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THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Oral health and changes in weight and waist circumference among community-dwelling older adults in Brazil

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Achange in body weight is an important predictor of health outcomes[1] and has been associated with mortality.[2,3] According to Newman and colleagues,[3] weight loss is common in old age,[4] and even a modest decrease in body weight is an important independent marker of mortality risk in older adults. Moreover, there is limited and divergent evidence[2,5] that weight gain may be associated with increased mortality in older adults. Weight gain is considered an important predictor of increased risk of cardiovascular disease in young adulthood through middle age and into later life.[6] In addition to weight changes, increased abdominal adiposity measured by means of waist circumference (WC) has been shown to be a significant predictor of cardiovascular events[1] and mortality.[1,5]

Among the factors reported to be related to weight and WC changes is oral health status, in which there has been increasing interest owing to the high prevalence rates of tooth loss among older adults.[7] In Brazil, people 60 years or older represent approximately 11 percent of the population.[8] The results of the most recent Brazilian

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ABSTRACT

Background. The authors conducted a study to evaluate the association between changes in weight and waist circumference (WC) and oral health status among older adults in Brazil.

Methods. The study sample consisted of community-dwelling people representing the population 60 years and older in the city of São Paulo who were enrolled in the Health, Well-being and Aging cohort study. Changes in weight and WC were classified as stable (within 5 percent of the second-wave weight and WC), loss (5 percent or more decrease since the second wave) and gain (5 percent or more increase since the second wave). The following baseline characteristics were the independent variables: sociodemographic variables (age, sex and education), general health data (number of self-reported chronic diseases, physical activity, weight, WC and smoking status) and oral health (edentulism, need for dental prostheses).

Results. The incidence of weight (33.2 percent) and WC (35.3 percent) gain was higher than that of loss (13.5 percent and 10.6 percent, respectively). Neither weight nor WC gains were associated with dental status. The risk of weight and WC loss was higher among edentulous participants than among dentate participants.

Conclusion. The results of this study show that edentulism status was a significant predictor of weight and WC loss, independent of socioeconomic and general health status.

Practical Implications. Edentulism has a significant impact on weight and WC, which highlights the importance of an integrated approach to health care among health care professionals.

Key Words. Oral health; aging; waist circumference; tooth loss; body weight changes.
JADA 2014;145(7):731-736.

doi:10.14219/jada.2014.35

TABLE 1

Distribution of outcomes, according to covariates.

VARIABLE	WEIGHT			WAIST CIRCUMFERENCE		
	Loss, %	Gain, %	P Value	Loss, %	Gain, %	P Value
Age, in Years						
60-69	11.0	36.8		8.4	37.1	
70-79	16.4	28.5	.001	13.6	34.0	.040
≥ 80	25.7	17.3		18.5	23.9	
Education, in Years						
0-3	13.6	37.0		8.9	41.4	
4-7	14.5	31.4	.195	13.8	32.7	.014
≥ 8	11.0	28.0		7.7	26.8	
Sex						
Female	15.3	34.6	.042	11.2	37.2	.237
Male	10.4	30.8		9.5	32.1	
Smoking Status						
Never	13.6	34.4		11.3	34.4	
Former smoker	14.0	30.0	.753	9.6	34.2	.566
Current smoker	11.5	36.4		9.7	42.9	
Diseases						
0-1	9.8	37.0	.053	9.0	38.4	.184
≥ 2	16.6	30.0		11.9	32.8	
Physical Activity						
Yes	12.2	34.0	.095	10.6	36.8	.227
No	19.1	29.6		10.6	29.2	
Edentulism (Dental Status)						
No	9.3	35.8	< .001	7.0	36.1	.001
Yes	19.6	29.3		15.7	34.3	
Need for Dental Prostheses						
No	14.5	29.3	.124	11.8	33.9	.457
Yes	12.4	37.6		9.2	37.0	

oral health survey showed a mean of 27.53 decayed, missing and filled teeth among people aged 65 to 74 years; the missing teeth component accounted for 91.9 percent of the index, and 97.7 percent of the elderly people surveyed needed dental prostheses.[9]

Evidence indicates that impaired oral health is related to inadequate nutrient intake,[10] frailty,[11,12] nutritional status[13] and changes in weight.[14-16] With regard to weight, limited data from longitudinal studies support the associations between weight and oral health, and the available evidence from these studies is inconclusive. Some authors found that edentulous people had a greater chance of gaining weight in a single year,[15] whereas others found that edentulous people were more likely to

lose weight.[14] With regard to WC, the evidence is lacking regarding the association.

