

Body composition and heart failure subtypes in the UK Biobank: a prospective study of 500,000 adults

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Background: Obesity has been associated with increased heart failure (HF) risk. However, the shape and strength of associations between different adiposity measures and HF subtypes remain unclear.

Purpose: This study investigated associations between various adiposity measures and incidence of different HF subtypes.

Methods: In 2006-2010, 502,599 adults (age 40-70 years) were recruited from UK general population. Resurvey on a subset of 20,346 participants was conducted in 2012-13. Participants were followed up by linkage to electronic health records. Analyses exclude participants with major cardiac and vascular diseases at baseline. Regression dilution ratios (RDR) of the different adiposity measures were calculated using Pearson's correlation method to obtain usual levels of each adiposity measure. Association between usual levels of adiposity measures (body mass index [BMI], waist circumference [WC] and waist-hip ratio [WHR]) and incident HF subtypes were determined using Cox proportional hazards regression models. Hazard ratios (HRs) are presented as per equivalent 5 usual BMI units higher adiposity measure.

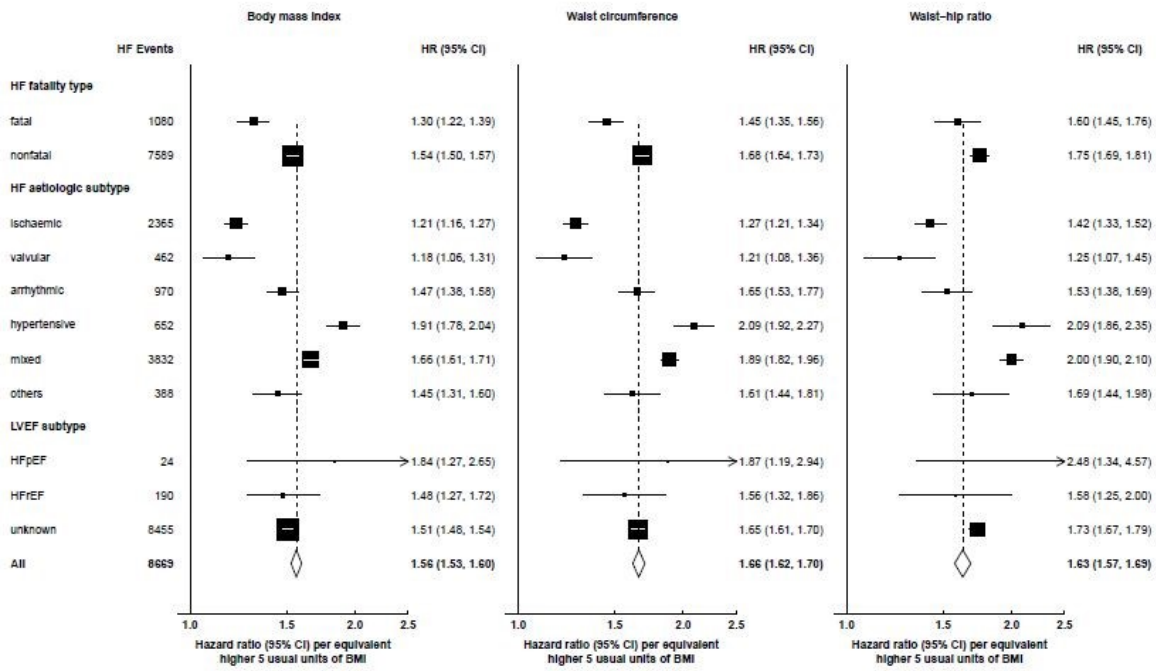
Results: After exclusions, 428,087 individuals (mean age 55.9 years, 56% women) remained. Over a median follow-up of 12.8 years, there were 8,669 first-ever incident HF events (5205 in men and 3464 in women). Increasing usual levels of adiposity measures were positively and log-linearly associated with increased risk of HF. Associations were notably stronger for central adiposity, e.g. WC (HR per usual 12.2 units 1.66, 95% CI 1.62-1.70) compared with BMI (HR per usual 5 units 1.56, 95% CI 1.53-1.60). Compared to individuals within the lowest quintile of each adiposity measure, Individuals within the highest quintile of BMI had an adjusted HR (aHR) of 2.65 (95% CI, 2.54-2.75), those within highest quintile of WC had aHR of 3.21 (95% CI, 3.07-3.36) while those within highest quintile of WHR had aHR of 3.34 (95% CI, 3.16-3.53). Among HF aetiologic subtypes, hypertensive HF (HR per usual 12.2 WC units 2.09, 95% CI 1.92-2.27; HR per usual 5 BMI units 1.91, 95% CI 1.78-2.04) and mixed aetiology HF (HR per usual 12.2 WC units 1.89, 95% CI 1.82-1.96; HR per usual 5 BMI units 1.66, 95% CI 1.61-1.71) showed stronger association with adiposity while ischaemic HF (HR per usual 12.2 WC units 1.27, 95% CI 1.21-1.34; HR per usual 5 BMI units 1.21, 95% CI 1.16-1.27) and valvular HF (HR per usual 12.2 WC units 1.21, 95% CI 1.08-1.36; HR per usual 5 BMI units 1.18, 95% CI 1.06-1.31) showed weaker association with adiposity. HF with preserved ejection fraction (HFpEF) showed stronger association with adiposity than HF with reduced ejection fraction (HFrEF) while non-fatal HF showed stronger association with adiposity than fatal HF.

Conclusions: Adiposity measures especially central adiposity showed stronger association with hypertensive HF and mixed aetiology HF than ischaemic and valvular HF; and are strongly associated with HFpEF than HFrEF.

Table 1: Selected demographic and lifestyle characteristics, and adiposity measures at baseline

Characteristics	Mean (SD) or percent		
	Women (n=239775)	Men (n=188312)	All (n=428087)
Demographics and lifestyle			
Age, years	55.9 (7.9)	55.9 (8.2)	55.9 (8.0)
England	88.7	88.9	88.9
University educated	47.2	49.2	48.1
Most deprived	18.7	19.5	19.1
Regular drinkers	63.8	78.6	70.3
Current smokers	8.7	12.3	10.3
Low physical activity	17.9	16.9	17.4
High sedentary time	11.7	23.1	16.7
Body composition			
BMI, Kg/m ²	26.9 (5.0)	27.7 (4.1)	27.2 (4.7)
WC, cm	84.2 (12.2)	96.4 (10.9)	89.6 (13.1)
WHR	0.81 (0.07)	0.93 (0.06)	0.87 (0.09)

Figure 1: Association of adiposity measures and HF subtypes



Hazard ratios (95% CI) were stratified by age at risk (10-year age groups), sex and UK region (3 groups), and were adjusted for ethnicity (4 groups), education (2 groups), Townsend deprivation index (fifths), smoking (3 groups) and alcohol (4 groups), physical activity (3 groups) and sedentary time (3 groups). HR per usual units=exponent of natural log of HR per baseline unit/RDR. 5 usual BMI units=12.2 usual WC units and 0.07 usual WHR units.