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An evaluation of serum albumin, root caries, and other covariates in Gullah African Americans with type-2 diabetes

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Abstract

Objectives—Associations between dental conditions and overall health have been previously reported. Investigators have also shown significant inverse relationships between serum albumin (a general health status marker) and root caries. This relationship was explored among a study population of Gullah African Americans (who have a considerably lower level of non-African genetic admixture when compared to other African American populations) with type-2 diabetes (T2DM) and self-reported history of normal kidney function ($N = 280$).

Methods—Root caries indices were defined as total decayed and/or filled root surfaces. The coronal caries index [total decayed, missing, and/or filled coronal surfaces (DMFS)], level of glycemic control, total number of teeth, and other covariates were also evaluated. Logistic regression models were used to evaluate the associations between these factors and hypoalbuminemia (serum albumin concentrations <4 g/dl).

Results—Serum albumin concentrations ranged 2.4–4.5 g/dl (mean = 3.8, SD = 0.3), with 70.4% exhibiting hypoalbuminemia. Root caries totals ranged 0–38 (mean = 1.3, SD = 4.5) surfaces decayed/filled, while total teeth ranged 1–28 (mean = 19.4, SD = 6.2). DMFS totals ranged 2–116 (mean = 55.2, SD = 28.0). We failed to detect significant associations for root caries; however, the final multivariable logistic regression models showed significant associations between hypoalbuminemia and total teeth [odds ratio (OR) = 0.93, $P = 0.01$], poor glycemic control (OR = 2.49, $P < 0.01$), elevated C-reactive protein (OR = 1.57, $P < 0.01$), glomerular filtration rates ≥ 60 (OR = 0.31, $P = 0.03$), and age (OR = 0.97, $P = 0.03$).

Conclusions—Previously reported inverse relationships between serum albumin and root caries were not evident in our study population. We propose that these null findings are because of the considerably lower level of root caries as well as other differing characteristics (including oral health status, the chronic presence of T2DM, and predominantly younger age) within our study population compared to these previously assessed groups.

Keywords

diabetes; Gullah African Americans; root caries; serum albumin

Hypoalbuminemia can present in patients with many conditions, including inflammatory states (such as diabetes), liver diseases, renal diseases, and malnutrition (1–6). Recent studies have shown an association between general health in the elderly and serum albumin levels (7–10), leading to the use of serum albumin as a general health status marker. Additionally, some reports have indicated a link between dental caries and general health (11, 12), particularly with coronary heart disease and conditions with the increased levels of immune response.

Given these results, several studies have assessed the relationship between serum albumin levels and root caries (13, 14). Risk factors for root caries that have been previously identified include past caries experience, periodontal status (particularly gingival recession), decreased salivary flow, and salivary levels of cariogenic bacteria. Significant and negative associations between root caries and serum albumin concentration were identified in both cross-sectional (13) and longitudinal (14) studies of elderly persons, who are at an increased risk for oral conditions because of the process of aging, and the authors concluded that persons with hypoalbuminemia are at high risk for root caries (14).

Type-2 diabetes mellitus (T2DM) is a disease that is systemic in nature and often leads to impaired general health (potentially characterized by hypoalbuminemia), including oral conditions, such as periodontal disease (15) and root caries (16). Previous results have shown that after adjusting for population age differences, non-Hispanic African Americans are 1.8 times more likely to have T2DM compared to non-Hispanic Caucasians. Gullah African Americans of coastal South Carolina and Georgia (or, simply, the Gullah) have high rates of T2DM, including a considerable relative risk (RR) of T2DM to siblings (RR = 3.3, a figure that is much higher than other African American communities) (17).

The Gullah are a direct descendant population of rice plantation enslaved Africans who were brought to coastal regions of South Carolina and Georgia from Sierra Leone and certain other parts of West Africa (18). Their ancestors remained in their Gullah communities when these slave practices became illegal (19). The Gullah today have a considerably lower level of non-African genetic admixture ($3.5 \pm 0.9\%$) when compared to other African American populations (20), which is thought to be largely because of their longtime geographic, social, and cultural isolation (21). Their genetic homogeneity as well as substantial disparities for chronic diseases position the Gullah as a remarkable population to study.