The aim of this prospective study was to evaluate the association between changes in two important predictors of mortality and cardiovascular diseases—weight and WC—and oral health status (dentate or edentulous with or without dentures) in a sample of community-dwelling older adults in Brazil.

METHODS

We carried out this prospective study by using data from the Survey on Health, Well-being and Aging (Saúde, Bem-estar e Envelhecimento [SABE]),[17] which is a multiple-cohort study that began in 2000 involving a multiple-stage probabilistic sample (n = 2,143) of people 60 years or older residing in the city of São Paulo. In 2006, researchers conducted a second wave of the study, in which 1,115 participants from the first wave were interviewed again and a new cohort was established. In 2010, the third wave was conducted by means of the same procedures as used earlier. Details pertaining to the study methodology are described elsewhere.[11]

We included participants for whom complete data were available for the covariates needed for analysis in the second and third waves (2006 and 2010). We omitted from analysis participants for whom data were missing regarding any of the variables. Thus, the final sample for our analysis of changes in weight consisted of 798 participants, which represents 648,806 elderly people in the city of São Paulo. The sample for the analysis of changes in WC consisted of 802 participants, representing 650,663 elderly people.

Trained interviewers from SABE collected all data at the participants' homes by means of a structured questionnaire that addressed socioeconomic variables, general health, living conditions and a set of anthropometric measures. Dentists who had undergone a training and calibration exercise performed the oral examinations at the participants' homes on the basis of World Health Organization criteria.[18]

Changes in weight and WC. We assessed weight by using calibrated digital scales in all waves, with the participants barefoot and wearing lightweight clothing. We measured WC by using a nonelastic anthropometric tape and recorded circumference to the nearest 0.1 centimeter at the midpoint between the iliac crest and lower rib. Trained nutritionists obtained two measures in each wave and recorded the mean value as the final measure. We classified changes in weight and WC at the third wave as stable (within 5 percent of the second-wave weight and WC), loss (decrease of 5 percent or more since the second wave) and gain (increase of 5 percent or

TABLE 2

Final multinomial logistic regression model for factors related to weight change among older adults.

VARIABLE	WEIGHT LOSS*	WEIGHT GAIN*
	Adjusted RRR† (95% CI‡)	Adjusted RRR (95% CI)
Age, in Years (Reference, 60-69)		
70-79	1.09 (0.61-1.96)	0.67 (0.47-0.95)§
≥ 80	1.46 (0.87-2.43)	0.35 (0.19-0.65)¶
Male Sex	0.70 (0.41-1.20)	0.79 (0.57-1.11)
Education, in Years (Reference, 0-3)		
4-7	1.18 (0.74-1.86)	0.77 (0.53-1.13)
≥ 8	0.97 (0.47-2.00)	0.66 (0.42-1.06)
Diseases (Reference, 0-1)		
≥ 2	1.47 (0.76-2.85)	0.85 (0.58-1.24)
Edentulism	2.11 (1.35-3.30)¶	0.87 (0.61-1.24)
Need for Dental Prostheses	1.27 (0.75-2.15)	1.42 (0.90-2.24)
No Physical Activity	1.72 (1.00-2.96)§	1.06 (0.67-1.66)
Weight	0.99 (0.98-1.01)	0.97 (0.96-0.99)¶

* Reference is stable category; n = 798 representing 648,806 people; final model adjusted for baseline weight; model $P < .001$.
† RRR: Relative risk ratio.
‡ CI: Confidence interval.
§ $P < .05$.
¶ $P < .01$.

TABLE 3

Final multinomial logistic regression model for factors related to change in waist circumference (WC) among older adults.

VARIABLE	WC LOSS*	WC GAIN*
	Adjusted RRR† (95% CI‡)	Adjusted RRR† (95% CI)
Education, in Years (Reference, 0-3)		
4-7	1.73 (1.07-2.80)§	0.68 (0.45-1.02)
≥ 8	0.96 (0.46-1.99)	0.47 (0.26-0.85)§
Age, in Years (Reference, 60-69)		
70-79	1.52 (0.90-2.56)	0.89 (0.58-1.37)
≥ 80	1.75 (0.92-3.34)	0.52 (0.29-0.94)§
Male Sex	0.90 (0.53-1.54)	0.88 (0.57-1.36)
Diseases (Reference, 0-1)		
≥ 2	0.99 (0.63-1.56)	0.85 (0.60-1.20)
Edentulism	2.54 (1.45-4.45)¶	0.94 (0.63-1.40)
Need for Dental Prostheses	1.09 (0.66-1.78)	1.13 (0.76-1.68)
No Physical Activity	0.83 (0.47-1.49)	0.81 (0.52-1.26)
WC	1.01 (0.99-1.04)	0.97 (0.95-0.99)¶

