Title: Dynapenic abdominal obesity increases mortality risk among English and Brazilian older adults: a 10-year follow-up of the ELSA and SABE studies

Authors: Tiago da Silva Alexandre[1,2], Shaun Scholes[1], Jair Licio Ferreira Santos[3], Yeda Aparecida de Oliveira Duarte[4], Cesar de Oliveira[1]

Affiliations:

[1] Department of Epidemiology and Public Health, University College London, London, United Kingdom

[2] Department of Gerontology, Federal University of Sao Carlos, Sao Carlos, Brazil

[3] Department of Social Medicine, University of Sao Paulo, Ribeirao Preto, Brazil

[4] Department of Medical-Surgical Nursing, University of Sao Paulo, Sao Paulo, Brazil

Corresponding author: Tiago da Silva Alexandre, Department of Epidemiology and Public Health, 1-19 Torrington Place, London - UK, Zip code: WC1E 6BT, Telephone: +44 207 679 8251, E-mail: tsfisioalex@gmail.com

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Short running head

Dynapenic obesity and mortality risk

ABSTRACT

Background/Objective: There is little epidemiological evidence demonstrating that dynapenic abdominal obesity has higher mortality risk than dynapenia and abdominal obese alone. Our main aim was to investigate whether dynapenia combined with abdominal obesity increases mortality risk among English and Brazilian older adults over ten-year follow-up. **Design:** Cohort study. **Setting:** United Kingdom and Brazil**. Participants:** Data came from 4,683 individuals from the English Longitudinal Study of Ageing (ELSA) and 1,490 from the Brazilian Health, Well-being and Aging study (SABE), hence the final sample of this study was 6,173 older adults. **Measurements:** The study population was categorized in non-dynapenic/non-abdominal obese, abdominal obese, dynapenic and dynapenic abdominal obese according to their handgrip strength (< 26 kg for men and < 16 kg for women) and waist circumference (> 102 cm for men and > 88 cm for women). The outcome was all-cause mortality over a ten-year follow-up. Adjusted hazard ratios by sociodemographic, behavioural and clinical characteristics were estimated using Cox proportional hazards models. **Results:** The fully adjusted models showed that dynapenic abdominal obesity has a higher mortality risk among the groups. The hazard ratios (HR) were 1.37 for dynapenic abdominal obesity (95% CI = 1.12 - 1.68), 1.15 for abdominal obesity (95% CI = 0.98 - 1.35), and 1.23 for dynapenia (95% CI = 1.04 - 1.45). **Conclusions:** Dynapenia is an important risk factor for mortality but dynapenic abdominal obesity has the highest mortality risk among English and Brazilian older adults.

Key words: Dynapenia, handgrip, waist circumference, obesity, mortality

INTRODUCTION

The prevalence and incidence of obesity have been increasing in both developed and developing countries (1). According to data from the English Longitudinal Study of Ageing (ELSA) and the Brazilian Health, Well-being and Aging study (SABE-Brazil), the prevalence of obesity using the WHO cut-off points (BMI > 30 kg/m^2) is 27.5% and 23.6% respectively (2,3). In older adults excessive body fat, especially if this accumulation is featured as abdominal obesity, is associated with a higher prevalence of cardiovascular and metabolic disease, cancer, and numerous other medical conditions (4).

In addition to obesity, another important aspect of the body composition that changes with aging is the concomitant sarcopenia and its relationship with reduced muscle strength defined as dynapenia (5,6). Various studies showed that dynapenia is mediated by physiological neuromuscular adaptations and is influenced by increases in body fat with consequent infiltration of intramuscular fat, not resulting only from sarcopenia (7,8,9,10,11,12).

