

PREVALENCE AND FACTORS ASSOCIATED WITH OBESITY AND OVERWEIGHT AMONG PENSIONERS IN THE EASTERN REGION OF GHANA

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ABSTRACT

BACKGROUND

The population of the elderly is seen as one of the fastest growing in the developing world. The elderly population is associated with many challenges. Obesity and overweight have been associated with increased mortality and reduced quality of life in the elderly. The study aimed at obtaining the prevalence and factors associated with obesity the elderly

METHOD

A cross-sectional studies was conducted among 401 pensioners using questionnaires and physical examination and laboratory examination of blood samples in the eastern regional capital of Ghana. Cross tabulations were used to obtain the prevalence of obesity and overweight. Logistic regression was carried out to find out factors associated with obesity and overweight.

FINDINGS

The prevalence of obesity among pensioners was 14.2%. Females were more likely to be obese with prevalence of 35.4% for female and 4.4% for males (p-value <0.001). Age, Social class, current marital status and highest educational level were socio-demographic factors associated with obesity/overweight. Hypertension, diabetes, serum total cholesterol, serum Low-density lipoprotein, serum triglyceride and use of eyeglasses were medical factors associated with obesity.

CONCLUSION

Obesity and overweight are associated with medical conditions even in the elderly population. Reducing obesity must start before pension.

KEY WORDS

Body Mass Index, Pensioners, elderly, prevalence, associated factors

BACKGROUND

The population of pensioners is progressively increasing in the developing and developed world. In the developed world however, the elderly population is seen to represent a fastest growing segment of the population (1). There are several problems of the elderly (2). However, health research in the developing countries has been and continues to be heavily centered on younger and working population groups (3). There is little work ongoing in the area of the health of the elderly in developing countries (including Ghana). Ghana has been described as a country experiencing significant increase in its aging population however research on the health of the aged in Ghana is grossly lacking. The population of elderly aged 65 years and above in Ghana constitutes 4.7% (4) and it is associated with many medical problems.

Obesity and overweight is an important public health challenge in both the developed and the developing world. In the year 2008, an estimated 1.4 billion adults were overweight of which about 500 million were obese (4, 5). Six years after and in the year 2014, more than 1.9 billion adults thus 39% of adults aged 18 years and older were overweight of which over 600 million were obese (7). Prevalence of obesity between the older adult and pensioners is lacking significantly across Africa. Majority of values that exist for prevalence are estimates based on very old data. Overweight and Obesity accounts for a significant proportion of the non-communicable diseases like hypertension, diabetes mellitus and many others. Even in the elderly aged group, Obesity and overweight has being linked to poor quality of life. Obesity is a major risk factor for much non-communicable disease. The health effect of obesity can be seen in almost all age groups with an associated 2.8 million deaths worldwide directly attributable to obesity (5).

In West Africa, studies on prevalence and associated risk factors particularly in the older adult age groups are lacking. A Meta-analysis performed using the DerSimonian-Laird random effect model involving Twenty-eight studies estimated the prevalence of obesity in West Africa at 10.0% (95% CI, 6.0–15.0) (8). In that study, it was found out that women in West Africa were more likely to be obese than men. In Ghana however, a study conducted in 2005 found the prevalence of obesity to be 5.5% (females 7.4%, males 2.8%) (9). Ten years after this study, little work has been done to show the current prevalence of obesity and overweight across the various age groups.

Most studies in Ghana are heavily focused on all adults with little in the area of pensioners or older adults to support interventions activities. It therefore became necessary for this study, which was conducted among the pensioners population in the eastern region of Ghana. The study reported on the prevalence of obesity within different strata of the pensioner population. Determined factors those were associated with obesity and overweight as well as developing a model for predicting Body mass index (BMI) from factors that were found to correlate with BMI.

METHODS

A cross sectional study was conducted in the eastern region of Ghana among the members of the National pensioners association (NPA) in the eastern region of Ghana. The survey was conducted as part of a registration exercise for all members of the National Pensioners association for the start of a Pensions Medical Scheme (PMS). The scheme was aimed as a top-up scheme for the members of the National Pensioners scheme that would finance health care expenses of members of the scheme in instances where the National health insurance scheme (NHIS) does not cover. It was a nationwide exercise that took place from April to December of 2014. However this particular study focused on the eastern region survey. All the members of the national pensioners association converge at the registration/ medical screening within the days of the screening. The medical screening in the eastern region of Ghana was carried out in Koforidua; the regional capital of the eastern region.

Participants were made to rest for at least 30 minutes, after which they go through the registration and the medical screening exercise.

STUDY SITE

The study took place in the eastern regional capital of Koforidua. Participants were from the eastern region. However, majority of the participants were from the regional capital. The eastern region of Ghana is one of the ten administrative regions of Ghana with a land surface area of 19,323 square kilometres (8% of Ghana's total surface area). It has 26 administrative districts and a population of about 2,633,154 (4). The eastern region has 12.6% of the population of the elderly in Ghana (10).

STUDY POPULATION AND ELIGIBILITY CRITERIA

The study subjects were the elderly defined in this study by the United Nations classification of 60 years and above. There were three participants below 60 years who have retired before the retirement age of 60 years due to disability and other reasons thereby qualifying as a pensioner. All pensioners who were members of the National Pensioners Association were eligible as participants of the study. Within the study period of one week, 401 members of the national pensioners association presented for the medical screening. The screening exercise was for all the members who report at the venue for the screening but the participants were given the option

and could opt out. Participant must be a member of the National Pensioners association and must be resident in the Eastern region of Ghana.

SAMPLE SIZE AND SAMPLING METHOD

A census of all the participants was the target. The study because it forms part of a registration exercise for a Pensioners medical scheme, every member of the National pensioners association resident in the Eastern region. It was the hope of the study to recruit as many as were Pensioners in the eastern region during the one-week registration and screening exercise.

STUDY MATERIALS AND DATA CAPTURE TOOL

Study questionnaires were made as shown in appendix 1. It collected demographic as well as social information. It had a section on past medical history collecting information on known past medical history. It further collected information on allergies, alcohol, smoking, exercise and diet. There is a physical examination form attached to the form, which was used to capture data of the physical examination. Weight was measured with a weighing scale with a tool attached for measuring the height. The Blood pressure was measured using electronic sphygmomanometer with appropriate cuff sizes. The vision was measured using the snellian chart. Blood sample was taken and a glucometer was used to measure the random blood sugar. Blood sample was collected into a serum separator bottle and transported to a laboratory for measurement of serum cholesterol. Medical officers perform physical examination while trained ophthalmic nurses perform fundoscopy.

