Original Research Article

CROSS SECTIONAL ANALYSIS OF NUTRITIONAL STATUS AND MAJOR CHRONIC CONDITIONS IN OLDER ADULTS

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.

Method

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 ($\chi 2$) was employed to determine the degree of association between the various conditions and statistical significance was set at a p value <0.05.

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 (≈70%), was highly associated with dyslipidemia (100%) and was associated highly with inadequate diet(62%).

Conclusion

Overall the study showed a non-linear 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.

KEY WORDS: Adult**,** BMI, Hypertension, Nutrition, Older

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]

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.[5] 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.[5]

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.

METHODS AND MATERIAL

Study design: This is a cross-sectional descriptive study.

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 Port Harcourt, Rivers State, Nigeria, and 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.

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

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 (m^2). The WHO classification was used as follows underweight< 18.5kg/m^2, normal 18.5-4.9kg/m^2, overweight 25.0-29.9kg/m^2 and obesity > 30kg/m^2.

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 was 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.

Data was cleaned, coded and subsequently entered into Microsoft Excel 2010 sheet. The data was analyzed and inferential statistics using chi square ($\chi 2$) 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.

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.

RESULTS

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: 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)		23(62.7)	14(37.8)	37(100)
Underweight	6(10.7)	1(3.6)	0.250	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)		12(80.0)	3(20.0)	15(100)
Underweight	0(0.0)	2(15.4)	0.109	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)		18(32.7)	37(67.3)	55(100)
Underweight	2(6.8)	11(11.8)	0.232	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)
	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)	
Underweight	5(6.8)	8(18.2)	0.216
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)**

Discussion

A good proportion of the respondents were retired which is expected as these were elderly people who if they had a career of paid employment would retire averagely from 60years 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 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.[7] 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, 7] 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 %. 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.[8] 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.[9] 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.[10] The reason increased BMI was not associated with hypertension in this study may 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 were 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. 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.[11] 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, 9] 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. 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.[12] 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).[13, 14] 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; [15] 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.[13, 14, 16]

The percentage of abnormal values 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]

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, 17] Elevated FBG was about 33% (28) in the respondents which is more than that reported among elderly in Ogun State at about 11%.[11] 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 underweight(≈70%), which was double the number 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.[18] 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. 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 were 31–32 kg/m^2 for female and 27–28 kg/m^2 for male when considering all factors including nutritional status and geriatric assessment health indicators.[20] 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.[21]

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 showed a non-linear 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.

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.

REFERENCES

1. WHO. Ageing and Health. www.who.int. Accessed (22-11- 2022)
2. WHO Africa. Ageing. *Health topics*. www.afro.who.int. Accessed (22-11-2022)
3. Corcoran C, Murphy C, Sleator RD, Culligan EP, Walton S. 2019 Malnutrition in the elderly. SAGE Journals.
4. Li N, Hong J, Yang W, Liu S, Zho Q, Wang M, Wen W, Hu J, Cal X. 2022. Association between the geriatric nutritional risk index and the risk of stroke in elderly patients with hypertension. A longitudinal and cohort study. Sci. Clinical Nutrition. https//dc.org/10.53891.1 2022/1048206
5. Webster-Gandy J, Madden A, Holdsworth M 2006. Obesity. Chapter 17 in Oxford Handbook of Nutrition and Dietetics. Oxford University Press. pp 405-409.
6. Agrawal N, Agrawal MK, Kurari I, Kumar S.2017 Correlation between Body Mass Index and Blood Glucose levels in Jharkhand Population. International journal of Contemporary Medical Research. ISSN (online). 2393-915. Vol 4; 1633-1636
7. Ford DW, Hartman TJ, Still C, Wood C, Mitchell D, Hsiao PY, eta al. Diet related Practices and BMI are associated with diet quality in older adults. Public Health Nutrition. Cambridge University Press. 2014;17:1565-9.
8. Egbewale BE, Oyekale AO, Adedokun SA, Akindele AA, Adejimi AA. Prevalence and pattern of hypertension among elderly in Osun State. International Journal of Community Medicine and Public Health. Vol6, No 12(2019)
9. Charissa O, Yanti LS, Frisca, Kumala M. Association of Nutritional status with Diabetes Mellitus and hypertension in the elderly. Atlantis Press. Proceedings of the Tarmangara International conference on Medicine and health.
10. Zhang W, He K, Zhao H et al. Association of Body Mass Index and Waist Circumference with high blood pressure in older adults. BMC Geriatr 21, 260 (2021). https;11 doi.org/ 10.1186/8/2877-021-021s4-5.
11. Okafor JC, Adepoju AB. Nutritional status and blood glucose levels of elderly residents in Ilaro, Ogun State
12. Emmanuel B, Nzeagwu O, Iheme G. Anthropometric Status and lipid profile of older persons in Dekina LGA of Kogi State, Nigeria. Human Nutrition and Metabolism. Vol 30. 2022.

13. Alhamdan AA. Body Mass Index, Waist-to-hip ratio and lipid profile in Elderly subjects living in a nursing home. Journal of Medical sciences. 8;177-181
14. Hussain A, Ali I, Kaleem WA, Yasmeen F. Correlation between BMI and lipid profiles in patients with type 2 Diabetes attending a tertiary care hospital in Peshwar. Park J med sci 2019, 35: 591-597.
15. Feingold KR. Obesity and Dyslipidemia. [Updated 2020 Nov 2]. In: Feingold KR, Anawalt B, Boyce A, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK305895/
16. Kok P, Seidell JC, Meinders AE. De waarde en de beperkingen van de 'body mass index' (BMI) voor het bepalen van het gezondheidsrisico van overgewicht en obesitas [The value and limitations of the body mass index (BMI) in the assessment of the health risks of overweight and obesity]. Ned Tijdschr Geneeskd. 2004 Nov 27;148(48):2379-82. Dutch. PMID: 15615272.
17. Ojule IN. Prevalence of hyperyension and knowledge of its risk behaviors among residents of rural and urban communities in Rivers State, Nigeria. International journal of Tropical Disease and Health, 34 (1), 22018; Article no. IJDTH
18. Karastergiou K, Smith SR, Greenberg AS, Fried SK. Sex differences in human adipose tissues - the biology of pear shape. Biol Sex Differ. 2012 May 31;3(1):13. doi: 10.1186/2042-6410-3-13. PMID: 22651247; PMCID: PMC3411490.
19. Coin A, Sergi G, Benincà P, Lupoli L, Cinti G, Ferrara L, Benedetti G, Tomasi G, Pisent C, Enzi G. Bone mineral density and body composition in underweight and normal elderly subjects. Osteoporos Int. 2000;11(12):1043-50. doi: 10.1007/s001980070026. PMID: 11256896.
20. Kıskaç M, Soysal P, Smith L, Capar E, Zorlu M. What is the Optimal Body Mass Index Range for Older Adults? Ann Geriatr Med Res. 2022 Mar;26(1):49-57. doi: 10.4235/agmr.22.0012. Epub 2022 Mar 25. PMID: 35368193; PMCID: PMC8984168.
21. Izadi N, Rahimi MA, Shetabi HR, Hashemi Nazari SS, Najafi F. Dyslipidemia and Its Components Across Body Mass Index Levels Among Type II Diabetic Patients in the West of Iran. Int J Prev Med. 2020 Dec 11;11:188. doi: 10.4103/ijpvm.IJPVM_305_18. PMID: 33815712; PMCID: PMC8000169.