**Supplementary Material**

**Comparison of different measures of obesity in their association with health-related quality of life in older adults – results from the KORA-Age study**

**Running title:** Comparison of obesity measures in the elderly

**Additional Information on Subjects and Methods**

**Study population**

The Cooperative Health Research in the Region of Augsburg (KORA) is a research platform for population-based health research in the city of Augsburg and its two surrounding counties Augsburg and Aichach-Friedberg. As part of the international World Health Organization (WHO) Multinational Monitoring of Trends and Determinants in Cardiovascular Disease (MONICA) Augsburg project (continued as KORA), four independent cross-sectional surveys (participation rate between 79% in survey 1 and 67% in survey 4) were conducted between 1984 and 2001. Together, about 18 000 individuals, which were randomly selected from the population registries of the study region, participated.([1](#_ENREF_1))

Of these, 9197 participants were eligible for the KORA-Age study (aged ≥65 years), but only 5991 participated in the baseline examination in 2009, since 2734 had died, 45 had moved away and 427 refused their participation. A postal questionnaire concerning chronic health conditions and quality of life was sent to these 5991 participants, of which 3833 answered directly and another 732 were convinced to answer the questions by telephone after eight weeks without response. 4127 participants completed an additional telephone interview about morbidity and mental health. Furthermore, an age- and sex-stratified sub-sample of 2005 participants was invited for intensive physical examinations in the study centre in Augsburg, whereof 1079 participants (53.8%) took part. Since 98 participants died and 159 withdrew from the study during the follow-up time, 822 of 1079 participants (76.2%) were examined again in 2012. The investigation program included, amongst others, blood examination, anthropometric and grip strength measurements, gait analysis, BIA as well as a personal examination interview.([2](#_ENREF_2))

**Assessment and classification of variables**

With the participants in light clothing without shoes, weight was measured to the nearest 0.1 kg and height, WC and hip circumference to the nearest 0.1 cm. For BIA measurements, subjects were lying relaxed on their back on a nonconductive surface with arms and legs spread without moving. Four skin electrodes were attached (wrist and dorsum of the dominant hand, ankle and dorsum of the dominant leg) to record resistance [Ω], reactance [Ω] and phase angle [°] as means of at least two measurements with 50 kHz. Considering height in cm, weight in kg and sex (men=1, women=0), fat-free mass was calculated using Kyle’s equation([3](#_ENREF_3),[4](#_ENREF_4)) (verified in 22-94 year old healthy adults with a BMI range of 17.0-33.8 kg/m²):

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| --- | --- |
|  | (1) |

TG levels were determined in non-fasting blood samples obtained usually at the left arm of the sitting participant. The blood was charged into serum gel S-Monovette tubes [Sarstedt, Nümbrecht, Germany]. After two inversions, it was incubated upright for 30 min at room temperature to reach full coagulation. Then, samples were centrifuged for 10 min with 4000 UpM/2560 gmax at 15°C. Finally, serum was filled into Nunc cyrotubes [Thermo Fisher Scientific, Waltham, MA, USA], stored for a maximum of 6 h at 4°C and then freezed at -80°C until TG levels were determined in an enzymatic colorimetric analysis using the GPO-PAP-method. Grip strength of the dominant hand was assessed in standing position. The arm was held at an angle of 90° close to the body. Participants were asked to press with maximal strength for only a few milliseconds. The mean grip strength was calculated from three consecutive measurements with short breaks in between.

Regarding the outcome HRQoL, each of the five topics of the EQ-5D contains three response options (no, moderate, or extreme difficulties), resulting in 243 different health states. For the calculation of the continuous EQ-5D index the scoring algorithm recommended by Greiner et al.([5](#_ENREF_5)) based on the evaluation with time trade-off values by a representative German population sample was used.

Concerning the covariables, education years included both the highest degree in school and vocational training and were classified into three groups, in accordance with the German school system. Self-report of physical activity was assessed with the physical activity scale for the elderly (PASE) in the personal interview and was transformed by means of the “PASE scoring algorithm”. The resulting continuous PASE score, ranging between 0 and 365, includes all subcategories of leisure, work and household activities: “walk outside home”, “light activities”, “moderate activities”, “strenuous activities”, “muscle strength/endurance exercise” and “housework/gardening/caring for another person/work”.([6](#_ENREF_6)) The amount of average daily consumption of alcoholic beverages (beer, wine, and spirits) was estimated by an effective recall-method concerning the last week (workday and weekend).([7](#_ENREF_7)) The presence of various diseases was assessed via standardized telephone interview or postal questionnaire. Hypertension was defined as a blood pressure ≥140/90 mmHg or as the existence of a drug controlled, known hypertension. In contrast to other diseases, diabetes mellitus, heart attack and stroke were assessed by asking participants specifically for a medical diagnosis of the respective disease.

**Statistical analysis**

As the continuous variables were non-normally distributed, medians, 25th and 75th percentiles were calculated. For categorical variables, total and relative frequencies were determined. Differences in characteristics of the study population between the respective categories of sex, HRQoL (no, any restriction) and SRPC (excellent/good, fair/poor) were detected by Mann-Whitney-Wilcoxon-U-test for the non-normally distributed continuous and Pearson’s chi-squared test or Fisher’s exact test for categorical variables. The sample sizes and exclusions of the analyses are shown in Supplemental Fig. 1.

The relationship between the measures of obesity and HRQoL at baseline and change in HRQoL over time was shown to be linear. The supposed inverted U-shaped relationship reported by Hunger et al.([8](#_ENREF_8),[9](#_ENREF_9)) could not be confirmed, presumable due to lack of underweight participants. As assumptions like normal distribution of residuals and homoscedasticity are relatively robust, deviations were not worrisome.([10](#_ENREF_10),[11](#_ENREF_11)) Thus, linear regression models were used:

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|  | (2) |

with y as dependent variable, β0 as intercept, β1-βk as k slopes, x1-xk as k independent variables and ε as error variable.

As an example of all cross-sectional and longitudinal comparisons of the associations between the measures of obesity and HRQoL, the regression equation for categorized BMI was adjusted according to model 1 like this:

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| --- | --- |
|  | (3) |

Entering the results of the cross-sectional analysis resulted in the following equation:

|  |  |
| --- | --- |
|  | (4) |

with dummy coded BMI (BMI ≥30 kg/m²=1 and BMI <30 kg/m²=0), age in years, and dummy coded sex (women=1 and men=0).