DATA COLLECTION

The research team fills the questionnaire based on the response of the study participants by trained research assistants. The weight was measure with the weighing scale to the nearest one-kilogram while the height to the nearest one millimeter. Random blood sugar was measured using glucometer. Blood sample was collected into a serum separator bottle and transported to a laboratory for measurement of serum cholesterol. Medical officers perform physical examination while the eye team checked the vision and performed fundoscopy. Personalized reports of the medical screening were made available to each participant.

DATA PROCESSING AND ANALYSIS

The data generated in the research were entered into Epidata 3.1 and exported into STATA/MP 11.0 (copyright 2004-2009) for analysis. The primary outcome in the study is overweight and Obesity. Some variables were grouped and reclassified based on desired outcome. With regard to social class, participants previous occupation was classified under various social class heading according to the registrar general's occupational classification of England and wales. The background characteristics of the respondents were obtained by cross tabulation. Logistic regression was used to analyze the factors association with obesity. First, the association between

each of the potential factors and overweight/obesity was examined ignoring other variables. This analysis was important because it gave a fair idea as to which of the variables are strong predictors/ related to overweight and obesity. Second to construct a model with factors that is independently associated with overweight and obesity, each of the independent variable was a candidate provided that the p-value was 0.1 or less. To investigate whether the relationship between overweight/obesity and a continuous covariate was non-linear, likelihood ratio test was used to compare the fit of the models when the continuous covariate was included as continuous or a categorical variable. Systolic blood pressure and diastolic blood pressure was also considered a priori as categorical variable because of the decision to include Mean arterial pressure in the model as a continuous variable to help predict overweight and obesity. Correlation coefficient was obtained through a correlation analysis between BMI and the continuous covariates. In checking for confounding, first, the association between the potential confounder and the outcome variable was assessed as well as the degree of association between the potential confounder and the primary exposure variable (which is overweight and obesity) was explored. If the potential confounder satisfies the criteria of being related to both the exposure and the outcome variable, then likelihood ratio test was used to assess the exposure outcome relationship seen in the strata of the confounding variable to find out if it is in the same magnitude and direction as that seen in the crude analysis. Finally, likelihood ratio was used to assess if the exposure outcome relationship seen in the crude analysis is similar in magnitude and direction as that seen when potential confounder has been adjusted for in the analysis. If it differs by 10%, then the potential confounder was considered a confounder. Graphical representation BMI was carried out using pie charts. Box and whisker plots were also used to describe the BMI. Scatter plot with line of best fit was also used in the analysis to display a pictorial relationship between BMI and continuous covariates.

ETHICAL CONSIDERATIONS

Members of the National Pensioners association gave the permission to carry out the study. The content of the medical screening exercise was developed in extensive consultation with the executives of the National Pensioners Association. Consent was voluntary and each study participant had the right to withdraw at any stage of the study process. Uttermost privacy and confidentiality were maintained. No compensation or payments were made to any study participants. However, personalized results of the study were sent to each participant. Data files were password protected. Hard copy and electronic data were stored in locked file cabinets, and access was limited to the Principal investigator.

RESULTS

BACKGROUND CHARACTERISTICS OF PARTICIPANTS

This survey found out that, 274 (68.3%) of the 401 study participant were males. While the female population was 127, constituting 31.7% of the study population as shown in table 2. The

mean height of all study participants was 163.9 cm with a standard deviation of 8cm. There was significant difference between the heights of the normal/underweight group (165.1cm, standard deviation of 7.9cm) compared to the obese/ overweight group (162.1cm, standard deviation of 7.9). Table one displays the background characteristics of the respondents using the variables with continuous variables. The story is different with weight; while normal/underweight group were taller, the obese/ overweight group were heavier than the normal/underweight group.

Table 1: Background characteristics of respondents using continuous variables

Characteristics	All participants	Normal/ underweight	Overweight/O bese
Mean Height (cm)	163.9 (8.0)	165.1 (7.9)	162.1 (7.9)
Mean Weight (Kg)	64.8 (13.0)	57.3 (8.2)	76.5 (10.1)
Mean Age (years)	68.0 (5.8)	69.1 (6.0)	66.1 (4.9)
Blood Pressure in millimeters of mercury			
Mean Systolic	141 (24)	137 (24)	146 (22)
Diastolic (median/IQR) [#]	78 (18)	76 (18)	81 (14)
Serum Cholesterol in mille moles per liter			
Total cholesterol (mean/SD)*	6.0 (1.4)	5.7 (1.4)	6.4 (1.4)
Triglyceride (median/IQR) [#]	1.4 (0.8)	1.3 (0.7)	1.5 (0.7)
HDL [§] cholesterol (Mean/SD)	1.44 (0.39)	1.42 (0.40)	1.46 (0.37)
LDL [^] cholesterol (median/IQR) [#]	3.9 (1.6)	3.7 (1.4)	4.2 (1.7)
Coronary risk (Mean/SD)	4.3 (1.0)	4.2 (1.0)	4.5 (1.1)
Blood sugar [@] (median/IQR) [#]	4.8 (1.1)	4.8 (1.0)	4.8 (1.2)

Mean and standard deviation were reported for all variables except otherwise specified

Mean (SD)* mean plus standard deviation in brackets

(Median/IQR)[#] Median and interquartile range in brackets reported if $-1.5 \leq$ co-efficient of skewness ≥ 1.5

HDL[§] High density lipoprotein

LDL[^] Low density lipoprotein

[@] Random blood sugar

Table 2: Background characteristics of respondents using discrete variables

Characteristics	Proportions		
	All participants	Normal/ underweight	Overweight/Obese
	N (%)	n (%)	n (%)
Sex			
Male	274 (68.3)	201 (73.4)	73 (26.6)
Female	127 (31.7)	43 (33.9)	84 (66.1)
Religion			
Christianity	379 (96.7)	227 (60.1)	151 (40.0)
Islam	12 (3.1)	9 (75.0)	3 (25.0)
Others	1 (0.3)	1 (100)	-
Social class [#]			
I [Professional]	25 (6.3)	8 (32.0)	17 (68.0)
II [Managerial/technical]	72 (18.1)	44 (62.0)	27 (38.0)
III [(N) Skilled non-manual]	153 (38.5)	80 (52.3)	73 (47.7)
III [(M) Skilled Manual]	34 (8.6)	29 (85.3)	5 (14.7)
IV [Partly skilled]	64 (16.1)	43 (67.2)	21 (32.8)
V [Unskilled]	49 (12.3)	36 (73.5)	13 (26.5)
Current Marital Status			
Never Married	6 (1.6)	3 (50.0)	3 (50.0)
Married	274 (71.4)	182 (66.4)	92 (33.6)
Widow/Widower	64 (16.7)	28 (44.4)	35 (55.6)
Divorced	14 (3.7)	8 (57.1)	6 (42.9)
Separated	26 (6.8)	8 (30.8)	18 (69.2)