The relationship between serum albumin concentration and root caries is unknown among the Gullah with T2DM. Given their potentially high risk for both hypoalbuminemia and root caries, we evaluated the relationships between these factors within a cross-sectional study population of Gullah African Americans with T2DM and self-reported history of normal kidney function. Measures of coronal caries, diabetes-control, total teeth, and other clinical factors were also assessed for their potential impact on hypoalbuminemia in this study population.

Materials and methods

Our study population comprised a secondary analysis of data extracted from a cross-sectional epidemiologic study, described elsewhere (22), where the primary goal was to assess the prevalence of periodontal disease among adult Gullah African Americans with T2DM and normal kidney function ($N = 313$) according to their level of glycemic control. The use of human subjects for the cross-sectional study was approved by the institutional review board (IRB) process, and data collection was obtained only upon signed informed consent by the enrolled subjects. Our report was limited to subjects enrolled in this cross-sectional study with nonmissing data for serum albumin (the outcome of interest), root

caries (our primary predictive factor of interest), and all other assessed covariates, with the exception of BMI ($N = 280$).

Root caries indices were assessed according to (i) total number of decayed and/or filled root surfaces in the mouth (root-DFS), (ii) total number of decayed root surfaces in the mouth (root-DS), and (iii) total number of filled root surfaces in the mouth (root-FS). Albumin was assessed in grams per deciliter (g/dl) and dichotomized with cut points of <4 (hypoalbuminemia) and ≥ 4 (normal) g/dl, according to previous reports (7, 23, 24). Other covariates of interest included coronal caries index [decayed, missing, or filled coronal surfaces (DMFS)], total teeth with root surfaces present, gender (female, male), urine microalbumin concentration (<30 mg/l, ≥ 30 mg/l), glomerular filtration rate (GFR) [<60 , ≥ 60 ml/min/1.73 m² (25)], glycyated hemoglobin (HbA_{1C}) levels [well-controlled-diabetes: HbA_{1C} $<7\%$, poor-controlled-diabetes: HbA_{1C} $\geq 7\%$ (26)], high-sensitivity C-reactive protein (CRP mg/l, with levels >1 considered elevated), smoking status (never, current, past), BMI (normal: <25 , overweight: $25\text{--}30$, obese: >30 , missing), and age (years).

All variables were first summarized according to their overall and albumin-status specific (<4 or ≥ 4 g/dl) distributions using means with standard deviations (SD) (if continuous) or frequencies (if categorical). Then, in our initial assessments for significant associations ($P < 0.05$) between serum albumin concentration (g/dl) and root caries indices, we determined that statistical methods that relied on normally distributed data were not appropriate, including linear regression modeling of serum albumin concentration as a continuous outcome in untransformed, log-transformed, and Box–Cox-transformed formats. Next, Spearman rank correlations were estimated as a nonparametric evaluation of the relationships between serum albumin (continuous) and root caries indices. Further, because of problems with non-normality, we selected computationally feasible logistic regression techniques to evaluate clinically meaningful multivariable associations for serum albumin as a dichotomous outcome [hypoalbuminemia (<4 g/dl) versus normal (≥ 4 g/dl) (7, 23, 24)]. Two series of logistic regression models were assessed: one series included root-DFS as the primary independent variable and a second series included root-DS and root-FS separately as the primary independent variables.

All previously described covariates were entered with the root caries indices in full multivariable models. The number of teeth present was included in all models so that the root caries information was adjusted for variation in the number of teeth. Aside from root caries indices, the number of teeth present, and potential confounders (e.g., age, gender, and smoking status), all other covariates were tested for their inclusion in the final multivariable models using a process of backward elimination. Applying the *P-value* for the adjusted effects (i.e., ‘Type-III’ Wald chi-square test), those with the largest *P-value* greater than 0.05 were each successively removed until $P < 0.05$ for this group of covariates. Final models for hypoalbuminemia were produced for both series of models (one for root-DFS as the primary predictor and a second with root-DS and root-FS assessed as separate primary predictors) that included root caries indices, number of teeth present, potential confounders (age, gender, and smoking status), and all other covariates with significance. All statistical analyses for this paper were generated using SAS software, Version 9.2 of the SAS System for XP-Pro, Copyright © 2002–2003, SAS Institute Inc., Cary, NC, USA.