This showed the inverse association of BMI ≥30 kg/m², increasing age and female sex with HRQoL at baseline.

The F-test tested for a significant improvement of the model without the measure of obesity after the inclusion of the respective measure. In this example, the F-test provided the F-value=17.22 and a p-value <0.0001. This indicated that the inclusion of BMI improved the model significantly and therefore that a BMI ≥30 kg/m² was significantly associated with worse HRQoL.

To compare the associations of the measures of obesity with regard to the dichotomized outcomes baseline SRPC, its deterioration and its improvement over the 3-year follow-up, a binary logistic regression model was used with the following general equation:

|  |  |
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|  | (5) |

with π as odds, β0 as intercept, β1-βk as k slopes, x1-xk as k independent variables and ε as error variable.

Exemplarily, the regression equation of the cross-sectional analysis of the association between the categorized BMI and baseline SRPC adjusted according to model 1 is shown:

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|  | (6) |
|  | (7) |

with dummy coded BMI (BMI ≥30 kg/m²=1 and BMI <30 kg/m²=0), age in years, and dummy coded sex (women=1 and men=0).

The with the related 95% CI=1.45-2.69 was calculated. A BMI ≥30 kg/m² significantly nearly doubled the odds for fair/poor SRPC as the 95% CI did not include the value 1, which corresponds to no effect.

The AUC of the BMI model was 0.6310 and is shown in Supplemental Fig. 2. As the AUC of the model without BMI was 0.5962, the difference between both was ΔAUC=0.0348, showing an improvement of the model after adding the BMI variable.



HRQoL, health-related quality of life; SRPC, self-rated physical constitution.

**A** cross-sectional analyses; **B** longitudinal analyses.

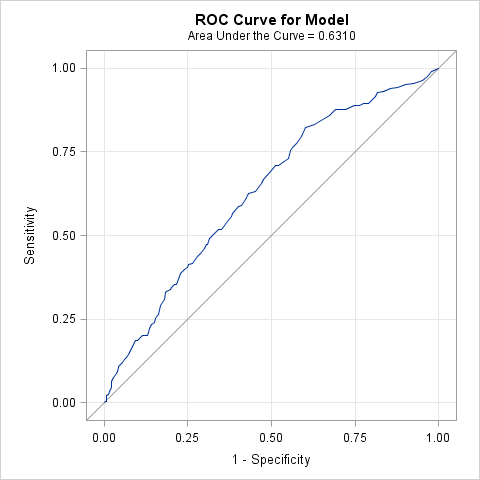
**Model 1:** adjusted for age, sex.

**Model 2:** additionally adjusted for further socio-demographic (marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.

**Model 3:** additionally adjusted for the presence of diseases (hip/femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease).

Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012.

**Supplemental Fig. 1:** Sample sizes and exclusions of the analyses



ROC, receiver operating characteristic; AUC, area under the curve; BMI, body mass index; SRPC, self-rated physical constitution.

Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012.

**Supplemental Fig. 2:** AUC of the cross-sectional association between the categorized BMI and baseline SRPC adjusted according to model 1 (age, sex)

**Sensitivity Analysis with Continuous Versions of the Investigated Measures of Obesity**

For this sensitivity analysis, the measures of obesity, which were combinations of two continuous components, respectively, i.e. HTGW and SO had to be transformed into continuous variables. Therefore, binary logistic regression models were created with the respective dichotomized measure of obesity as dependent variable and its continuous components as independent variables:

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|  | (8) |

and

|  |  |
| --- | --- |
|  | (9) |

with dummy coded HTGW (WC ≥102/88 cm (men/women) and TG ≥1.7 mmol/l = 1, WC <102/88 cm (men/women) and TG <1.7 mmol/l = 0), dummy coded SO (FMp ≥30.41/41.10% (men/women) and handgrip strength <30/20 kg (men/women) = 1, FMp <30.41/41.10% (men/women) and handgrip strength ≥30/20 kg (men/women) = 0) and continuous WC, TG, FMp and handgrip strength.

The continuous variables were calculated by adding the resulting predicted values and their respective Pearson residuals. All measures of obesity were z-transformed to provide comparable β estimates.

The results of the longitudinal analyses with categorized or continuous measures of obesity are shown in Supplemental Tables 1–6.

**Supplemental Table 1:** Comparison of longitudinal associations between the categorized measures of obesity and change in HRQoL

| **Measure of obesity** | **β estimate** | **F-test** | **p-value** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- |
| **Model 1 (N=689)** | | | | | | |
| BMI | -0.026 | 3.20 | 0.07 | 0.0047 | -2395 | -2377 |
| WC | -0.003 | 0.04 | 0.85 | 0.0001 | -2392 | -2374 |
| WHR | -0.008 | 0.36 | 0.55 | 0.0006 | -2392 | -2374 |
| WHtR | -0.014 | 1.03 | 0.31 | 0.0015 | -2393 | -2375 |
| FMp | -0.017 | 1.58 | 0.21 | 0.0023 | -2393 | -2375 |
| HTGW | -0.011 | 0.55 | 0.46 | 0.0009 | -2392 | -2374 |
| SO | -0.004 | 0.04 | 0.84 | 0.0001 | -2392 | -2374 |
| **Model 2 (N=689)** | | | | | | |
| BMI | -0.023 | 2.33 | 0.13 | 0.0242 | -2389 | -2325 |
| WC | 0.0001 | 0.00 | 0.99 | 0.0209 | -2386 | -2323 |
| WHR | -0.009 | 0.41 | 0.52 | 0.0215 | -2387 | -2323 |
| WHtR | -0.009 | 0.43 | 0.51 | 0.0215 | -2387 | -2323 |
| FMp | -0.014 | 1.05 | 0.31 | 0.0224 | -2387 | -2324 |
| HTGW | -0.006 | 0.17 | 0.68 | 0.0211 | -2386 | -2323 |
| SO | 0.001 | 0.00 | 0.96 | 0.0209 | -2386 | -2323 |
| **Model 3 (N=689)** | | | | | | |
| BMI | -0.013 | 0.71 | 0.40 | 0.0416 | -2373 | -2246 |
| WC | 0.007 | 0.24 | 0.62 | 0.0409 | -2372 | -2245 |
| WHR | -0.003 | 0.04 | 0.85 | 0.0406 | -2372 | -2245 |
| WHtR | -0.0004 | 0.00 | 0.98 | 0.0405 | -2372 | -2245 |
| FMp | -0.008 | 0.31 | 0.58 | 0.0410 | -2372 | -2246 |
| HTGW | -0.0005 | 0.00 | 0.98 | 0.0405 | -2372 | -2245 |
| SO | 0.002 | 0.01 | 0.91 | 0.0406 | -2372 | -2245 |
| HRQoL, health-related quality of life; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio; FMp, fat mass percentage; HTGW, hypertriglyceridemic waist; SO, sarcopenic obesity.  Linear regression models: change in HRQoL=HRQoL at follow-up – HRQoL at baseline.  **Model 1:** adjusted for age, sex.  **Model 2:** additionally adjusted for further socio-demographic (marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.  **Model 3:** additionally adjusted for the presence of diseases (hip/femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease).  Results are shown for the obesity categories: BMI ≥30 kg/m², WC ≥102/88 cm (m/f), WHR ≥1/0.85 (m/f), WHtR ≥0.6, FMp ≥30.41/41.10% (m/f), HTGW: WC ≥102/88 cm (m/f) and TG ≥1.7 mmol/l, SO: FMp ≥30.41/41.10% (m/f) and handgrip strength <30/20 kg (m/f).  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | |

**Supplemental Table 2:** Comparison of longitudinal associations between the continuous measures of obesity and change in HRQoL

| **Measure of obesity** | **β estimate** | **F-test** | **p-value** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- |
| **Model 1 (N=689)** | | | | | | |
| BMI | -0.004 | 0.35 | 0.55 | 0.0006 | -2392 | -2374 |
| WC | -0.004 | 0.31 | 0.58 | 0.0005 | -2392 | -2374 |
| WHR | 0.003 | 0.09 | 0.77 | 0.0002 | -2392 | -2374 |
| WHtR | -0.005 | 0.48 | 0.49 | 0.0007 | -2392 | -2374 |
| FMp | -0.008 | 0.56 | 0.45 | 0.0009 | -2392 | -2374 |
| HTGW | -0.004 | 0.37 | 0.54 | 0.0006 | -2392 | -2374 |
| SO | 0.001 | 0.03 | 0.86 | 0.0001 | -2392 | -2374 |
| **Model 2 (N=689)** | | | | | | |
| BMI | -0.001 | 0.04 | 0.84 | 0.0209 | -2386 | -2323 |
| WC | -0.002 | 0.05 | 0.82 | 0.0210 | -2386 | -2323 |
| WHR | 0.004 | 0.18 | 0.67 | 0.0211 | -2386 | -2323 |
| WHtR | -0.002 | 0.11 | 0.74 | 0.0210 | -2386 | -2323 |
| FMp | -0.004 | 0.13 | 0.71 | 0.0211 | -2386 | -2323 |
| HTGW | -0.004 | 0.32 | 0.57 | 0.0213 | -2387 | -2323 |
| SO | 0.003 | 0.17 | 0.68 | 0.0211 | -2386 | -2323 |
| **Model 3 (N=689)** | | | | | | |
| BMI | 0.004 | 0.27 | 0.60 | 0.0409 | -2372 | -2245 |
| WC | 0.003 | 0.17 | 0.68 | 0.0408 | -2372 | -2245 |
| WHR | 0.009 | 0.83 | 0.36 | 0.0417 | -2373 | -2246 |
| WHtR | 0.002 | 0.11 | 0.74 | 0.0407 | -2372 | -2245 |
| FMp | -0.0002 | 0.00 | 0.98 | 0.0405 | -2372 | -2245 |
| HTGW | -0.003 | 0.19 | 0.67 | 0.0408 | -2372 | -2245 |
| SO | 0.003 | 0.17 | 0.68 | 0.0408 | -2372 | -2245 |
| HRQoL, health-related quality of life; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio; FMp, fat mass percentage; HTGW, hypertriglyceridemic waist; SO, sarcopenic obesity.  Linear regression models: change in HRQoL=HRQoL at follow-up – HRQoL at baseline.  **Model 1:** adjusted for age, sex.  **Model 2:** additionally adjusted for further socio-demographic (marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.  **Model 3:** additionally adjusted for the presence of diseases (hip/femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease).  Results are shown for one standard deviation increase in measures of obesity, as they were z-standardized for direct comparability.  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | |

**Supplemental Table 3:** Comparison of longitudinal associations between the categorized measures of obesity and deterioration of SRPC

| **Measure of obesity** | **β estimate** | **p-value** | **OR (95% CI)** | **AUC (ΔAUC)** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Model 1 (N=622)** | | | | | | | |
| BMI | 0.219 | 0.39 | 1.25 (0.76-2.05) | 0.6563 (0.0036) | 0.0363 | 477.49 | 495.22 |
| WC | 0.082 | 0.74 | 1.09 (0.67-1.76) | 0.6530 (0.0003) | 0.0353 | 478.11 | 495.85 |
| WHR | 0.355 | 0.15 | 1.43 (0.88-2.32) | 0.6623 (0.0096) | 0.0383 | 476.18 | 493.91 |
| WHtR | 0.195 | 0.42 | 1.22 (0.76-1.95) | 0.6546 (0.0019) | 0.0361 | 477.58 | 495.31 |
| FMp | 0.172 | 0.48 | 1.19 (0.74-1.91) | 0.6530 (0.0003) | 0.0359 | 477.73 | 495.46 |
| HTGW | 0.056 | 0.83 | 1.06 (0.63-1.78) | 0.6536 (0.0009) | 0.0352 | 478.18 | 495.91 |
| SO | 0.288 | 0.36 | 1.33 (0.72-2.47) | 0.6540 (0.0013) | 0.0364 | 477.42 | 495.15 |
| **Model 2 (N=622)** | | | | | | | |
| BMI | 0.129 | 0.62 | 1.14 (0.68-1.90) | 0.6966 (0.0017) | 0.0578 | 483.44 | 545.50 |
| WC | -0.032 | 0.90 | 0.97 (0.59-1.60) | 0.6948 (-0.0001) | 0.0574 | 483.67 | 545.73 |
| WHR | 0.292 | 0.25 | 1.34 (0.82-2.20) | 0.7007 (0.0058) | 0.0594 | 482.35 | 544.41 |
| WHtR | 0.129 | 0.61 | 1.14 (0.70-1.86) | 0.6967 (0.0018) | 0.0578 | 483.42 | 545.48 |
| FMp | 0.074 | 0.77 | 1.08 (0.66-1.76) | 0.6944 (-0.0005) | 0.0576 | 483.59 | 545.66 |
| HTGW | -0.064 | 0.81 | 0.94 (0.55-1.60) | 0.6945 (-0.0004) | 0.0575 | 483.63 | 545.69 |
| SO | 0.206 | 0.52 | 1.23 (0.66-2.31) | 0.6943 (-0.0006) | 0.0580 | 483.28 | 545.34 |
| SRPC, self-rated physical constitution; OR, odds ratio; CI, confidence interval; AUC, area under the receiver operating curve; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio; FMp, fat mass percentage; HTGW, hypertriglyceridemic waist; SO, sarcopenic obesity.  Logistic regression models: reference category=no change of SRPC.  **Model 1:** adjusted for age, sex.  **Model 2:** additionally adjusted for further socio-demographic (marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.  **Model 3 (N=622):** additionally adjusted for the presence of diseases (hip or femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease) not calculable because of insufficient small sample size and statistical power.  Results are shown for the obesity categories: BMI ≥30 kg/m², WC ≥102/88 cm (m/f), WHR ≥1/0.85 (m/f), WHtR ≥0.6, FMp ≥30.41/41.10% (m/f), HTGW: WC ≥102/88 cm (m/f) and TG ≥1.7 mmol/l, SO: FMp ≥30.41/41.10% (m/f) and handgrip strength <30/20 kg (m/f).  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | | |

**Supplemental Table 4:** Comparison of longitudinal associations between the categorized measures of obesity and improvement of SRPC

| **Measure of obesity** | **β estimate** | **p-value** | **OR (95% CI)** | **AUC (ΔAUC)** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Model 1 (N=605)** | | | | | | | |
| BMI | -0.006 | 0.98 | 0.99 (0.57-1.73) | 0.5126 (-0.0007) | 0.0003 | 428.96 | 446.58 |
| WC | 0.063 | 0.81 | 1.07 (0.63-1.80) | 0.5209 (0.0076) | 0.0004 | 428.91 | 446.53 |
| WHR | 0.123 | 0.65 | 1.13 (0.66-1.92) | 0.5241 (0.0108) | 0.0007 | 428.76 | 446.38 |
| WHtR | -0.031 | 0.91 | 0.97 (0.58-1.63) | 0.5158 (0.0025) | 0.0004 | 428.95 | 446.57 |
| FMp | 0.016 | 0.95 | 1.02 (0.60-1.72) | 0.5167 (0.0034) | 0.0003 | 428.96 | 446.58 |
| HTGW | 0.094 | 0.74 | 1.10 (0.63-1.92) | 0.5117 (-0.0016) | 0.0005 | 428.85 | 446.47 |
| SO | -0.171 | 0.69 | 0.84 (0.36-1.95) | 0.5019 (-0.0114) | 0.0006 | 428.80 | 446.42 |
| **Model 2 (N=605)** | | | | | | | |
| BMI | -0.012 | 0.97 | 0.99 (0.55-1.77) | 0.6328 (-0.0002) | 0.0270 | 432.63 | 494.30 |
| WC | 0.006 | 0.98 | 1.01 (0.58-1.74) | 0.6331 (0.0001) | 0.0270 | 432.63 | 494.31 |
| WHR | 0.106 | 0.71 | 1.11 (0.64-1.93) | 0.6338 (0.0008) | 0.0272 | 432.49 | 494.17 |
| WHtR | -0.127 | 0.65 | 0.88 (0.51-1.52) | 0.6347 (0.0017) | 0.0273 | 432.42 | 494.10 |
| FMp | 0.011 | 0.97 | 1.01 (0.58-1.75) | 0.6328 (-0.0002) | 0.0270 | 432.63 | 494.30 |
| HTGW | 0.071 | 0.81 | 1.07 (0.61-1.91) | 0.6330 (0.0000) | 0.0270 | 432.58 | 494.25 |
| SO | -0.169 | 0.70 | 0.85 (0.36-2.01) | 0.6310 (-0.0020) | 0.0272 | 432.48 | 494.16 |
| **Model 3 (N=605)** | | | | | | | |
| BMI | -0.016 | 0.96 | 0.98 (0.54-1.81) | 0.6874 (-0.0003) | 0.0447 | 449.50 | 572.84 |
| WC | 0.034 | 0.91 | 1.03 (0.59-1.83) | 0.6870 (-0.0007) | 0.0447 | 449.49 | 572.83 |
| WHR | 0.110 | 0.71 | 1.12 (0.63-1.99) | 0.6893 (0.0016) | 0.0449 | 449.36 | 572.71 |
| WHtR | -0.137 | 0.64 | 0.87 (0.49-1.55) | 0.6862 (-0.0015) | 0.0450 | 449.28 | 572.63 |
| FMp | -0.047 | 0.87 | 0.95 (0.54-1.69) | 0.6876 (-0.0001) | 0.0447 | 449.47 | 572.82 |
| HTGW | 0.077 | 0.80 | 1.08 (0.60-1.96) | 0.6876 (-0.0001) | 0.0448 | 449.44 | 572.78 |
| SO | -0.269 | 0.56 | 0.76 (0.31-1.90) | 0.6875 (-0.0002) | 0.0452 | 449.15 | 572.50 |
| SRPC, self-rated physical constitution; OR, odds ratio; CI, confidence interval; AUC, area under the receiver operating curve; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio; FMp, fat mass percentage; HTGW, hypertriglyceridemic waist; SO, sarcopenic obesity.  Logistic regression models: reference category=no change of SRPC.  **Model 1:** adjusted for age, sex.  **Model 2:** additionally adjusted for further socio-demographic (marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.  **Model 3:** additionally adjusted for the presence of diseases (hip or femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease).  Results are shown for the obesity categories: BMI ≥30 kg/m², WC ≥102/88 cm (m/f), WHR ≥1/0.85 (m/f), WHtR ≥0.6, FMp ≥30.41/41.10% (m/f), HTGW: WC ≥102/88 cm (m/f) and TG ≥1.7 mmol/l, SO: FMp ≥30.41/41.10% (m/f) and handgrip strength <30/20 kg (m/f).  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | | |

**Supplemental Table 5:** Comparison of longitudinal associations between the continuous measures of obesity and deterioration of SRPC

| **Measure of obesity** | **β estimate** | **p-value** | **OR (95% CI)** | **AUC (ΔAUC)** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Model 1 (N=622)** | | | | | | | |
| BMI | 0.072 | 0.54 | 1.08 (0.85-1.35) | 0.6536 (0.0009) | 0.0357 | 477.85 | 495.58 |
| WC | 0.110 | 0.41 | 1.12 (0.86-1.45) | 0.6560 (0.0033) | 0.0362 | 477.54 | 495.27 |
| WHR | 0.160 | 0.34 | 1.17 (0.85-1.63) | 0.6553 (0.0026) | 0.0366 | 477.29 | 495.03 |
| WHtR | 0.086 | 0.48 | 1.09 (0.86-1.38) | 0.6554 (0.0027) | 0.0359 | 477.73 | 495.46 |
| FMp | 0.265 | 0.16 | 1.30 (0.90-1.89) | 0.6575 (0.0048) | 0.0382 | 476.25 | 493.98 |
| HTGW | -0.038 | 0.76 | 0.96 (0.75-1.23) | 0.6533 (0.0006) | 0.0353 | 478.14 | 495.87 |
| SO | 0.118 | 0.26 | 1.13 (0.92-1.38) | 0.6558 (0.0031) | 0.0370 | 477.03 | 494.76 |
| **Model 2 (N=622)** | | | | | | | |
| BMI | 0.028 | 0.82 | 1.03 (0.81-1.31) | 0.6954 (0.0005) | 0.0575 | 483.63 | 545.69 |
| WC | 0.037 | 0.79 | 1.04 (0.79-1.36) | 0.6953 (0.0004) | 0.0575 | 483.61 | 545.67 |
| WHR | 0.083 | 0.63 | 1.09 (0.78-1.53) | 0.6950 (0.0001) | 0.0578 | 483.45 | 545.51 |
| WHtR | 0.022 | 0.86 | 1.02 (0.80-1.31) | 0.6947 (-0.0002) | 0.0575 | 483.65 | 545.71 |
| FMp | 0.173 | 0.38 | 1.19 (0.81-1.75) | 0.6965 (0.0016) | 0.0586 | 482.91 | 544.97 |
| HTGW | -0.056 | 0.64 | 0.95 (0.75-1.20) | 0.6943 (-0.0006) | 0.0577 | 483.49 | 545.55 |
| SO | 0.088 | 0.41 | 1.09 (0.89-1.35) | 0.6956 (0.0007) | 0.0584 | 483.01 | 545.08 |
| SRPC, self-rated physical constitution; OR, odds ratio; CI, confidence interval; AUC, area under the receiver operating curve; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio; FMp, fat mass percentage; HTGW, hypertriglyceridemic waist; SO, sarcopenic obesity.  Logistic regression models: reference category=no change of SRPC.  **Model 1:** adjusted for age, sex.  **Model 2:** additionally adjusted for further socio-demographic (marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.  **Model 3 (N=622):** additionally adjusted for the presence of chronic diseases (hip or femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease) not calculable because of insufficient small sample size and statistical power.  Results are shown for one standard deviation increase in measures of obesity, as they were z-standardized for direct comparability.  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | | |

**Supplemental Table 6:** Comparison of longitudinal associations between the continuous measures of obesity and improvement of SRPC

| **Measure of obesity** | **β estimate** | **p-value** | **OR (95% CI)** | **AUC (ΔAUC)** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Model 1 (N=605)** | | | | | | | |
| BMI | 0.062 | 0.62 | 1.06 (0.83-1.36) | 0.5404 (0.0271) | 0.0007 | 428.72 | 446.35 |
| WC | 0.086 | 0.55 | 1.09 (0.83-1.44) | 0.5437 (0.0304) | 0.0009 | 428.60 | 446.22 |
| WHR | 0.112 | 0.54 | 1.12 (0.78-1.60) | 0.5269 (0.0136) | 0.0010 | 428.59 | 446.21 |
| WHtR | 0.106 | 0.41 | 1.11 (0.86-1.43) | 0.5399 (0.0266) | 0.0014 | 428.30 | 445.92 |
| FMp | 0.229 | 0.25 | 1.26 (0.85-1.86) | 0.5524 (0.0391) | 0.0026 | 427.62 | 445.24 |
| HTGW | -0.0001 | 0.99 | 1.00 (0.77-1.29) | 0.5141 (0.0008) | 0.0003 | 428.96 | 446.58 |
| SO | -0.184 | 0.28 | 0.83 (0.59-1.16) | 0.5363 (0.0230) | 0.0026 | 427.58 | 445.20 |
| **Model 2 (N=605)** | | | | | | | |
| BMI | 0.018 | 0.89 | 1.02 (0.78-1.33) | 0.6337 (0.0007) | 0.0270 | 432.62 | 494.29 |
| WC | 0.062 | 0.68 | 1.06 (0.79-1.43) | 0.6363 (0.0033) | 0.0272 | 432.46 | 494.14 |
| WHR | 0.105 | 0.58 | 1.11 (0.77-1.61) | 0.6357 (0.0027) | 0.0274 | 432.33 | 494.00 |
| WHtR | 0.069 | 0.62 | 1.07 (0.82-1.41) | 0.6374 (0.0044) | 0.0273 | 432.39 | 494.06 |
| FMp | 0.204 | 0.33 | 1.23 (0.81-1.85) | 0.6460 (0.0130) | 0.0285 | 431.67 | 493.34 |
| HTGW | -0.013 | 0.92 | 0.99 (0.77-1.26) | 0.6339 (0.0009) | 0.0270 | 432.62 | 494.30 |
| SO | -0.173 | 0.33 | 0.84 (0.59-1.19) | 0.6346 (0.0016) | 0.0287 | 431.52 | 493.20 |
| **Model 3 (N=605)** | | | | | | | |
| BMI | 0.026 | 0.86 | 1.03 (0.78-1.36) | 0.6880 (0.0003) | 0.0447 | 449.47 | 572.81 |
| WC | 0.069 | 0.66 | 1.07 (0.78-1.47) | 0.6895 (0.0018) | 0.0450 | 449.31 | 572.66 |
| WHR | 0.144 | 0.47 | 1.16 (0.78-1.70) | 0.6918 (0.0041) | 0.0455 | 448.97 | 572.32 |
| WHtR | 0.103 | 0.49 | 1.11 (0.83-1.48) | 0.6935 (0.0058) | 0.0454 | 449.02 | 572.37 |
| FMp | 0.187 | 0.38 | 1.21 (0.79-1.84) | 0.6954 (0.0077) | 0.0459 | 448.73 | 572.08 |
| HTGW | -0.020 | 0.88 | 0.98 (0.76-1.26) | 0.6881 (0.0004) | 0.0447 | 449.48 | 572.82 |
| SO | -0.206 | 0.27 | 0.81 (0.57-1.17) | 0.6927 (0.0050) | 0.0470 | 448.05 | 571.39 |
| SRPC, self-rated physical constitution; OR, odds ratio; CI, confidence interval; AUC, area under the receiver operating curve; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio; FMp, fat mass percentage; HTGW, hypertriglyceridemic waist; SO, sarcopenic obesity.  Logistic regression models: reference category=no change of SRPC.  **Model 1:** adjusted for age, sex.  **Model 2:** additionally adjusted for further socio-demographic (marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.  **Model 3:** additionally adjusted for the presence of chronic diseases (hip or femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease).  Results are shown for one standard deviation increase in measures of obesity, as they were z-standardized for direct comparability.  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | | |

**Sensitivity Analysis for the Definition of SO**

Two extended definitions of SO, considering muscle strength as well as muscle mass, were examined to verify the definition of the main analyses (Supplemental Tables 7 and 8).([12](#_ENREF_12)) In addition to FMp and handgrip strength, relative muscle mass and normal gait speed were used. Considering height in cm, BIA resistance [Ω], sex (men=1, women=0) and age in years, skeletal muscle mass was determined using the equation proposed by Janssen et al.([13](#_ENREF_13)):

|  |  |
| --- | --- |
|  | (10) |

This equation was established in a population of 230 men and 158 women aged 18-86 years against magnetic resonance imaging with R²=0.86 and standard error=2.7 kg (9%). Relative muscle mass was calculated by dividing skeletal muscle mass by height squared.([14](#_ENREF_14)) In absence of established cut-points, sarcopenia was defined in comparison with a young reference group.([15](#_ENREF_15)) Therefore, the sex-specific distributions of the relative muscle mass of participants in the KORA survey 4 aged 25-39 years were determined. By using severe sarcopenia, defined as a relative muscle mass more than -2 SD below the values of young adults, the number of cases was too little in combination with the other three criteria for the extended definition of SO. For this reason we decided to use moderate sarcopenia with a relative muscle mass more than -1 SD below the mean of a sex-specific young reference group (<9.62/7.12 kg/m² for men and women, respectively). Restrictions in normal gait speed were either measured with a GAITRite portable carpet (>0.8 m/s for both sexes and all ages)([12](#_ENREF_12)), or the “Timed-up-and-go test“ (TUG), where the time needed to stand up from a seat, walk three meters, turn back and sit down again was measured (>9.0 s (60-69 years), >10.2 s (70-79 years), >12.7 s (80-99 years) for both sexes)([16](#_ENREF_16)). Details about the combination of the criteria in the extended definitions of SO have been reported elsewhere.([12](#_ENREF_12))

**Supplemental Table 7:** Comparison of cross-sectional and longitudinal associations between different definitions of categorized SO and (change in) HRQoL

| **Measure of obesity** | **β estimate** | **F-test** | **p-value** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- |
| **Cross-sectional (Model 3: N=824)** | | | | | | |
| SO | -0.041 | 7.32 | **0.01** | 0.1620 | -3136 | -3004 |
| SO extended (GAITRite) | -0.007 | 0.11 | 0.73 | 0.1544 | -3129 | -2997 |
| SO extended (TUG) | 0.005 | 0.07 | 0.78 | 0.1544 | -3129 | -2997 |
| **Longitudinal (Model 3: N=665)** | | | | | | |
| SO | -0.011 | 0.29 | 0.59 | 0.0511 | -2320 | -2194 |
| SO extended (GAITRite) | 0.012 | 0.18 | 0.67 | 0.0509 | -2319 | -2193 |
| SO extended (TUG) | -0.015 | 0.33 | 0.56 | 0.0511 | -2320 | -2194 |
| SO, sarcopenic obesity; HRQoL, health-related quality of life; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; TUG, Timed-up-and-go test.  Linear regression models: change in HRQoL=HRQoL at follow-up – HRQoL at baseline (longitudinal).  **Model 3:** fully adjusted for socio-demographic (age, sex, marital status, years of education), lifestyle (PASE score, smoking status, alcohol consumption) variables and the presence of diseases (hip or femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease).  Results are shown for the obesity categories: SO: FMp ≥30.41/41.10% (m/f) and handgrip strength <30/20 kg (m/f), SO extended (GAITRite): FMp ≥30.41/41.10% (m/f) and handgrip strength <30/20 kg (m/f) and relative muscle mass <9.62/7.12 kg/m² (m/f) and normal gait speed >0.8m/s, SO extended (TUG): FMp ≥30.41/41.10% (m/f) and handgrip strength <30/20 kg (m/f) and relative muscle mass <9.62/7.12 kg/m² (m/f) and TUG >9.0 s (60-69 years), >10.2 s (70-79 years), >12.7 s (80-99 years).  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | |

**Supplemental Table 8:** Comparison of cross-sectional and longitudinal associations between different definitions of categorized SO and (deterioration of/improvement of) SRPC