Highest Formal Educational Status

None	30 (8.1)	22 (73.3)	8 (26.7)
Basic/ MSLC [§]	141 (37.9)	94 (66.7)	47 (33.3)
Secondary	79 (21.2)	45 (57.0)	34 (43.0)
Tertiary	120 (32.3)	61 (50.8)	59 (49.2)
Others	2 (0.5)	1 (50.0)	1 (50.0)

Ethnicity

Ga-Dangme	53 (13.0)	31 (58.5)	22 (41.5)
Akan	226 (55.3)	130 (57.5)	96 (42.5)
Ewe	46 (11.3)	130 (65.2)	16 (34.8)
Guang	32 (7.8)	30 (65.2)	16 (34.8)
All other ethnic	52 (12.7)	33 (75.0)	11 (25.0)

Alcohol intake

No Alcohol	304 (80.4)	180 (59.4)	123 (40.6)
Takes alcohol	74 (19.6)	45 (60.8)	28 (39.2)

Vegetarian status

Non-vegetarian	374 (99.5)	223 (59.8)	150 (40.2)
Vegetarian	2 (0.5)	1 (50.0)	1 (50.0)

Exercise lasting for at least 30 minutes, three times per week

Less than three	79 (43.9)	45 (57.0)	34 (43.0)
Three	36 (20.0)	19 (52.8)	17 (47.2)
More than three	65 (36.1)	40 (61.5)	25 (38.5)

[#] Social class based on registrar general's occupational classification England and wales of previous occupation during active service

MSLC[§] – Middle School Leaving Certificate

The obese/ overweight group had a mean weight of 76.5kg (standard deviation of 10.1kg) while the normal/underweight group had a weight of 57.3kg (standard deviation of 8.2kg). The mean weight of all study participants was 64.8 Kg (standard deviation of 13Kg) as shown in table 1. The total cholesterol is higher among the obese/over weight group compared to that of the underweight normal group. The total cholesterol level for all participants was 6.0 (SD=1.4) mmol/L. as shown in table 1. Overall, BMI was higher in the females compared to that of the males as shown in figure 1.

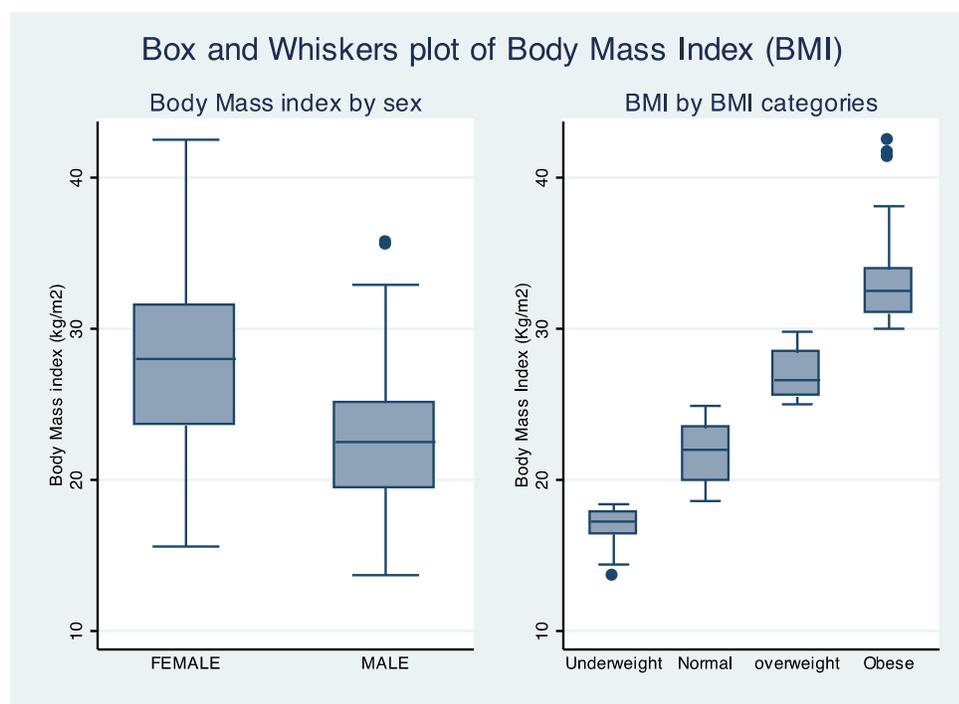


Figure 1: Box and Whiskers plot of Body Mass Index by sex and BMI categories

With regards to the background of the participants using categorical variables, majority of all respondents were Christians with 96.7% of the study population. There was significant difference between the social class of the groups; with 68% of the professional social class group being in the overweight and obese group compared to only 32% in the normal/underweight group. Concerning participants who drink alcoholic beverages,, 60.8% were underweight/normal weight while 39.2% were over weight/obese as shown in table 2.

PREVALENCE OF OBESITY AND OVERWEIGHT AMONG THE ELDERLY

Table 3 is the distribution of the prevalence of the various body mass index classes by the variables. The overall prevalence of obesity among the study participants was 14.2%. 24.9% were however overweight while 9.5% of participants was underweight. Majority of the female pensioners were obese (35.4%) while 30.7% were overweight as shown in table 3. Figure 2 also displays the BMI classification by sex and also the overall values.