Obesity and dynapenia have been independently associated with increased functional limitations, disability and all-cause mortality (4,8,11,12). The only two recent studies examining the risk of obesity associated with dynapenia on mortality showed conflicting findings. Stenholm et al. (13), using data from 3,594 community dwelling Finnish adults aged 50 years and older, over a 33-year follow-up, found higher mortality risk among obese participants independently of dynapenia: lower handgrip tertile (HR = 1.16, 95%CI 1.03 - 1.31), medium handgrip tertile (HR = 1.19, 95%CI 1.01 - 1.41) and higher handgrip tertile (HR = 1.23, 95%CI 1.04 - 1.46). However, Rossi et al. (14) using data from 93 men and 169 women aged between 66 and 78 years from eleven Italian general practitioners over a 10-year follow-up found that dynapenic/abdominal obese individuals had higher mortality risk than non-dynapenic non-abdominal obese (HR = 2.46. 95%CI 1.34 - 4.52).

Therefore, our main aim was to investigate whether dynapenia combined with abdominal obesity, measured by handgrip strength and waist circumference, would increase mortality risk among English and Brazilian older adults over a ten-year follow-up.

METHODS

Study Design and Population

Data came from the English Longitudinal Study of Ageing (ELSA) and from the Brazilian Health, Well-being and Aging Study (SABE). ELSA is an ongoing prospective observational study of community-dwelling people aged 50 years and over in England that commenced in 2002. The ELSA sample was drawn from participants that had previously participated in the Health Survey for England (HSE); an annual health examination survey, which each year recruits a different nationally representative sample using a multi-staged stratified random probability design (15,16). After baseline, follow-up interviews within ELSA occur every two years and health examinations i.e. a nurse visit, every four years. The first health examination was in 2004. SABE is a panel study that began in 2000, which was a multicenter survey carried out in the main urban centers of seven countries in Latin America and the Caribbean. In Brazil, a probabilistic sample representative of the urban population aged 60 years or more was used, totaling 2,143 residents of the city of Sao Paulo. At baseline, the evaluation involved an at-home interview, anthropometric measures and physical performance tests. After baseline, follow-up interviews within SABE occur every five years (17). Detailed description of study design and sampling of both cohorts has been published previously (16,18).

In each cohort, we included participants who were aged 60 years or older in 2004 for ELSA and 2000 for SABE. In ELSA, of 6,623 participants interviewed in 2004, 1,940 were excluded. In SABE, of 2,143 participants interviewed in 2000, 653 were excluded. These exclusions were due to missing data for handgrip strength, waist circumference or other covariates, resulting in

a final analytical sample of 4,683 individuals for ELSA and 1,490 individuals for SABE, hence the final sample of this study was 6,173 older adults. These measurements were not taken in participants who were unable to remain in standing position or incapable to perform the handgrip test. In order to combine ELSA and SABE datasets, we included in our analyses only those variables either measured in a similar way or those whose cut-off points were comparable.

Ethics Approval and Informed Consent

All ELSA and SABE participants gave written informed consent. The National Research Ethics Service (London Multicenter Research Ethics Committee (MREC/01/2/91) has approved the English Longitudinal Study of Ageing. The Brazilian Human Research Ethics Committee has approved Health, Well-being and Aging Study (MS/315/99).

Anthropometric measurements and classification of the groups

A trained evaluator carried out the waist circumference measure with a flexible tape placed at the midpoint between the last rib and the iliac crest. The participants remained upright with the arms alongside the body and without the upper portion of their clothes and were instructed to relax the abdomen and the measure was taken at the end of the expiratory phase of a breathing cycle. Abdominal obesity was defined by a waist circumference > 102 cm for men and > 88 cm for women (19).

Muscle strength was assessed by using a hand-held dynamometer (Takei Kiki Kogyio TK 1201 in SABE and Smedley in ELSA). During the test, the participant rested in a sitting position, with elbow resting on the table with forearm and palm facing up; the participant was then prompted to grip with as much strength as possible. Grip size was adjustable so that each participant felt comfortable while squeezing the grip (20). Three maximum strength tests were performed in ELSA and two in SABE with a one-minute rest between tests and the highest

value was used. Dynapenia was defined based on two cut-off points for grip strength: < 26 kg for men and < 16 kg for women (21).