| **Measure of obesity** | **β estimate** | **p-value** | **OR (95% CI)** | **AUC (ΔAUC)** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Cross-sectional (Model 3: N=824)** | | | | | | | |
| SO | 0.257 | 0.29 | 1.29 (0.81-2.07) | 0.7343 (-0.0002) | 0.1387 | 872.67 | 1004.67 |
| SO extended (GAITRite) | -0.138 | 0.66 | 0.87 (0.47-1.63) | 0.7354 (0.0009) | 0.1377 | 873.60 | 1005.60 |
| SO extended (TUG) | -0.198 | 0.52 | 0.82 (0.45-1.49) | 0.7360 (0.0015) | 0.1379 | 873.37 | 1005.36 |
| **Longitudinal deterioration (Model 2: N=601)** | | | | | | | |
| SO | 0.249 | 0.45 | 1.28 (0.68-2.44) | 0.7145 (0.0003) | 0.0726 | 457.91 | 519.49 |
| SO extended (GAITRite) | -0.128 | 0.77 | 0.88 (0.37-2.09) | 0.7142 (0.0000) | 0.0719 | 458.39 | 519.97 |
| SO extended (TUG) | 0.121 | 0.77 | 1.13 (0.51-2.50) | 0.7144 (0.0002) | 0.0719 | 458.39 | 519.97 |
| **Longitudinal improvement (Model 3: N=584)** | | | | | | | |
| SO | -0.128 | 0.79 | 0.88 (0.35-2.21) | 0.6899 (-0.0001) | 0.0483 | 430.84 | 553.20 |
| SO extended (GAITRite) | -0.027 | 0.96 | 0.97 (0.31-3.02) | 0.6901 (0.0001) | 0.0481 | 430.92 | 553.27 |
| SO extended (TUG) | 0.352 | 0.48 | 1.42 (0.53-3.79) | 0.6902 (0.0002) | 0.0489 | 430.45 | 552.80 |
| SO, sarcopenic obesity; SRPC, self-rated physical constitution; OR, odds ratio; CI, confidence interval; AUC, area under the receiver operating curve; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; TUG, Timed-up-and-go test.  Logistic regression models: reference category=excellent/good SRPC (cross-sectional), no change of SRPC (longitudinal).  **Model 2:** adjusted for sociodemographic (age, sex, marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.  **Model 3:** additionally adjusted for the presence of diseases (hip or femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease) not calculable for the longitudinal SRPC deterioration because of insufficient small sample size and statistical power.  Results are shown for the obesity categories: SO: FMp ≥30.41/41.10% (m/f) and handgrip strength <30/20 kg (m/f), SO extended (GAITRite): FMp ≥30.41/41.10% (m/f) and handgrip strength <30/20 kg (m/f) and relative muscle mass <9.62/7.12 kg/m² (m/f) and normal gait speed >0.8m/s, SO extended (TUG): FMp ≥30.41/41.10% (m/f) and handgrip strength <30/20 kg (m/f) and relative muscle mass <9.62/7.12 kg/m² (m/f) and TUG >9.0 s (60-69 years), >10.2 s (70-79 years), >12.7 s (80-99 years).  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | | |

**Analyses to Test for Sex-specific Differences**

WC, WHR, FMp, HTGW and SO have established sex-specific obesity cut-points. Thus, the comparison of cross-sectional associations between the continuous measures of obesity and baseline HRQoL/SRPC was repeated after adding a cross-product interaction term between the specific measure of obesity and sex to each model (Supplemental Tables 9 and 10). Except for the SO model with regard to SRPC, the interaction term was not significant in all other models, so that sex-specific differences could not be shown. Hence, the main analyses were conducted without stratification by sex in contrast to the analyses by Tan et al.([17](#_ENREF_17)).

Exemplary for the analyses with the interaction term, the BMI model with the adjustment according to model 1 is shown for the linear regression analysis of baseline HRQoL:

|  |  |
| --- | --- |
|  | (11) |

and for the binary logistic regression analysis of baseline SRPC:

|  |  |
| --- | --- |
|  | (12) |

with continuous z-standardized BMI, age in years and dummy coded sex (women=1 and men=0).

F-test in linear regression and ΔAUC in logistic regression compared the full model against the model reduced by measure of obesity and the interaction term with sex for a model improvement.

**Supplemental Table 9:** Comparison of cross-sectional associations between the continuous measures of obesity and HRQoL (with a cross-product interaction term between the specific measure of obesity and sex)

| **Measure of obesity** | **β estimate for men** | **β estimate for women** | **p-value of the interaction term with sex** | **F-test** | **p-value** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model 1 (N=883)** | | | | | | | | |
| BMI | -0.028 | -0.042 | 0.20 | 23.76 | **<0.0001** | 0.0917 | -3232 | -3209 |
| WC | -0.032 | -0.041 | 0.46 | 18.91 | **<0.0001** | 0.0820 | -3223 | -3199 |
| WHR | -0.022 | -0.029 | 0.65 | 5.60 | **0.004** | 0.0546 | -3197 | -3173 |
| WHtR | -0.025 | -0.042 | 0.11 | 21.77 | **<0.0001** | 0.0877 | -3229 | -3205 |
| FMp | -0.033 | -0.057 | 0.15 | 14.63 | **<0.0001** | 0.0734 | -3215 | -3191 |
| HTGW | -0.012 | -0.023 | 0.42 | 3.88 | **0.02** | 0.0509 | -3194 | -3170 |
| SO | -0.009 | -0.031 | 0.08 | 5.17 | **0.01** | 0.0536 | -3196 | -3172 |
| **Model 2 (N=883)** | | | | | | | | |
| BMI | -0.023 | -0.037 | 0.20 | 17.48 | **<0.0001** | 0.1284 | -3249 | -3177 |
| WC | -0.025 | -0.035 | 0.44 | 12.41 | **<0.0001** | 0.1185 | -3239 | -3167 |
| WHR | -0.013 | -0.022 | 0.53 | 2.78 | 0.06 | 0.0991 | -3220 | -3148 |
| WHtR | -0.018 | -0.037 | 0.08 | 14.89 | **<0.0001** | 0.1234 | -3244 | -3172 |
| FMp | -0.025 | -0.050 | 0.14 | 9.96 | **<0.0001** | 0.1136 | -3234 | -3162 |
| HTGW | -0.012 | -0.018 | 0.64 | 3.26 | **0.04** | 0.1000 | -3221 | -3149 |
| SO | -0.007 | -0.028 | 0.09 | 3.86 | **0.02** | 0.1013 | -3222 | -3150 |
| **Model 3 (N=883)** | | | | | | | | |
| BMI | -0.023 | -0.040 | 0.10 | 19.19 | **<0.0001** | 0.1872 | -3283 | -3144 |
| WC | -0.025 | -0.036 | 0.36 | 12.55 | **<0.0001** | 0.1749 | -3269 | -3131 |
| WHR | -0.015 | -0.020 | 0.71 | 2.53 | 0.08 | 0.1557 | -3249 | -3110 |
| WHtR | -0.018 | -0.038 | 0.06 | 15.36 | **<0.0001** | 0.1802 | -3275 | -3136 |
| FMp | -0.025 | -0.048 | 0.16 | 9.66 | **<0.0001** | 0.1695 | -3264 | -3125 |
| HTGW | -0.011 | -0.018 | 0.55 | 2.92 | 0.05 | 0.1565 | -3250 | -3111 |
| SO | -0.004 | -0.022 | 0.16 | 2.35 | 0.10 | 0.1553 | -3249 | -3110 |
| HRQoL, health-related quality of life; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio; FMp, fat mass percentage; HTGW, hypertriglyceridemic waist; SO, sarcopenic obesity.  Linear regression models.  **Model 1:** adjusted for age, sex.  **Model 2:** additionally adjusted for further socio-demographic (marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.  **Model 3:** additionally adjusted for the presence of diseases (hip/femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease).  Results are shown for one standard deviation increase in measures of obesity, as they were z-standardized for direct comparability.  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | | | |

**Supplemental Table 10:** Comparison of cross-sectional associations between the continuous measures of obesity and SRPC (with a cross-product interaction term between the specific measure of obesity and sex)

| **Measure of obesity** | **OR (95% CI) for men** | **OR (95% CI) for women** | **p-value of the interaction term with sex** | **AUC (ΔAUC)** | **R²** | **AIC** | **BIC** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Model 1 (N=883)** | | | | | | | |
| BMI | 1.35 (1.07-1.71) | 1.62 (1.33-1.97) | 0.25 | 0.6442 (0.0480) | 0.0539 | 1011.50 | 1035.42 |
| WC | 1.48 (1.15-1.90) | 1.82 (1.44-2.30) | 0.23 | 0.6534 (0.0572) | 0.0593 | 1006.47 | 1030.39 |
| WHR | 1.30 (0.97-1.74) | 1.64 (1.21-2.22) | 0.27 | 0.6169 (0.0207) | 0.0353 | 1028.73 | 1052.65 |
| WHtR | 1.39 (1.09-1.77) | 1.77 (1.44-2.17) | 0.14 | 0.6523 (0.0561) | 0.0621 | 1003.83 | 1027.74 |
| FMp | 1.44 (1.05-1.96) | 2.33 (1.58-3.42) | 0.06 | 0.6413 (0.0451) | 0.0482 | 1016.88 | 1040.79 |
| HTGW | 1.27 (0.93-1.75) | 1.63 (1.22-2.18) | 0.25 | 0.6271 (0.0309) | 0.0354 | 1028.66 | 1052.57 |
| SO | 0.96 (0.80-1.15) | 1.44 (1.10-1.87) | **0.01** | 0.6106 (0.0144) | 0.0281 | 1035.28 | 1059.20 |
| **Model 2 (N=883)** | | | | | | | |
| BMI | 1.29 (1.01-1.65) | 1.50 (1.22-1.84) | 0.34 | 0.7029 (0.0265) | 0.0984 | 988.99 | 1060.74 |
| WC | 1.41 (1.08-1.83) | 1.67 (1.31-2.14) | 0.34 | 0.7076 (0.0312) | 0.1027 | 984.80 | 1056.55 |
| WHR | 1.21 (0.89-1.65) | 1.51 (1.11-2.07) | 0.31 | 0.6846 (0.0082) | 0.0867 | 1000.40 | 1072.15 |
| WHtR | 1.31 (1.01-1.68) | 1.64 (1.32-2.03) | 0.18 | 0.7075 (0.0311) | 0.1040 | 983.47 | 1055.22 |
| FMp | 1.37 (0.99-1.90) | 2.05 (1.38-3.05) | 0.12 | 0.6997 (0.0233) | 0.0955 | 991.86 | 1063.61 |
| HTGW | 1.23 (0.90-1.68) | 1.55 (1.15-2.08) | 0.29 | 0.6896 (0.0132) | 0.0888 | 998.32 | 1070.07 |
| SO | 0.94 (0.78-1.13) | 1.39 (1.05-1.83) | **0.02** | 0.6837 (0.0073) | 0.0839 | 1003.06 | 1074.81 |
| **Model 3 (N=883)** | | | | | | | |
| BMI | 1.31 (1.01-1.69) | 1.60 (1.28-2.00) | 0.24 | 0.7517 (0.0178) | 0.1634 | 950.94 | 1089.66 |
| WC | 1.42 (1.08-1.88) | 1.69 (1.30-2.20) | 0.36 | 0.7519 (0.0180) | 0.1634 | 950.93 | 1089.64 |
| WHR | 1.18 (0.86-1.62) | 1.40 (1.00-1.95) | 0.47 | 0.7389 (0.0050) | 0.1474 | 967.65 | 1106.37 |
| WHtR | 1.32 (1.02-1.72) | 1.67 (1.32-2.11) | 0.18 | 0.7540 (0.0201) | 0.1648 | 949.42 | 1088.14 |
| FMp | 1.43 (1.02-2.00) | 2.10 (1.37-3.23) | 0.16 | 0.7460 (0.0121) | 0.1586 | 956.01 | 1094.72 |
| HTGW | 1.25 (0.89-1.75) | 1.59 (1.16-2.18) | 0.31 | 0.7439 (0.0100) | 0.1529 | 961.96 | 1100.68 |
| SO | 0.92 (0.75-1.12) | 1.31 (0.97-1.75) | 0.05 | 0.7349 (0.0010) | 0.1465 | 968.60 | 1107.32 |
| SRPC, self-rated physical constitution; OR, odds ratio; CI, confidence interval; AUC, area under the receiver operating curve; AIC, Akaike information criterion; BIC, Schwarz Bayesian information criterion; BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio; FMp, fat mass percentage; HTGW, hypertriglyceridemic waist; SO, sarcopenic obesity.  Logistic regression models: reference category=excellent/good SRPC.  **Model 1:** adjusted for age, sex.  **Model 2:** additionally adjusted for further socio-demographic (marital status, years of education) and lifestyle (PASE score, smoking status, alcohol consumption) variables.  **Model 3:** additionally adjusted for the presence of diseases (hip/femoral neck fracture in the last five years, hypertension, diabetes mellitus, lung disease, joint disease, gastrointestinal disease, heart disease, heart attack in the last three years, kidney disease, liver disease, cancer occurring in the last three years, neurological disease, stroke in the last three years, eye disease).  Results are shown for one standard deviation in measures of obesity, as they were z-standardized for direct comparability.  Significant results (p<0.05) are **highlighted**.  Data of the KORA-Age study conducted in Southern Germany between 2009 and 2012. | | | | | | | |

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