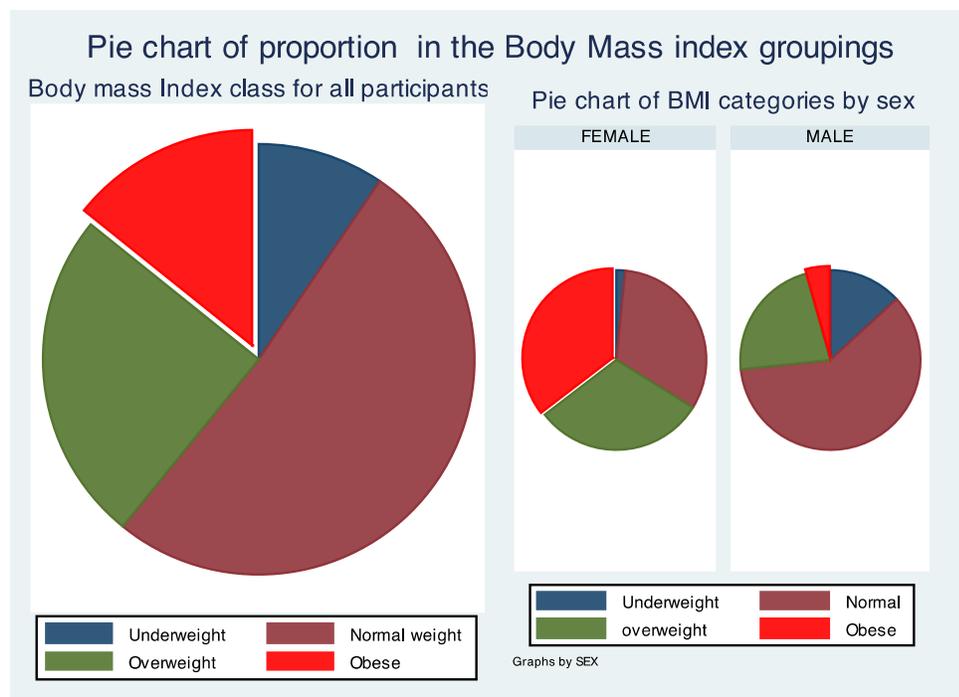


Figure 2: Pie Chart showing the proportion of the elderly by Body Mass Index classification

By age classification, the proportion of obesity reduces with increasing age. The above 80-year-old group in this study had no obese individual. It is not clear if the obese individuals die early and as such could not find obese individuals as one age. Another explanation could be that without work and the harsh economic reality, many of the pensioners continue to lose weight as they age. This however needs to be tested in a further study. Obesity was significantly associated with the marriage life as the proportion of obesity is higher in the marriage group than any other group as shown in table 3.

Table 3: Prevalence of the various Body Mass Index classes among the elderly in the eastern region of Ghana by demographic factors

	Underweight	Normal	Overweight	Obesity	P-value*
	≤18.4	18.5 – 24.9	25.0 – 29.9	≥ 30	
Variable	n (%)	n (%)	n (%)	n (%)	
Overall Prevalence	38 (9.5)	206 (51.4)	100 (24.9)	57 (14.2)	
Sex					
Male	36 (13.1)	165 (60.2)	61 (22.3)	12 (4.4)	<0.001

Female	2 (1.6)	41 (32.3)	39 (30.7)	45 (35.4)	
Current Age in years					
Less than 65	6 (4.3)	57 (41.0)	45 (32.4)	31 (22.3)	<0.001
65 – 69	11 (8.6)	68 (53.1)	34 (26.6)	15 (11.7)	
70 – 74	10 (13.2)	47 (61.8)	12 (15.8)	7 (9.21)	
75 – 79	3 (9.7)	20 (64.5)	6 (19.4)	2 (6.5)	
≥ 80	7 (35.0)	10 (50.0)	3 (15.0)	-	
Religion					
Christianity	32 (8.5)	195 (51.6)	95(25.1)	56 (14.8)	<1.0
Islam	1 (8.3)	8 (66.7)	2 (16.7)	1 (8.3)	
Others	-	1 (100)	-	-	
Highest Formal Educational Level					
None	4 (13.3)	18 (60.0)	6 (20.0)	2 (6,7)	<0.5
Basic/ MSLC [#]	14 (9.9)	80 (56.7)	30 (21.3)	17 (12.1)	
Secondary	4 (5.1)	41 (51.9)	26 (32.9)	8 (10.1)	
Tertiary	8 (6.7)	53 (44.2)	32 (26.7)	27 (22.5)	
Others	-	1 (50)	1 (50)	-	
Current Marital status					
Never Married	-	3 (50)	3 (50)	-	<0.01
Married	31 (11.3)	151 (55.1)	59 (21.5)	33 (12.0)	
Widow/Widower	1 (1.6)	27 (42.9)	20 (31.8)	15 (23.8)	
Divorced	1 (7.1)	7 (50.0)	5 (35.7)	1 (7.1)	
Separated	1 (3.9)	7 (26.9)	12 (46.2)	6 (23.1)	

*Pearson Chi square P-value, significant at 0.05

MSLC[#] – Middle School Leaving Certificate

Considering the social factors, the prevalence of obesity was high in the professional social class group accounting for 44.0%. It was also worth noting that those in the skilled manual groups low overweight proportion of 14.7% with none of them obese as shown in table 4. It can therefore be argued that the previous social class while working significantly affects the onset of obesity. Manual skilled work was associated with low overweight and obesity while the professional group had the highest rate of obese individuals. Table 4 shows the prevalence of obesity by social factors.

Table 4: Prevalence of the various Body Mass Index classes among the elderly in the eastern region of Ghana by Social factors

Social factor	Underweight	Normal	Overweight	Obesity	P-value*
	≤18.4 n (%)	18.5 – 24.9 n (%)	25.0 – 29.9 n (%)	≥ 30 n (%)	
Prevalence by ethnicity					
Ga-Dangme	5 (9.4)	26 (49.1)	18 (34.0)	4 (7.6)	<0.5
Akan	19 (8.4)	111 (49.1)	59 (26.1)	37 (16.4)	
Ewe	3 (6.5)	27 (58.7)	11(23.9)	5 (10.9)	
Guang	4 (12.5)	16 (50.0)	6 (18.8)	6 (18.8)	
All other ethnic	7 (15.9)	26 (59.1)	6 (13.6)	5 (11.4)	
Prevalence by social class [#]					
I [Professional]	1 (4.0)	7 (28.0)	6 (24.0)	11 (44.0)	
II [Managerial/technical]	4 (5.6)	40 (56.3)	24 (33.8)	3 (4.2)	<0.001
III [(N) Skilled non-manual]	15 (9.8)	65 (42.5)	47 (30.7)	26 (17.0)	
III [(M) Skilled Manual]	2 (5.9)	27 (79.4)	5 (14.7)	-	
IV [Partly skilled]	6 (9.4)	37 (57.8)	8 (12.5)	13 (20.3)	
V [Unskilled]	9 (18.4)	27 (55.1)	9 (18.4)	4 (8.2)	
Alcohol intake					
No Alcohol	28 (9.2)	152 (50.2)	76 (25.1)	47 (15.5)	<0.5