Dynapenic abdominal obesity was defined as the presence both dynapenia and abdominal obesity and participants were then classified into four groups: non dynapenic/non-abdominal obese; abdominal obese only; dynapenic only; and dynapenic abdominal obese.

Covariates

Sociodemographic characteristics included were age, sex, marital status, income and educational level. Marital status was classified as married (married individuals or those in a stable relationship) and not married (divorced, separated or widowed individuals). Quintiles of total monthly income in US dollars were used in both cohorts. Level of educational was categorized as follows: 0-11 years of schooling, 12-13 years of schooling, and >13 years of schooling.

Health behaviors characteristics included were smoking status, alcohol intake and physical activity level. Smoking status was assessed by asking participants whether they were a non-smoker, former smoker or current smoker. Alcohol intake was classified as non-drinkers or drank rarely (even once a week), frequently (2-6 times a week) or daily in both studies. Sedentary lifestyle was defined as a physical activity level less than three times a week over the previous 12 months in SABE and less than once a week in ELSA.

Systemic arterial hypertension, diabetes, cancer, lung disease, heart disease, stroke and falls were the health conditions recorded based on self-reports. Depression was defined by the Center for Epidemiologic Studies Depression Scale score ≥ 4 in ELSA and by 15-item Geriatric Depression Scale score ≥ 5 in SABE.

Body mass index (BMI) was calculated by dividing weight in kilograms by height in meters squared (kg/m^2). The World Health Organization classification was used: underweight (BMI < 18.5 kg/m^2), normal weight (BMI ≥ 18.5 kg/m^2 and < 25kg/m^2), overweight (BMI ≥ 25 kg/m^2 and < 30kg/m^2) and obesity (BMI ≥ 30kg/m^2) (22).

Disability was assessed with a modified version of the Katz Activity of Daily Living (ADL) scale (23) and the Lawton Instrumental Activities of Daily Living (IADL) scale (24). Disability in ADLs and IALDs were analyzed as continuous variable.

Mortality

For England, death registrations up to February 2013 were obtained from the Office for National Statistics for all consenting participants and up to November 2011 from state and municipal records in Brazil.

Statistical Analyses

Descriptive data were expressed as means, standard deviations and proportions. Differences in baseline characteristics between included and excluded individuals and between the four analytical groups were assessed using the chi square test, t test and analysis of variance and post hoc Tukey test. For all analyses, $p < 0.05$ was used to indicate statistical significance.

We examined all deaths occurred during the 10-year follow-up and analyzed survival curves according the Kaplan-Meier method to explore the association of abdominal obesity, dynapenia and dynapenic abdominal obesity with survival. Differences between curves were evaluated using log-rank test. The assumption of proportional hazards was verified graphically by means of a log-log plot of the response variable.

Unadjusted and adjusted hazard ratios (HR) and 95% confidence intervals (CI) for mortality risk with abdominal obesity, dynapenia, and dynapenic abdominal obesity were calculated using Cox proportional hazard models. Model 1 is the unadjusted model. Model 2 was adjusted for all socioeconomic and behavioral characteristics, clinical conditions, disability and BMI. BMI was included because a recent meta-analysis showed that waist circumference provides different information from BMI and, therefore, they should be used together to assess obesity related mortality in adults (25).

A variable called cohort study was created and included in the models to allow us to investigate potential differences in mortality risk between the two cohort studies (0 = ELSA; 1 = SABE). A potential interaction between the variables measuring obesity and dynapenia status and cohort study was tested and it was not statistically significant ($p<0.05$) and, therefore, not retained. In addition, a possible collinearity between abdominal obesity and BMI was estimated using the variance inflation factor (VIF) test after the final model.

