were about 23% of the respondents were hypertensive. Of

those hypertensive (Table 4), about 62% had normal BMI. About 19% of those obese were hypertensive while 15% of those overweight were hypertensive.

The greatest odds of having inadequate diet was among those with normal weight but this was not statistically significant as shown in Table 5.

4. DISCUSSION

A good proportion of the respondents were retired (Table 1) which is expected as these were elderly people who if they had a career of paid employment would retire averagely from 60 years of age. This is partly because functioning capacity reduces as people get to their older adult age. This suggests that most of them would need care and support if they are afflicted by chronic conditions. This is also significant since it can affect the income and thus provision of food with adequate nutrients.

Majority of those with normal, overweight or obese BMI had adequate diets (Table 5) but majority of those with underweight BMI had inadequate diets suggesting an association of dietary adequacy with BMI. This is similar to a study carried out among the elderly in Pennsylvania, USA where those with low BMI had a much poorer diet quality than the normal weight, overweight or obese [11]. A study carried out in Ghana found higher rates of underweight among the elderly and this was associated with inadequate nutrition [5]. The higher prevalence of underweight found in the Ghanaian study may be due to the fact that this latter study was community based compared to our present study. The inadequacy of the diet may be linked difficulties faced by the elderly in eating such as decline in sensory ability leading to poor appetite and difficulty in chewing and associated with increased mortality [3,11]. This suggests that efforts should be made to ensure elderly people have meals made in forms suitable for their physiology to prevent poor nutritional status.

The elderly respondents in this study who were hypertensive those that were normal weight constituted 62%, those overweight were about 17% and those obese were about 14 % (Table 3). This is contrary to conclusions reached in a study carried out in Osun State, Nigeria where hypertension was found to be associated more with higher BMI [12]. It also differs from findings from a study carried out in Jakarta, Indonesia among elderly where about 70% of those obese were found to have high blood pressure [13].

Hypertension was seen in less than one fifth of the obese respondents in this study. Another study among the elderly in China also found a linear relationship between BMI and hypertension [14]. The reason increased BMI was not associated with hypertension in this study may be because elderly people are likely to have other risk factors for hypertension such as being black and being a male. In addition this is a hospital based study where those with normal BMI are more likely to have hypertension compared to those in the general population.

About 50% of those obese had elevated fasting blood glucose (FBG) compared with about 14% of those underweight and 37% of those normal BMI (Table 2). This suggests that those obese were more likely to have abnormal FBG compared to those with normal or underweight BMI. This is similar to findings from Ogun State, Nigeria where nutritional status was associated with higher values fasting blood glucose [15]. A study in India similarly found a correlation between nutritional status and blood glucose while a study done in Indonesia found no relationship between BMI and FBG [6,13]. This suggests that obesity is likely to be a risk factor for diabetes among elderly in Rivers State. Obese elderly people should be screened for diabetes and also prevention of obesity should be part of strategies for combating diabetes.

Among the participants in this study 20% of those with normal BMI had abnormal lipid profile, as well as 100% of those underweight BMI and about 44% of those obese (Table 4). This suggests no real increased risk of abnormal lipid profile due from obesity compared with underweight. This differs from findings from a study among older adults in Kogi state where a significant association was found between anthropometric parameters and lipid profile [16]. In Saudi Arabia among residents in a care home BMI was positively correlated with triglyceride and in India negative correlation was found with high density lipoprotein cholesterol (HDL-C) [17,18]. The differences observed in this study compared with other studies could be because of the few participants that had their lipid profile only 37 out of the 122 respondents. The participants were also drawn from hospital patients compared to the participants drawn from nursing home and rural community in the Saudi Arabia and Kogi State studies respectively. Dyslipidemia has been noted to be seen more in those obese, because increase in lipid synthesis is seen more in obese people; [19] however BMI may not be best method of accessing obesity in

the elderly since the weight may be due to muscle mass although in the elderly there is increase body fat and reduced lean mass [17,18,20].

The percentage of abnormal values (Tables 5 and 6) suggests that dietary problems, hypertension and diabetes mellitus exist significantly in Rivers State. About 37% (44) of the participants had inadequate diet which is of

concern as dietary inadequacy has been linked to malnutrition. Malnutrition is associated with poor clinical prognosis in patients with various diseases, reduced immunity leading to increased rates of infection [3]. The theory that malnutrition may play a role in the emergence of cardiovascular disease was not supported by results from this study as those with underweight BMI had the lowest prevalence of the various risk factors looked at [4].