Takes alcohol	5 (6.8)	40 (54.1)	22 (29.7)	7 (9.5)	
Exercise lasting for at least 30 minutes, three times per week					
Less than three times	3 (3.8)	42 (53.1)	22 (27.9)	12 (15.2)	<0.5
Three times /more	10 (9.9)	49 (48.5)	28 (27.7)	14 (13.9)	
Current Pensioner working status					
Not working	20 (8.6)	112 (48.1)	65 (27.9)	36 (15.5)	<0.5
Working	12 (10.6)	65 (57.5)	22 (19.5)	14 (12.4)	

*Pearson Chi square P-value, significant at 0.05

Social class based on registrar general's occupational classification England and wales of previous occupation during active service

Prevalence of body mass index classes by known medical factors also displays some interesting findings. Hypertensives were more obese compared to non-hypertensive with the prevalence of Obesity among the hypertensive group calculated as 18.8% compared with 9.6% in the non-hypertensive groups. Likewise Obesity was twice as high among the diabetic compared to non-diabetics. Obesity is a known risk factor for hypertension and diabetes. This has been widely studied. Other medical conditions studied like Asthma, Arthritis, bodily pains did not show significant variation in the prevalence of Obesity and as such was not reported.

Table 5: Prevalence of the various Body Mass Index classes among the elderly in the eastern region of Ghana by medical factors

	Underweight	Normal	Overweight	Obesity	P-value
Medical factor	≤18.4	18.5 – 24.9	25.0 – 29.9	≥ 30	
	n (%)	n (%)	n (%)	n (%)	
Prevalence by known hypertensive status					
Non-hypertensive	26 (13.1)	106 (53.3)	48 (24.1)	19 (9.6)	<0.01
Hypertensive	12 (5.9)	100 (49.4)	52 (25.7)	38 (18.8)	
Prevalence by Known diabetes Mellitus status					
Non Diabetic	38 (10.6)	189 (52.8)	85 (23.7)	46 (12.9)	<0.05
Diabetic	-	17 (41.5)	13 (31.7)	11 (26.8)	

Prevalence by total serum cholesterol level

≤ 6.50 mmol/L	30 (11.3)	152 (57.4)	55 (20.8)	28 (10.6)	<0.001
> 6.50 mmol/L	8 (6.0)	53 (39.6)	45 (33.6)	28 (20.9)	

Prevalence by serum triglyceride level

≤ 1.71 mmol/L	31 (10.9)	160 (56.3)	64 (22.5)	29 (10.2)	<0.001
> 1.71 mmol/L	7 (6.1)	45 (39.1)	36 (31.3)	27 (23.5)	

Prevalence by serum Low density lipoprotein level

≤ 3.88 mmol/L	22 (1.1)	119 (59.8)	39 (19.6)	19 (9.6)	<0.05
> 3.88 mmol/L	16 (8.0)	86 (43.0)	61 (30.5)	37 (18.5)	

Prevalence by coronary risk

≤ 5.0	32 (10.7)	161 (54.0)	72 (24.2)	33 (11.1)	<0.05
> 5.0	6 (5.9)	44 (43.6)	28 (27.7)	23 (22.8)	

*Pearson Chi square P-value, significant at 0.05

FACTORS ASSOCIATED WITH OBESITY/OVERWEIGHT AMONG PENSIONERS.

The survey studied demographic, social and medical factors that could be associated with obesity either as risk factor, prognostic or complication of obesity. Table 6 displays the socio-demographic factors associated with overweight and obesity in the unadjusted analysis. The socio-demographic factors that had a very high level of significance P-value less than 0.0001 includes age, sex, and social class. Being a female has higher odds of being obese with an odds ratio of 5.4 (95% CI, 3.4 – 8.5). There was a significant reduction in the odds of being obese as one moves across the five-year age class. The lowest odds ratio of being obese/overweight in the age category was found in the age group 80 years and above. The odds ratio of obesity/overweight in the professional social class group in the crude analysis was about six times that of the unskilled social class. Among the social class, being a skilled manual worker reduces your risk of being overweight /obese by 50%.

Certain ethnic groups were associated with higher odds of being obese than others. For example the Ga-Dangme had odds ratio of 2.1(95% CI=0.9 – 5.1) of being obese/overweight. In the eastern region of Ghana, being a Muslim reduces your risk of being obese by 50% as shown in table 6. Other social factor like alcohol intake was found to reduce the odds of being obese by

10%. Smoking however did not produce significant results because of the very low prevalence of smoking among the study participants.

Tertiary education being the highest level of education was significantly associated with higher odds of being obese/overweight with odds ratio of 2.7 (95% CI of 1.1 – 6.4). In this study, current exercise status did not significantly affect odds of being overweight / obese. Table 6 displays the socio-demographic factors examined and their crude odds ratio obtained.

Table 6: Univariate univariable logistic regression analysis of socio-demographic factors with obesity/overweight

Variable	Crude odds ratio	95% CI*	P-value
Sex			<0.0001
Male	-	-	
Female	5.4	3.4 – 8.5	
Highest Formal Educational Level			<0.05
None	-	-	
Basic/ MSLC [#]	1.4	0.5 – 3.3	
Secondary	2.1	0.8 – 5.2	
Tertiary	2.7	1.1 – 6.4	
Others	2.8	0.2 – 49.5	
Age			
Less than 65	-	-	<0.0001
65 – 69	0.51	0.31 – 0.83	
70 – 74	0.27	0.15 – 0.51	
75 – 79	0.28	0.12 – 0.69	
≥ 80	0.15	0.04 – 0.52	
Current Marital status			< 0.005
Never Married	-	-	