Six sensitivity analyses were performed. First, including only individuals aged 70 years and over since there are doubts whether the relationship between obesity and mortality remains even at older ages (26) and some authors argue that this relationship is reduced because individuals susceptible to overweight have died early and the elderly group with overweight and obesity are regarded as resistant survivors (27,28,29). Second, excluding individuals with heart disease, third, excluding individuals with heart disease and considering only deaths after the first five years of follow-up, given that cardiovascular mortality is the leading cause of mortality in the elderly and its relationship with obesity (30). Fourth, including only non-smokers due to the relationship between sarcopenia, dynapenia and smoking and the fact that smokers have an elevated mortality compared with non-smokers (31,32). Fifth, excluding individuals with heart disease, smokers and considering only deaths after the first five years of follow-up. Sixth, using

BMI categories instead abdominal obesity/dynapenia status in order to investigate whether BMI is better than dynapenic abdominal obesity to identify mortality risk.

All analyses were performed using STATA 14.0 (Stata Corp LLP, College Station, TX).

RESULTS

Of the 6,173 participants at baseline, 1,544 died (950 in ELSA and 594 in SABE) in a mean follow-up period of 8.3 years. Pooled data baseline characteristics and according each cohort are shown in Tables 1 and 2. Baseline characteristics according abdominal obesity and dynapenia status are shown in Supplemental Table 1.

The excluded participants were older and reported more ADL and IADL disability, more arterial hypertension, diabetes, heart disease, stroke, falls, depressive symptoms and sedentary lifestyle. They also had no partner, lower education, lower income, worse handgrip strength and lower BMI ($p < 0.05$ data not shown).

The prevalence of dynapenic abdominal obesity was 7.2%. Dynapenia was found in 7.5% of the sample. Forty five percent had abdominal obesity and 40.4% were non-dynapenic/non-abdominal obese (Table 2).

In the unadjusted models, dynapenic individuals showed higher mortality risk than those who were non-dynapenic non-abdominal obese. In the fully adjusted models, dynapenia remained associated with mortality, however, dynapenic abdominal obese individuals had a higher mortality risk than non-dynapenic non-abdominal obese (Table 3).

Underweight older adults, according to BMI, had high mortality risk in the unadjusted and fully adjusted models. However, those individuals classified as overweight and obese had lower mortality risk with or without dynapenic obesity in the models (Tables 3 and 4). We tested the potential collinearity between abdominal obesity and BMI using the variance inflation factor (VIF) test. The VIF value was 3.73 for abdominal obesity and 1.07 for BMI. The VIF values were lower than 5.3 and, therefore, the possibility of collinearity (33) was excluded. This also confirms that our findings showed an independent association between abdominal obesity, BMI and mortality risk.

The combination of dynapenia and abdominal obesity on 10-year survival was also tested comparing Kaplan-Meier survival curves for mortality. Survival curves differed significantly at the log-rank test ($p < 0.001$) (Figure 1).

All sensitivity analyses showed a higher mortality risk for those individuals with dynapenic obesity compared to the other groups. Dynapenia alone showed a high mortality risk only when participants with cardiovascular disease were excluded from the models (Table 4).

DISCUSSION

Our main findings showed that dynapenic/abdominal obese older adults have the highest mortality risk. In addition, dynapenia was associated with mortality risk in English and Brazilian older adults.

Few studies have investigated dynapenic abdominal obesity as a risk factor for mortality. Rossi et al. (14) found that dynapenic abdominal obesity was associated with mortality at 10-year follow up. Our HR of dynapenic abdominal obesity on mortality is lower than the one reported by Rossi et al. Perhaps their decision to exclude individuals unable to walk at least half a mile,

renal failure, disabling knee osteoarthritis, heart failure, cancer and serious lung disease as well as some important risk factors for mortality, may have resulted in them finding a larger HR than ours. Furthermore, the HR for dynapenia and abdominal obesity were not reported by that study preventing us to compare our results.