Results

Serum albumin concentrations for this study population of Gullah African Americans with T2DM ranged from 2.40 to 4.50 g/dl (mean = 3.77, SD = 0.33, median = 3.80) (Table 1). There were 197 (70.36%) patients with serum albumin concentrations <4 g/dl, while 83 (29.64%) patients were ≥ 4 g/dl (Table 1). Patient age ranged from 27 to 87 (mean = 55.44,

SD = 10.62) (Table 1). Results for root caries indices ranged from 0 to 38 (mean = 1.32, SD = 4.52, median = 0) for root-DFS, from 0 to 38 (mean = 1.16, SD = 4.46, median = 0) for root-DS, and from 0 to 12 (mean = 0.16, SD = 0.87, median = 0) for root-FS (Table 1). DMFS totals ranged 2 to 116 (mean = 55.21, SD = 28.01), and total teeth with root surfaces present ranged 1 to 28 (mean = 19.41, SD = 6.18, median = 21.00) (Table 1). Poorly controlled diabetics (60.71%) were more prevalent than well-controlled diabetics (39.29%) (Table 1). Additional demographic, clinical, and behavioral characteristics for this study population can be found in Table 1.

Compared to previous reports of a significant and negative relationship between serum albumin and root caries (13, 14), the results of this report failed to show significant associations between hypoalbuminemia and root caries indices in both the bivariate (results omitted from tables for brevity) and multivariable (Tables 2 and 3) logistic regression models. Further, Spearman rank correlation estimates did not show significant associations for serum albumin as a continuous measure with root caries indices (root-DFS: $\rho = -0.11$, $P = 0.08$; root-DS: $\rho = -0.07$, $P = 0.22$; root-FS: $\rho = -0.07$, $P = 0.21$; results omitted from tables for brevity). Results from our final multivariable logistic regression model (Table 3) did show that hypoalbuminemia was significantly more likely among those with poor-controlled diabetes [odds ratio (OR) = 2.49, 95% confidence interval (CI) = 1.41–4.42, $P < 0.01$] and increased CRP concentrations (for every $\log_e$ *mg/mL increase: OR = 1.57, 95% CI = 1.20–2.06, $P < 0.01$) and significantly less likely among those with higher GFR (OR = 0.31, 95% CI = 0.11–0.91, $P = 0.03$), older age (for every year increase: OR = 0.97, 95% CI = 0.94–0.997, $P = 0.03$), and more teeth (for every tooth count increase: OR = 0.93, 95% CI = 0.89–0.99, $P = 0.01$) after adjusting for root caries indices and all other final model covariates.

Discussion

In the 2000 release of ‘Oral Health in America: A Report of the Surgeon General’, the first such report on this topic in US history, the integral role of oral health with general health and well-being was vastly emphasized (27). Noting the potential links between dental caries and general health (11, 12, 27), previous reports (13, 14) have assessed for associations between root caries and serum albumin, a biomarker related to general health status as it provides an index of the severity of an underlying disease, with decreased results indicating poorer disease status (1–10). Despite the results of previous studies (13, 14), the analyses of this report failed to detect significant associations between serum albumin and root caries (decayed and filled, as separate and combined totals). This could be attributed, in part, to differences in root caries indices, total teeth present, and the presence of an inflammatory chronic disease (T2DM) among our predominantly younger study population (adults aged 27 to 87, with 90% aged 27 to 68) compared to the previously assessed elderly study population (adults aged 70 and 80 living in Niigata City, Japan) (13, 14).

One previous study (14) showed an overall mean root-DFS of 2.3 (SD = 3.2) for their cross-sectional study population of elderly adults (aged 70). However, among our cross-sectional study population of adult Gullah African Americans with T2DM (aged 27–87), the mean root-DFS was 1.3 (SD = 4.5), similar to the mean root-DFS of 1.2 (SD = 0.2) among subjects with T2DM in a previous report (16). Also, the majority of our study population had no root caries (81.43% with none decayed and 92.86% with none filled), yet the variability of the root caries indices for our study population should give adequate ability to predict hypoalbuminemia, if an association exists for our study population. Similarly, most (yet a lower majority) of the population (aged 70 and 80) from the previous report (13) had no filled root caries (74%) and, it would seem, high proportions with no decayed root caries, with reported means of 0 (SD = 0) among those with none filled, 0.77 (SD = 0.77) among

those with 1–2 filled, and 1.06 (SD = 1.06) among those with 3 or more filled. These differences in root caries experienced by our study population compared to the elderly nondiabetic populations of previous reports (13, 14) may partially explain why we failed to replicate their findings. Also, the results we report herein are based on logistic regression analyses (which we determined was the most appropriate method for our evaluations because of normality assumption violations), whereas the previous reports used linear regression, a more sensitive method in that it evaluates for continuous changes in serum albumin (as opposed to our dichotomous threshold of whether the subject had hypoalbuminemia). Still, our evaluations that used linear regression modeling (bivariate and multivariable) as well as Spearman rank correlations showed no significant associations between serum albumin (as a continuous measure) and root caries indices.