Married	0.5	0.1 – 2.5	
Widow/Widower	1.3	0.2 – 6.7	
Divorced	0.8	0.1 – 5.1	
Separated	2.3	0.4 – 13.7	
Prevalence by social class [#]			<0.0001
I [Professional]	5.9	2.1 – 16.9	
II [Managerial/technical]	1.7	0.8 – 3.8	
III [(N) Skilled non-manual]	2.5	1.2 – 5.1	
III [(M) Skilled Manual]	0.5	0.1 – 1.5	
IV [Partly skilled]	1.4	0.6 – 3.1	
V [Unskilled]	-	-	
Religion			<0.5
Christianity	-	-	
Islam	0.5	0.1 – 1.9	
Ethnicity			
Ga-Dangme	2.1	0.9 – 5.1	<0.5
Akan	2.2	1.1 – 4.6	
Ewe	1.6	0.6 – 3.9	
Guang	1.8	0.7 – 4.8	
Other ethnic groups	-	-	
Alcohol intake			
No Alcohol	-	-	<1.0
Takes alcohol	0.9	0.5 – 1.5	
Exercise lasting for at least 30 minutes, three times per week			
Less than three times	-	-	<1.0

Three times	1.2	0.5 – 2.6
More than three times	0.8	0.4 – 1.6

95% CI* 95% confidence interval MSLC[#] – Middle School Leaving Certificate

With regard to the medical factors related to obesity and overweight, the study found out that, diabetes status, use of eye aids/glasses, serum cholesterol levels, having blood pressure above the normal levels, were associated significantly with obesity and overweight. The odds of overweight/ obesity among the hypertension patients were 1.6 times the odds among the non-hypertensive patients as shown in table 7. Similarly, the odd ratio for overweight/obesity among the diabetic patients was 2.5 (95% CI =1.2 – 4.7) times that among the non-diabetic. The history of use of eye aid/ medicated lenses was used as a proxy for known refractive error. It was found out with a very low p-value (<0.005) that the use of medicated eyeglasses was associated with twice the risk of being overweight or obese. A diastolic blood pressure of more than 100mmHg was four times associated with obesity and overweight compared to those below 90mmHg.

Table 7: Univariate Univariable logistic regression analysis of medical factors with overweight/obesity

Variable	Crude odds ratio	95% CI*	P-value
Hypertension			
Non-hypertensive	-	-	<0.05
Hypertensive	1.6	1.1 – 2.4	
Diabetes			
Non Diabetic	-	-	<0.01
Diabetic	2.5	1.2 – 4.7	
Arthritis			
No arthritis	-	-	<1.0
Have arthritis	1.0	0.5 – 1.8	
Chronic bodily pains			
No chronic bodily pains	-	-	< 0.5
Have chronic bodily pains	0.8	0.6 – 1.3	

Asthma			
Non Asthmatic	-	-	<0.1
Asthmatic	0.9	0.3 – 3.0	
Other Known allergies			
No allergies	-	-	<0.5
Allergies	1.2	0.7 – 2.3	
Peptic Ulcer disease			
No Peptic ulcer	-	-	<1.0
Peptic ulcer disease	0.8	0.3 – 1.8	
Previous surgeries			
No previous surgery	-	-	<0.5
Had previous surgeries	1.3	0.8 -2.1	
Use of eye glasses to aid vision			
No eye glass	-	-	<0.005
Uses eye glasses	2.0	1.3 – 3.2	
Use of walking aid			
Uses walking aid	-	-	<1.0
Does not use walking aid	0.8	0.2 – 2.9	
Serum triglyceride in mmol/L			
Less than 1.7 (150mg/dL)	-	-	<0.0001
1.7 – 2.2 (150 – 199 mg/dL)	2.4	1.4 – 3.9	
Above 2.3 (499mg/dL)	4.0	1.7 – 9.3	
Low density lipoprotein in mmol/L			
Less than 3.38	-	-	<0.0005
3.38 – 4.16	1.7	0.9 – 3.2	

Above 4.16	2.6	1.6 – 4.0	
High density lipoprotein in mmol/L			
Less than 1.03	1.1	0.7 – 1.7	<0.1
1.02 – 1.55	0.5	0.2 – 1.0	
More than 1.55	-	-	
Coronary risk ratio			
Less than 5	-	-	
More than 5	1.8	1.1 – 2.8	<0.05
Systolic Blood pressure in mmHg			
Less than 140	-	-	<0.0001
140 - 160	2.6	1.6 – 4.0	
Above 160	2.5	1.4 – 4.5	
Diastolic Blood pressure in mmHg			
Less than 90	-	-	<0.005
91 – 99	1.0	0.6 – 2.0	
Above 100	4.2	1.6 – 10.3	

95% CI* 95% confidence interval

The analysis also found a number of the investigated variables not to be related with obesity and overweight. Some of these variables include Asthmatic status, current use of walking aid, previous surgery, and Peptic ulcer disease. Others include known allergies, chronic bodily pains and arthritis.

In the multivariable analysis, the analysis used factors, which were found through a likelihood ratio analysis as being independently associated with obesity. These factors identified were sex, social class, use of medicated eyeglasses, highest educational status, and current marital status. Others include diabetes, blood pressure and serum cholesterol profile results.

Table 8: Univariate Multivariable logistic regression of independent factors associated with overweight and Obesity P value <0.0001

Covariate	Adjusted odds ratio	95% Confidence interval
Sex		
Male	-	
Female	2.7	1.3 – 5.1
Social class[#]		
I [Professional]	1.9	0.4 – 7.8
II [Managerial/technical]	0.7	0.2 – 2.0
III [(N) Skilled non-manual]	1.7	0.7 – 4.5
III [(M) Skilled Manual]	0.3	0.08 – 1.3
IV [Partly skilled]	1.9	0.2 – 1.8
V [Unskilled]	-	-
Use of eye glasses to aid vision		
No eye glass	-	-
Uses eye glasses	1.9	1.1 – 3.4
Serum triglyceride		
Less than 1.7 (150mg/dL)	-	-
1.7 – 2.2 (150 – 199 mg/dL)	2.0	1.1 – 3.7
Above 2.3 (499mg/dL)	4.3	1.5 – 12.4
Low density lipoprotein in mmol/L		
Less than 3.38	-	-
3.38 – 4.16	1.4	0.7 – 3.4
Above 4.16	1.5	0.8 – 2.7

Systolic Blood pressure in mmHg		
Less than 140	-	-
140 - 160	2.6	1.5 – 4.6
Above 160	1.3	0.5 – 2.9
Diastolic Blood pressure in mmHg		
Less than 90	-	-
91 – 99	1.0	0.5 – 2.3
Above 100	4.8	1.4 – 16.5
Current Marital status		
Never Married	-	-
Married	1.5	0.2 – 10.8
Widow/Widower	1.9	0.3 – 14.1
Divorced	0.9	0.8 – 4.3
Separated	2.9	0.3 – 24.4
Diabetes		
Non Diabetic	-	-
Diabetic	1.8	0.8 – 4.3
Highest Formal Educational Level		
None	-	-
Basic/ MSLC [#]	0.9	0.3 – 2.8
Secondary	1.5	0.4 – 4.8
Tertiary	0.8	0.2 – 2.6
Others	3.3	0.1 – 95.8

In the adjusted analysis adjusting for all other covariates that were found to be independent risk factors as shown in the table 8 below, age had an adjusted odds ratio of 2.7 (95% CI=1.3 – 5.1). The overall model was highly significant with an overall model p-value of less than 0.0001.