In another recent study, Stenholm et al. (13) analyzing 3,594 individuals aged 50 to 91 years in 33 years of follow-up, using BMI, found that obesity (BMI $\geq$ 30) is a risk factor for mortality only in the 50-69 age group. However, in older adults aged 70 years and over both overweight and obesity were protective factors. These authors showed that the higher tertile of handgrip is a protective factor for mortality only in individuals older than 70 years. Finally, they found that the risk of mortality in obese individuals aged 50-69 years is independent of handgrip. Their models were adjusted by sex, education, smoking, alcohol use, physical activity, hypertension, cardiovascular disease, diabetes, and cancer. Using waist circumference, a surrogate for regional distribution and related to visceral and total fat, we found contrasting conclusions from Stenholm et al. (13). Our findings showed that dynapenia is an important mortality risk factor, however, dynapenic obese older adults have a higher mortality risk which was independent of age, BMI and other important risk factors.

The inclusion of BMI categories in the final model together with the findings from our sixth sensitivity analysis (Table 4) highlight the clinical importance of including abdominal obesity and dynapenia in the assessment of mortality risk among older adults. Using BMI on its own could be misleading. For example, overweight and obese older adults could have a lower mortality risk according to BMI but if dynapenic obesity is also considered such risk could be higher.

Recent evidence supports the premise that central fat and relative loss of fat-free mass may become more important than BMI in determining health risks associated with obesity in later life (24). Analyzing obese women Zamboni et al. (34) observed an age-dependent increase in visceral abdominal fat, and decrease in subcutaneous abdominal fat despite no significant BMI changes. Sahakyan et al. (35) analyzing individuals between 18 - 90 years from the Third National Health and Nutrition Examination Survey found that persons with normal-weight central obesity (measured by waist-to-hip ratio) had worst long-term survival. Men and women with a normal BMI and central obesity had greater total mortality risk than one with similar BMI but no central obesity. Men with normal-weight central obesity had twice the mortality risk than those overweight or obese only, while women had 32% more risk than those who were obese only. Therefore, waist circumference has been proposed as a surrogate measurement for regional fat distribution, because it is easy to measure and is strongly associated with both visceral and total fat assessed by computerized tomography and mortality and can be used alone or together with BMI to define obesity in the elderly (36,37).

The higher risk of mortality in dynapenic abdominal obese individuals has several explanations. Central obesity is associated with visceral fat accumulation and an adverse metabolic profile (38,39). Excessive visceral fat is associated with insulin resistance, hypertriglyceridemia, dyslipidemia and inflammation (40,41). The same way, older people with dynapenia have increased risk of metabolic diseases such as lipid disorders, metabolic syndrome or type 2 diabetes (42,43). Data from the US showed that dynapenic abdominal obesity individuals had more low HDL-cholesterol, hypertriglyceridemia, and metabolic syndrome than non-dynapenic/non abdominal obese and dynapenic only groups (44) reinforcing that some risk factors for mortality are more heavily present in these individuals which increasing the risk of mortality.

Our study has several strengths and potential limitations that need to be considered. First, the study was conducted on two large samples of community-dwelling older adults from a developed and developing country. Second, we used survival analysis in a large group of confounding variables associated with mortality. Third, sensitivity analyses allowed us to show some results considering two methodological approaches: exclude confounding factors or model them in a single analysis. Limitations arise from the use of self-reported data on chronic diseases. However, while this may be a source of bias, epidemiological studies have demonstrated that self-reported data offer good validity and are consistent with medical diagnoses and/or the results of physical tests (45). Another limitation could be due to the lack of information, in both cohorts, about age of onset of obesity, history of obesity and number of years of being overweight. Lastly, differences between excluded and included individuals could potentially be a source of bias. However, despite the fact that excluded individuals were weaker we still found an association between dynapenia and mortality indicating that this association was probably underestimated. Furthermore, it is important to mention that there was no difference between gender and waist circumference among those excluded and included in our analyses. Thus, the lack of association found between abdominal obesity and mortality could not be explained by this type of bias.