Our analyses found a significant association between hypoalbuminemia and total teeth, showing a 7% decrease in the odds of hypoalbuminemia for every additional tooth present. However, previous reports have shown no significant ($P = 0.06$) associations between serum albumin and number of remaining teeth at baseline (14), as well as no significant differences in serum albumin by levels of missing teeth (13). Using the same study population data of previous reports by Yoshihara et al. (13, 14), Iwasaki et al. (28) evaluated those aged 70 at study enrollment ($N = 304$) and reported 14.8% with 1–9 teeth present, 26.3% with 10–19 teeth present, and 58.9% with >19 teeth present. Whereas among our study population, there were 9.3% with 1–9 teeth present, 33.9% with 10–19 teeth present, and 56.8% with >19 teeth present (results omitted from tables for brevity). A chi-square test indicated a significant association ($P = 0.04$) between these trichotomized numbers of teeth present (1–9, 10–19, and >19) and study population type (Iwasaki et al. (28) versus our report). Further, the mean serum albumin level among our study population (3.8 ± 0.3) was significantly different ($P < 0.05$) from that found in a previous report (4.3 ± 0.2) (14), and the proportion of our study participants with hypoalbuminemia (70.4%) was much higher than the previous report (12.8%) (14). We therefore suggest that these additional differences in oral health characteristics as well as greater tendencies for hypoalbuminemia that exist among our study population compared to that of the previous studies (13, 14, 28) may partially explain the significant association between total teeth and hypoalbuminemia that was revealed in our analyses.

Our final multivariable logistic regression results showed a 57% increase in the odds for hypoalbuminemia related to elevated CRP levels (a marker of inflammation). These final multivariable results also showed significant associations between hypoalbuminemia (a 149% increase in odds) and HbA_{1C} levels $\geq 7\%$ (indicative of poor diabetic control). These results suggest that the systemic, chronic, and inflammatory nature of T2DM (suffered uniformly by our study participants) coupled with a preponderance of poor diabetic control may contribute to the considerably high proportion of hypoalbuminemia among our study population, when compared to previously assessed groups (13, 14). Lower serum albumin levels are often found in the elderly (29); however, results among our predominantly young study population (with 90% aged 27 to 68) showed a 3% decrease in the odds of hypoalbuminemia with every year increase in age. Increased kidney function has been shown to be positively correlated with increased serum albumin levels (30), and our results also showed significantly decreased odds for hypoalbuminemia among those with GFR ≥ 60 (indicative of normal to mildly decreased kidney function).

The results reported herein may be limited because other factors that may potentially impact hypoalbuminemia were not available within our data and thus not available to assess as potential covariates, including dietary measures (e.g., daily fat, sugar, and protein intake), serum IgG levels, and serum IgA levels. Further, the generalizability of these results may be limited given that our study population was comprised of adult Gullah African Americans

with T2DM and normal kidney function by self-reported history. A more appropriate analysis of the relationship between oral health measures and their potential impact on serum albumin among our study population would be achieved with the use of longitudinally collected data; however, the present report only had access to cross-sectional data. Future analyses using longitudinal data subsequently collected on a sample of these same study subjects are planned to better characterize the relationships presented in this report.

Despite these and other previously described limitations, our results suggest, among a predominantly younger study population of Gullah African Americans with T2DM, that factors related to hypoalbuminemia [and potential adverse health outcomes, e.g., mortality (8)] include poor glycemic control, elevated CRP, younger age, reduced GFR, and missing teeth. Further, these measures may also be indicative of general health status within this population, and given the noninvasive nature of assessing total teeth, this particular marker may have important implications for the clinical setting.