Some of the highest odds ratios were obtained in diastolic blood pressure above 100mmHg, which had 4.8 (95% CI=1.4 – 16.5) adjusted odds ratio of being overweight/obese. Also having a serum triglyceride level above 2.3mmol/L is associated with 4.3 times the odds of being overweight/obesity compared to that less than 1.7mmol/L. Diabetic were in the adjusted analysis found to be 80% more likely to be obese/overweight compared to non-diabetics.

CORRELATIONAL STUDIES OF FACTORS RELATED WITH BODY MASS INDEX

The studies also explored linear relationships between body mass index values and some continuous variables. The study measured the correlation coefficients of the individual linear relationships between body mass index and mean arterial pressure, systolic and diastolic blood pressure, total cholesterol and age. Table 9 displays the correlation coefficients of the correlation analysis. Age was inversely related with BMI with a correlation coefficient of -0.30. Likewise mean arterial blood pressure had a correlation coefficient of 0.28. Total cholesterol, systolic and diastolic blood pressure were weakly associated with BMI

Table 9: relationship of Body Mass Index with covariates

Variable	Correlation coefficient (r)*	P-value
Mean Arterial blood pressure (MAP)	0.28	<0.0001
Systolic blood pressure	0.25	<0.0001
Diastolic blood pressure	0.26	<0.0001
Total cholesterol	0.25	<0.0001
Age	-0.30	<0.0001

* All values were Pearson's correlation coefficients

The relationship between increasing BMI values and the mean arterial blood pressure, age and total cholesterol values were displayed pictorially in figure 3 using scatter plots with line of best fits plotted. Age showed an inverse relationship with increasing BMI while total cholesterol levels and mean arterial pressure showed positive relationships.

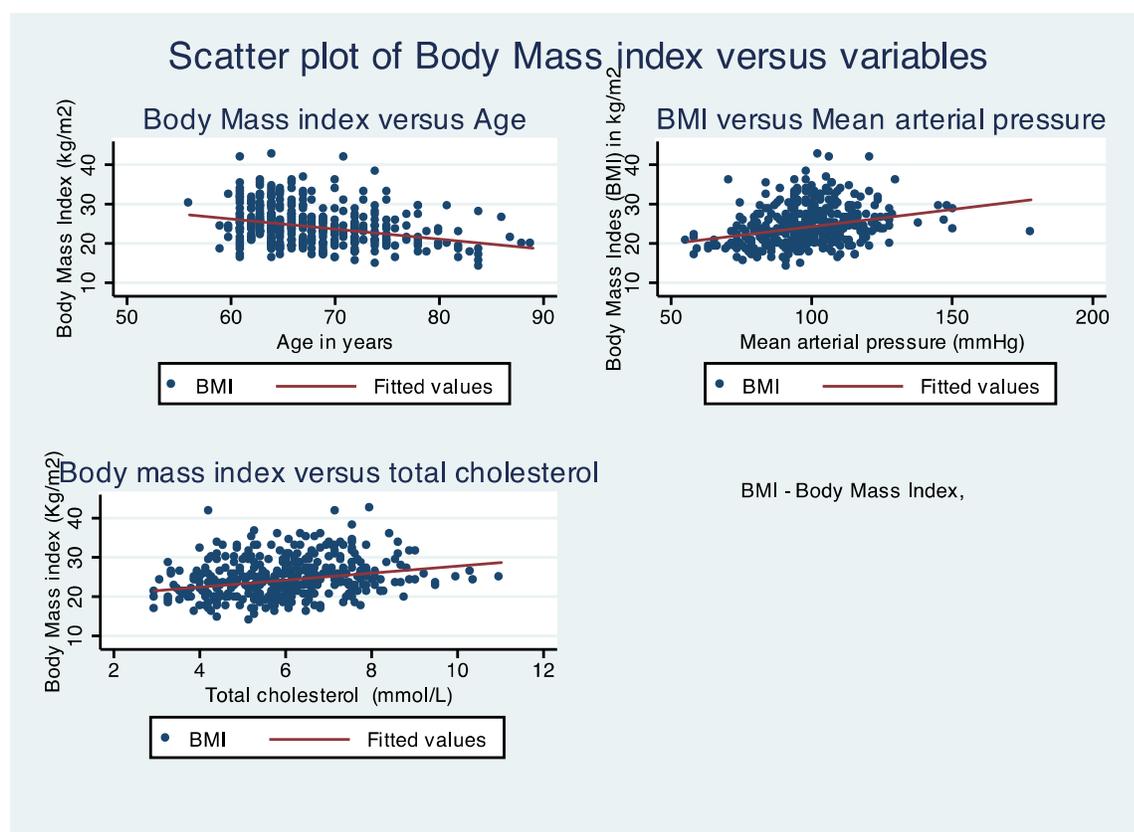


Figure 3: Scatter Plot of Body Mass Index with Age, Mean arterial Pressure and Total cholesterol level

DEVELOPING A LINEAR REGRESSION MODEL FOR PREDICTING BODY MASS INDEX

Using regression analysis, a model was developed to predict the BMI of pensioners from the age, total cholesterol level and the mean arterial blood pressure. Table 10 displayed the regression analysis results in a univariate univariable model of BMI and mean arterial pressure, age and total cholesterol level.

In the multivariable analysis however, a significant model (p-value < 0.0001) was developed that correctly predicts the BMI from the age, total cholesterol and mean arterial blood pressure. Table 11 displays the intercepts and the regression coefficients of the model.