CONSLUSION

Dynapenia is an important risk factor for mortality but dynapenic abdominal obese older adults have a higher risk of death. Our findings also highlight the clinical importance of including abdominal obesity and dynapenia in the assessment of mortality risk among older adults confirming previous research showing that using BMI on its own could be misleading. For example, overweight and obese older adults could have a lower mortality risk according to BMI but if dynapenic obesity is also considered such risk could be higher. Therefore, since abdominal obesity and dynapenia are modifiable and can reflect a question of lifestyle, the

present results indicate potential paths for preventing or delaying preventable deaths in older adults. Future research should investigate the effect of dynapenic abdominal obesity on other outcomes such as disability trajectories of both basic and instrumental activities of daily living in older adults.

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Conflict of interest

The authors declare that they have no conflict of interest.

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Ethical Standards

All ELSA and SABE participants gave written informed consent. The National Research Ethics Service (London Multicenter Research Ethics Committee (MREC/01/2/91) has approved the English Longitudinal Study of Ageing. The Brazilian Human Research Ethics Committee has approved Health, Well-being and Aging Study (MS/315/99).

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Table 1. Baseline sociodemographic and behavioural characteristics of 6,173 older adults from the ELSA (4,683) and SABE (1,490) Studies.

	Pooled data n = 6,173	ELSA n = 4,683	SABE n = 1,490
Age, years	71.1 ± 7.8	70.8 ± 7.8	72.1 ± 7.7
Sex (female), (%)	56.0	54.9	59.6
Marital status (married), (%)	61.9	64.2	54.8
Income, (%)			
1st quintile (highest quintile)	21.5	21.6	20.9
2nd quintile	21.1	21.2	21.1
3th quintile	20.5	20.4	20.6
4th quintile	18.5	18.7	18.1
5th quintile (lowest quintile)	18.4	18.1	19.3
Schooling, (%)			
0 – 11 years	66.7	57.3	96.2
12 -13 years	16.0	20.9	0.7
> 13 years	17.3	21.8	3.1
Smoking, (%)			
Never smoked	40.9	36.6	54.4
Ex-smoker	46.5	51.3	31.4
Current smoker	12.6	12.1	14.2
Alcohol intake, (%)			
Non-drinkers or drank rarely	49.2	36.8	88.2
Drank frequently	29.5	36.9	6.2
Drank daily	13.7	16.3	5.6
Did not answer	7.6	10.0	-
Sedentary lifestyle, (%)	21.9	5.3	74.2

Data are presented as proportions, means and standard deviation.

Table 2. Baseline clinical characteristics of 6,173 older adults from the ELSA (4,683) and SABE (1,490) Studies.

	Pooled data n = 6,173	ELSA n = 4,683	SABE n = 1,490
Arterial hypertension (yes), (%)	27.8	19.8	52.8
Diabetes (yes), (%)	7.3	4.3	16.9
Cancer (yes), (%)	3.8	3.8	3.8
Lung disease (yes), (%)	13.7	14.7	10.5
Heart disease (yes), (%)	12.7	10.8	18.7
Stroke (yes), (%)	2.6	1.7	5.2
Falls (yes), (%)	30.8	31.1	29.9
Depressive symptoms (yes), (%)	15.1	14.1	18.3
Non-dynapenic/Non-abdominal obese, (%)	40.4	41.9	35.6
Abdominal obese, (%)	44.9	45.8	42.4
Dynapenic, (%)	7.5	6.2	11.5
Dynapenic/Abdominal obese, (%)	7.2	6.1	10.5
Handgrip strength, kg	28.0 ± 10.6	29.1 ± 10.9	24.6 ±8.8
Waist circumference, cm	95.4 ± 12.7	95.6 ± 12.7	94.7 ± 12.7
Body Mass Index, (%)			
Normal weight	29.4	27.3	35.9
Underweight	1.5	0.9	3.3
Overweight	42.7	43.8	39.3
Obese	26.4	28.0	21.5
Number of ADL disability	0.3 ± 0.8	0.3 ± 0.8	0.4 ± 0.7
Number of IADL disability	0.4 ± 1.0	0.4 ± 0.9	0.7 ± 1.3

Data are presented as proportions, means and standard deviation. ADL – Activities of Daily Living; IADL – Instrumental Activities of Daily Living.