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Table 1

Characteristics of a study population of Gullah African Americans with diabetes and normal kidney function ($N = 280$)

Variable	All ($N = 280$) Mean $\pm$ SD (Range) or N (%)	Albumin <4 g/dl ($N = 197$) Mean $\pm$ SD (Range) or N (%)	Albumin ≥ 4 g/dl ($N = 83$) Mean $\pm$ SD (Range) or N (%)
Serum albumin concentration (g/dl)	3.77 $\pm$ 0.33 (2.40–4.50)	3.62 $\pm$ 0.26 (2.40–3.90)	4.12 $\pm$ 0.14 (4.00–4.50)
Root surfaces decayed/filled	1.32 $\pm$ 4.52 (0–38)	1.49 $\pm$ 5.04 (0–38)	0.92 $\pm$ 2.91 (0–16)
Root surfaces decayed	1.16 $\pm$ 4.46 (0–38)	1.28 $\pm$ 4.98 (0–38)	0.88 $\pm$ 2.90 (0–16)
Root surfaces filled	0.16 $\pm$ 0.87 (0–12)	0.21 $\pm$ 1.02 (0–12)	0.04 $\pm$ 0.24 (0–2)
Total teeth	19.41 $\pm$ 6.18 (1–28)	18.91 $\pm$ 6.38 (1–28)	20.60 $\pm$ 5.52 (6–28)
Coronal surfaces decayed/missing/filled (DMFS)	55.21 $\pm$ 28.01 (2–116)	57.01 $\pm$ 28.25 (2–116)	50.94 $\pm$ 27.11 (4–106)
Age (years)	55.44 $\pm$ 10.62 (27–87)	55 $\pm$ 10.93 (27–87)	56.43 $\pm$ 9.84 (32–82)
High-sensitivity C-reactive protein (mg/ml)	0.65 $\pm$ 0.96 (0.02–11.21)	0.75 $\pm$ 1.09 (0.02–11.21)	0.40 $\pm$ 0.46 (0.02–2.28)
Well-controlled diabetes ($HbA_{1c} < 7\%$)	110 (39.29%)	63 (31.98%)	47 (46.63%)
Poor-controlled diabetes ($HbA_{1c} \geq 7\%$)	170 (60.71%)	134 (68.02%)	36 (43.37%)
Urine microalbumin <30 mg/l	188 (67.14%)	124 (62.94%)	64 (77.11%)
Urine microalbumin ≥ 30 mg/l	92 (32.86%)	73 (37.06%)	19 (22.89%)
Glomerular filtration rate <60 ml/min/1.73 m ²	31 (11.07%)	26 (13.20%)	5 (6.02%)
Glomerular filtration rate ≥ 60 ml/min/1.73 m ²	249 (88.93%)	171 (86.801%)	78 (93.98%)
Male	68 (24.29%)	42 (21.32%)	26 (31.33%)
Female	212 (75.71%)	155 (78.68%)	57 (68.67%)
BMI <25 (Normal)	28 (10.00%)	17 (8.63%)	11 (13.25%)
BMI 25–30 (Overweight)	56 (20.00%)	27 (13.71%)	29 (34.94%)
BMI >30 (Obese)	184 (65.71%)	145 (73.60%)	39 (46.99%)
BMI missing	12 (4.29%)	8 (4.06%)	4 (4.82%)
Smoker: Never	194 (69.29%)	137 (69.54%)	57 (68.67%)
Smoker: Current	44 (15.71%)	28 (14.21%)	16 (19.28%)
Smoker: Past	42 (15.00%)	32 (16.24%)	10 (12.05%)

Table 2

Results from multivariable logistic regression models for the relationship between root caries (total decayed/filled root surfaces) and hypocalbinemia (<4 g/dl) among a study population of Gullah African Americans with type-2 diabetes and normal kidney function ($N = 280$)