Table 10: Univariate univariable linear regression analysis of independent predictors of Body Mass Index

Covariates	Intercept (95% CI)*	Beta (β) [#] (95% CI)	R-squared [^]	P-value
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Mean Arterial Pressure (mmHG)	15.6 (12.6 - 18.5)	0.09 (0.06 to 0.11)	0.08	<0.0001
Total serum cholesterol (Mmol/L)	18.9 (16.9 – 20.9)	0.89 (0.56 to 1.21)	0.07	<0.0001
Age (years)	41.6 (36.1 – 47.1)	-0.26 (-0.34 to -0.18)	0.09	<0.0001

(95% CI)* 95% confidence interval

Beta (β)[#] Regression coefficient

R-squared[^]

In the multivariable model aimed at developing a model to predict Body Mass Index, age in years, sex as a categorical variable, mean arterial pressure and total serum cholesterol was used. The model obtained for predicting the BMI from age, sex, mean arterial pressure and total cholesterol levels is:

$$\text{BMI} = 23.0 \text{ Kg} - 0.12 (\text{age in years}) + 0.07 (\text{MAP}) + 0.17 (\text{TCHOL}) + 4.4(\text{sex})$$

Where MAP is mean arterial pressure, TCHOL is total cholesterol in mmol/L and sex is an indicator variable allowing 0 for male and 1 for female. This model correctly predicts the BMI of the pensioner in the eastern region of Ghana correctly with a p-value of less than 0.0001. Table 11 displays the result of the analysis indicating the regression coefficients and the corresponding 95% confidence interval, p-values and the intercept of the model.

Table 11: Univariate multivariable linear regression analysis of independent predictors of Body Mass Index P-value <0.0001, intercept 23.0 Kg/m²

Variable	Regression coefficient	95% CI*	P-value
Age (years)	-0.12	-0,19 to -0.04	<0.005

Mean Arterial pressure (mmHg)	0.07	0.04 to 0.09	<0.001
Total cholesterol (mmol/L)	0.17	-0.13 to 0.48	<0.5
Sex (male=0, female=1)	4.4	3.4 to 5.3	<0.001

95% CI*: 95% confidence interval

DISCUSSION

This study found contrary to the proportion of elderly the country Ghana that there were more male pensioners than that of females. In the 2010 population and housing report on the elderly in Ghana (10), it was found out that the female elderly population was 56% as oppose to 44% of males which was attributed to higher life expectancy of females than males. However in this study, males constituted 68.3% while females constituted 31.7% of pensioners. This could be explained that, majority of females work in the informal sector of the country and are not members of the national pensioners association. Hence the low proportion of females surveyed in this study. Also with regard to the background of the study, majority of all respondents were Christians with 96.7% of the study population being Christians. This unusually high level of Christian can be explained due to the fact that the study area is in the predominantly Christian southern part of Ghana.

BMI was higher in the females compared to that of the males across most of the variables studied. Females had higher mean and range of BMI compared to that of the male counterparts. Studies have shown that females have higher body fat compared to that of males. It seems that this relationship extends into old age. The prevalence of obesity among the elderly was 14.2% among the pensioners in the eastern region of Ghana. This was relatively higher compared to that obtained ten years ago in a national survey that gave the prevalence of obesity across all age groups to be 5.5% (9). This could be explained as increasing prevalence of obesity over the years due to possible adoption of western unhealthy lifestyles. Other reasons could be due to advances in socio-economic status of the Ghanaians, which promote unhealthy lifestyles.

Hypertensive patients were more obese compared to non-hypertensive with the prevalence of Obesity among the hypertensive group calculated as 18.8% compared with 9.6% in the non-hypertensive groups. Likewise Obesity was twice as high among the diabetic compared to non-diabetics. Obesity is a known risk factor for hypertension and diabetes. This has been widely studied and it is therefore not surprising to find it associated with hypertension and obesity in our environment.

Also considering prevalence of obesity by social factors, the professional social class was most obese with as much as 44% of the professionals obese as oppose to the unskilled workers where the prevalence of obesity was about 8%. This could be explained from lifestyle approach and economic factors (11)(3). Firstly, the professional group is more likely to be sedentary compared to the unskilled group who are more likely to be involved in manual work, which on its own is a form of exercise. Also the professional group is more likely to be financially dependent such that they could afford the luxuries of life that further promote sedentary lifestyle (12).

With regards to factors associated with obesity and overweight, the study found out that age has an inverse relationship with BMI. The older one grows the lower the BMI. This is due to reduction in the body fat that increases with age. Other factors like chronic medical disease, poor feeding habits and difficult economic reality associated with pension life could also account for the decreasing prevalence of obesity or overweight among the pensioners. One could also argue that obesity and overweight are associated with high morbidity (13, 14) and mortality and as such the obese individuals were more likely to have died leaving low prevalence of obesity across the age groups. Some studies found excess death associated with obesity and overweight in the elderly population (15).

Certain factors were found in this study to weakly correlate with BMI; Age, serum cholesterol level and mean arterial blood pressure. It indicates that each of the factors alone cannot accurately predict Body Mass Index. Hence a model with these factors put together can predict the body mass index in old age, giving an indication of how you would look like in old age. Increasing age is non modifiable, likewise sex. However steps taken to reduce the mean arterial blood pressure and total cholesterol could help reduce the BMI. The model included both participants taking medication to reduce blood pressure, which directly affects mean arterial pressure. It also took no account of the role of taking statins and other medications that reduce total cholesterol level. It is therefore suggested that further studies could take account of the potential variation in results that could arise due to this confounders.

CONCLUSION

In conclusion, the prevalence of obesity in Ghana among the elderly had increased within the past 10 years to 14.2%. Females were more likely to be obese in old age compared to males. BMI reduces with increasing age. Some other factors like total serum cholesterol, triglyceride level, low-density lipoprotein and mean arterial blood pressure are significantly associated with obesity and overweight in old age. Medical disease conditions like hypertension, diabetes and problems with vision warranting medicated glasses are associated with obesity and overweight in the pensioners' population in the eastern region of Ghana. Asthma, arthritis, chronic bodily pains and exercise in the elderly were not found to significantly affect body mass index.

RECOMMENDATION

The study recommends steps to reduce BMI in young adult life, as increasing BMI is associated with chronic medical diseases and reduce quality of life. Weight loss strategies should be commenced while in active service because exercise in the elderly does not significantly reduce the risk of overweight and obesity.

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