Table 2. BMI and fasting blood sugar (N=84)

BMI	Proportion of normal or elevated FBS to the total number of Normal or Elevated FBS			Proportion of the normal or elevated FBS to the total number of persons in each BMI category		
	Fasting blood glucose		p- value	Fasting blood glucose		Total
	Normal (%)	Elevated (%)		Normal (%)	Elevated	
Normal	23(41.1)	14(50.0)	0.250	23(62.7)	14(37.8)	37(100)
Underweight	6(10.7)	1(3.6)		6(85.7)	1(14.3)	7(100)
Overweight	20(35.7)	6(21.4)		20(78.9)	6(23.1)	26(100)
Obese	7(12.5)	7(25.0)		7(50.0)	7(50.0)	14(100)
Total	56(100)	28(100)				84(100)

Table 3. BMI and fasting lipid profile (N=37)

BMI	Proportion of Normal or Abnormal FLP to the total number of Normal or Abnormal FLP			Proportion of the Normal or Abnormal FLP to the total number of persons in each BMI category		
	Normal (%)	Abnormal (%)	P-value	Normal (%)	Abnormal (%)	Total (%)
Normal	12(50.0)	3(23.1)	0.109	12(80.0)	3(20.0)	15(100)
Underweight	0(0.0)	2(15.4)		0(0.0)	2(100.0)	2(100)
Overweight	9(37.5)	7(53.8)		9(56.2)	7(43.8)	16(100)
Obese	3(12.5)	1(7.7)		3(75.0)	1(25.0)	4(100)
Total	24(100)	13(100)				37(100)

Table 4. Hypertension and BMI (N=122)

BMI	Proportion of hypertension to normal BP the total number			Proportion of hypertension Normal BP to the total number of persons in each category		
	Hypertension yes (%)	Hypertension no (%)	P-value	Hypertension yes (%)	Hypertension no (%)	Total
Normal	18(62.1)	37(39.8)	0.232	18(32.7)	37(67.3)	55(100)
Underweight	2(6.8)	11(11.8)		2(15.4)	11(64.6)	13(100)
Overweight	5(17.2)	28(30.1)		5(15.2)	28(84.8)	33(100)
Obese	4(13.8)	17(18.3)		4(19.0)	17(81.0)	21(100)
Total	29(100)	93(100)				122(100)

Table 5. Nutritional status and diet adequacy (N=118)

BMI	Adequate Diet	Inadequate diet	p-value
Normal	36 (48.6)	17 (38.6)	0.216
Underweight	5(6.8)	8(18.2)	
Overweight	21(28.4)	10(22.7)	
Obese	12(16.2)	9(20.5)	
Total	74(100)	44(100)	

Table 6. Nutritional Status of the Elderly (N=122)

BMI	All N (%)	Male N (%)	Female N (%)
Normal	55 (45.1)	38 (54.3)	17 (32.7)
Underweight	13 (10.7)	4 (5.7)	9 (17.3)
Overweight	33 (27.0)	15 (21.4)	18 (34.6)
Obese	21 (17.2)	13 (18.6)	8 (15.4)
Total	122(100)	70(100)	52(100)

The prevalence of hypertension was about 24%(29) among respondents which is similar to the value of 27% found among urban inhabitants in Rivers State and lower than the level of 44% found among Chinese elderly people [4,21]. Elevated FBG was about 33% (28) in the respondents which is more than that reported among elderly in Ogun State at about 11% [15]. This difference may be due to the fact that the study in Ogun State was carried out in the community while this present study was in the hospital. This study suggests that hypertension and diabetes prevalence are of public health importance among the elderly in Rivers State.

A look at the overall nutritional status of the respondents in this study showed that more men were in the study however more women were seen to be under weight ($\approx 70\%$), which was double the proportion of males. It is known that women tend to have more fat than men but the storage and distribution of fat is different which has less cardiovascular disease risk [22]. Women being more underweight, almost 70% (9) of those underweight in this study reflect they may have underlying health problems such as osteoporosis which may result from inadequate nutrients and the loss of the protective effect of estrogen [23]. The inadequate nutrient consumption as seen to be more in women 62%(8) may arise from financial difficulties that women face in within the region due loss of livelihood as they age or from retirement and loss of support from spouses due to widowhood or less commonly divorce. In terms of the older adults the optimum BMI should be 31–32 kg/m² for female and 27–28 kg/m² for male as has been suggested when considering all factors including nutritional status and geriatric assessment health indicators [24]. This study further buttress the fact that BMI and 24 hour dietary recall may not be the only indicators to assess the nutritional status of the older adult, however they can be a guide in management of nutritional deficiency in chronic disorders in the elderly. The non-linear relationship between BMI and dyslipidemia has also been seen in other studies particularly if they are diabetic [25].

5. CONCLUSION

This study showed a greater proportion of those with obesity had elevated fasting blood glucose and underweight was more in women, was highly associated with dyslipidemia and was associated highly with inadequate diet. Overall the study as evidenced by the chi square showed a no significant association between BMI and the major chronic disorders in older adults which were diabetes mellitus, dyslipidemia and hypertension. These findings may due to the fact that participants of this study are patients of a tertiary hospital who may be on medications that may have altered the nature of the assessed parameters. Nutrition al assessment parameters such as BMI and 24 hours dietary recall may not be enough to assess the nutritional status of older adults but remain non-invasive assessment tools that can guide the physician in management of nutritional insufficiency that can arise from chronic disorders in older adults.

6. RECOMMENDATIONS

Elderly people who are overweight or obese should be screened for lipid abnormalities, hypertension and diabetes. Health education on weight control should be carried out among adults. More research should be carried out on BMI and non-communicable diseases in communities.

7. LIMITATION

The values of the lipid profile and fasting blood glucose were unavailable for some of the respondents from the hospital records in this cross sectional study. The authors were not able to obtain these values for all participants in the study.

CONSENT

As per international standard or university standard, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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