Parameter	Full multivariable model (Hosmer and Lemeshow Goodness-of-Fit Test: $P = 0.34$)					Final multivariable model (Hosmer and Lemeshow Goodness-of-Fit Test: $P = 0.24$)				
	β	SE	P	OR	OR 95% CI	β	SE	P	OR	OR 95% CI
Intercept	4.15	2.09	<0.05	–	–	4.97	1.38	<0.01	–	–
Root surfaces decayed/filled	0.03	0.04	0.39	1.04	0.96–1.12	0.04	0.04	0.33	1.04	0.96–1.12
Total teeth	–0.07	0.05	0.20	0.93	0.84–1.04	–0.07	0.03	0.01	0.94	0.89–0.99
Coronal surfaces decayed/missing/filled (DMFS)	–0.001	0.01	0.90	0.999	0.98–1.02	–	–	–	–	–
Age (years)	–0.03	0.02	0.09	0.97	0.94–1.004	–0.03	0.02	0.04	0.97	0.94–0.999
High-sensitivity C-reactive protein ($\log_e$ *mg/ml)	0.26	0.15	0.08	1.29	0.97–1.72	0.42	0.13	<0.01	1.53	1.17–1.99
Poor-controlled diabetes ($HbA_{1c} \geq 7\%$)	0.89	0.30	<0.01	2.43	1.36–4.35	0.91	0.29	<0.01	2.48	1.41–4.37
Urine microalbumin ≥ 30 mg/l	0.42	0.35	0.24	1.52	0.76–3.03	–	–	–	–	–
Glomerular filtration rate ≥ 60 ml/min/1.73 m ²	–0.83	0.58	0.15	0.44	0.14–1.35	–1.09	0.55	<0.05	0.34	0.12–0.98
Male	–0.39	0.36	0.28	0.68	0.34–1.37	–0.39	0.34	0.26	0.68	0.35–1.32
Current smoker	–0.47	0.42	0.26	0.62	0.27–1.42	–0.51	0.41	0.22	0.60	0.27–1.35
Past smoker	0.25	0.45	0.58	1.28	0.53–3.09	0.31	0.43	0.48	1.36	0.58–3.18
Overweight (25–30 BMI)	–0.56	0.52	0.28	0.57	0.21–1.59	–	–	–	–	–
Obese (>30 BMI)	0.51	0.49	0.29	1.67	0.65–4.32	–	–	–	–	–
BMI missing	0.27	0.82	0.74	1.31	0.26–6.58	–	–	–	–	–

Table 3

Results from multivariable logistic regression models for the relationship between root caries (total decayed and total filled root surfaces) and hypalbuminemia (<4 g/dl) among a study population of Gullah African Americans with type-2 diabetes and normal kidney function ($N = 280$)

Parameter	Full multivariable model (Hosmer and Lemeshow Goodness-of-Fit Test: $P = 0.26$)					Final multivariable model (Hosmer and Lemeshow Goodness-of-Fit Test: $P = 0.16$)				
	β	SE	P	OR	OR 95% CI	β	SE	P	OR	OR 95% CI
Intercept	4.33	2.10	0.04	–	–	5.19	1.39	<0.01	–	–
Root surfaces decayed	0.02	0.04	0.52	1.03	0.95–1.10	0.03	0.04	0.48	1.03	0.96–1.10
Root surfaces filled	0.90	0.59	0.13	2.44	0.77–7.84	1.04	0.60	0.08	2.81	0.87–9.10
Total teeth	–0.07	0.05	0.18	0.93	0.84–1.04	–0.07	0.03	0.01	0.93	0.89–0.99
Coronal surfaces decayed/missing/filled (DMFS)	–0.002	0.01	0.88	0.998	0.98–1.02	–	–	–	–	–
Age (years)	–0.03	0.02	0.07	0.97	0.94–1.002	–0.03	0.02	0.03	0.97	0.94–0.997
High-sensitivity C-reactive protein ($\log_e$ *mg/ml)	0.29	0.15	0.05	1.33	0.995–1.78	0.45	0.14	<0.01	1.57	1.20–2.06
Poor-controlled diabetes ($HbA_{1c} \geq 7\%$)	0.89	0.30	<0.01	2.44	1.35–4.39	0.91	0.29	<0.01	2.49	1.41–4.42
Urine microalbumin ≥ 30 mg/l	0.42	0.35	0.23	1.52	0.76–3.04	–	–	–	–	–
Glomerular filtration rate ≥ 60 ml/min/1.73 m ²	–0.92	0.58	0.11	0.40	0.13–1.24	–1.17	0.55	0.03	0.31	0.11–0.91
Male	–0.34	0.36	0.35	0.71	0.35–1.45	–0.34	0.34	0.33	0.71	0.36–1.40
Current smoker	–0.45	0.42	0.28	0.64	0.28–1.46	–0.48	0.42	0.25	0.62	0.28–1.40
Past smoker	0.17	0.46	0.71	1.19	0.49–2.90	0.21	0.44	0.64	1.23	0.52–2.93
Overweight (25–30 BMI)	–0.41	0.53	0.44	0.66	0.23–1.88	–	–	–	–	–
Obese (>30 BMI)	0.56	0.49	0.26	1.75	0.67–4.58	–	–	–	–	–
BMI missing	0.41	0.83	0.62	1.50	0.30–7.63	–	–	–	–	–