Table 3. Cox Proportional Hazard Models predicting mortality during 10-years follow-up among 6,173 older adults from ELSA and SABE Studies.

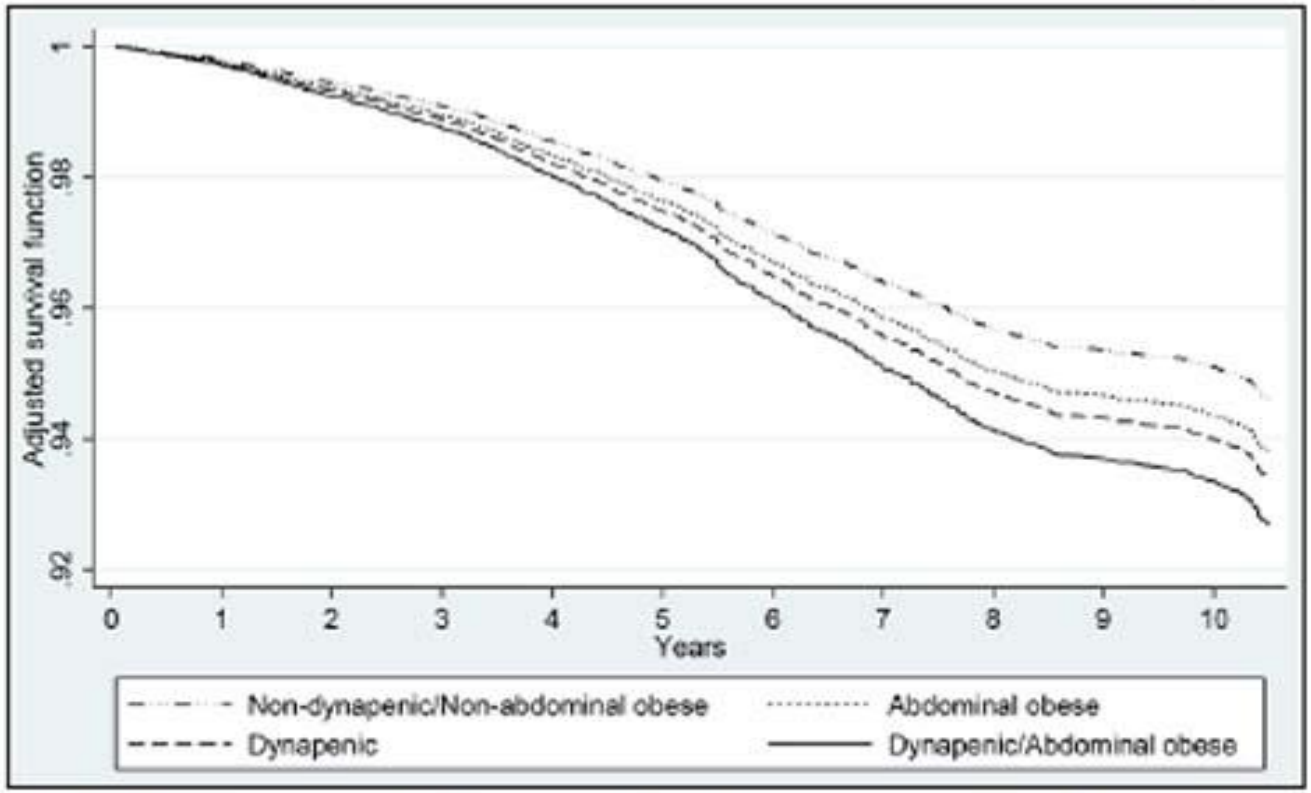
	Model 1 Unadjusted HR (95%CI)	**Model 2 Adjusted HR (95%CI)**
Non-dynapenic/Non-abdominal obese	1.00	1.00
Abdominal obese	0.98 (0.88 – 1.11)	1.15 (0.98 – 1.35)
Dynapenic	2.67 (2.28 – 3.12)	1.23 (1.04 – 1.45)
Dynapenic/Abdominal obese	1.97 (1.66 – 2.33)	1.37 (1.12 – 1.68)
Normal Weight	1.00	1.00
Underweight	2.66 (2.03 – 3.50)	1.38 (1.04 – 1.83)
Overweight	0.71 (0.63 – 0.79)	0.75 (0.65 – 0.86)
Obese	0.67 (0.59 – 0.77)	0.72 (0.60 – 0.87)

HR-Hazard Ratio. CI–Confidence Interval. **Model 2** – Adjusted for all sociodemographic and behavioral characteristics, clinical conditions, disability and body mass index

Table 4. Cox Proportional Hazard Models predicting mortality during 10-years follow-up – Sensitivity Analysis.

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
	HR (95%CI)	**HR (95%CI)**	**HR (95%CI)**	**HR (95%CI)**	**HR (95% CI)**	**HR (95% CI)**
ELSA Study	**n = 1,146**	**n = 5,388**	**4,777**	**n = 2,525**	**n = 2,037**	**n = 6,173**
ND/NAO	1.00	1.00	1.00	1.00	1,00	-
AO	1.04 (0.80 – 1.35)	1.13 (0.95 – 1.34)	1.17 (0.92 – 1.49)	1.31 (1.01 – 1.71)	1.24 (0.84 – 1.82)	-
D	1.10 (0.89 – 1.36)	1.24 (1.03 – 1.49)	1.16 (0.88 – 1.54)	1.34 (0.99 – 1.80)	1.29 (0.82 – 2.04)	-
D/AO	1.33 (1.01 – 1.75)	1.42 (1.13 – 1.79)	1.50 (1.09 – 2.06)	1.70 (1.23 – 2.36)	1.74 (1.06 – 2.84)	-
Normal Weight	1.00	1.00	1.00	1.00	1.00	1.00
Underweight	1.48 (1.02 – 2.14)	1.34 (0.95 – 1.88)	1.46 (0.86 – 2.47)	2.14 (1.31 – 3.50)	1.88 (0.80 – 4.43)	1.38 (1.04 – 1.82)
Overweight	0.77 (0.62 – 0.95)	0.75 (0.64 – 0.88)	0.82 (0.66 – 1.03)	0.90 (0.71 – 1.15)	1.09 (0.76 – 1.56)	0.79 (0.70 – 0.89)
Obese	0.68 (0.50 – 0.90)	0.74 (0.60 – 0.91)	0.85 (0.64 – 1.13)	0.80 (0.59 – 1.09)	0.92 (0.58 – 1.47)	0.79 (0.69 – 0.91)

HR – Hazard Ratio. CI – Confidence Interval. ND/NAO – Non-dynapenic/Non-abdominal obese. AO – Abdominal Obese. D – Dynapenic. D/AO – Dynapenic/Abdominal Obese. **Model 1** – Analysis only with individuals aged 70 years and over. **Model 2** – Analysis excluding individuals with heart disease. **Model 3** – Analysis excluding individuals with heart disease and death in the first 5-years of the study. **Model 4** – Analysis only with who never smoked. **Model 5 –** Analysis excluding individuals with heart disease, smokers and death in the first 5-years of the study. **Model 6** – Analysis excluding abdominal obesity and dynapenia status. All models were adjusted by all sociodemographic and behavioural characteristics, clinical conditions, disability and body mass index.



The baseline values were as follows: age 60 - 69, women, married, in highest quintile of income, schooling > 13 years, non-drinkers or drank rarely, non-smokers, no sedentary lifestyle, no hypertension, no diabetes, no cancer, no lung disease, no heart disease, no stroke, no falls, no ADL disability, no IADL disability, no depressive symptoms, normal weight and ELSA study participant.