* Reference is stable category; n = 802, representing 650,663 people; model $P < .001$.
† RRR: Relative risk ratio.
‡ CI: Confidence interval.
§ $P < .05$.
¶ $P < .01$.

more since the second wave).[3]

Covariates. The independent variables in this study were baseline sociodemographic factors (that is, age, sex and years of education), baseline general health (that is, number of self-reported chronic diseases [diabetes mellitus, hypertension, heart disease, chronic obstructive pulmonary disease, osteoporosis, stroke and arthritis]), physical activity (150 minutes or more per week, according to the short form of the International Physical Activity Questionnaire[19]), baseline weight, baseline WC, smoking status (never smoked, former smoker or current smoker) and baseline oral health status (edentulism, need for dental prostheses). We determined prosthetic need according to the dentist's assessment of the need to insert or replace dental prostheses (fixed or removable).[18]

Statistical analysis. Statistical analysis involved descriptive and inferential analyses, with a 5 percent significance level and 95 percent confidence interval (CI). We tested associations among categorical variables by using Rao-Scott analyses.[20] We incorporated all independent variables with a P value of less than .20 in the bivariate analysis into a multinomial logistic regression model. This model is adjusted in the same way as is a binomial logistic regression, allowing simultaneous comparisons of the effects of independent variables with the dependent variable categories. We sorted the variables

according to P value and included them, one by one, according to the following blocks: sociodemographic data, general health and oral health. We adjusted the models for physical activity and baseline weight or WC. We kept in the model all of the variables included in the model that had a P value of less than .05 or that significantly adjusted the model. We tested the interaction between edentulism and need for dental prostheses, but the result was not significant.

We used statistical software (Stata, Version 11.0, StataCorp, College Station, Texas) for the analyses and performed a correction for the design effect by using the software's "survey" command for the analysis of data originating from a complex sample. We calculated new sample weights and used them to maintain the representativeness of the 2006 wave of the SABE study.

Ethical considerations. The human research ethics committee of the School of Public Health, University of São Paulo, approved this study. We obtained written, informed consent from all participants at the time of the at-home interview.

RESULTS

A total of 63.1 percent of the participants were female; 64.5 percent were aged 60 to 69 years and 6.1 percent
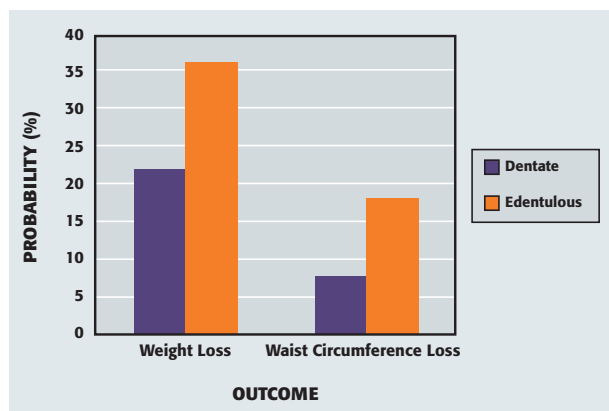
Figure. Probabilities of weight loss and waist circumference loss. Variables in the model included the following: age (80 years or older), education (0 to four years), two or more diseases, dental status, no physical activity, and mean weight (148.48 pounds [67.35 kilograms]) or mean waist circumference (36.02 inches [91.5 centimeters]).

were 80 years or older; and 42.5 percent had less than four years of education and 39.2 percent had four to seven years of education. With regard to health status, 54.1 percent of participants reported that they had two or more diseases, 81.2 percent were classified as being physically active, 55.3 percent reported that they had never smoked and 12.1 percent reported that they were current smokers. A total of 40.8 percent of participants were dentate and 47 percent had a need for dental prostheses.

A majority of the participants were stable with regard to weight (53.3 percent) and WC (54.1 percent). Moreover, the incidence of weight gain (33.2 percent) and WC gain (35.3 percent) was higher than that of weight and WC loss (13.5 percent and 10.6 percent, respectively).

Table 1 shows the distribution of outcomes according to the covariates. Changes in weight were associated with two sociodemographic variables (age and sex) and dental status. The proportion of weight gain was higher among women and those aged 60 to 69 years. A greater proportion of edentulous participants than of dentate participants lost weight. Changes in WC were associated significantly with age, education and dental status.

In the final multinomial logistic regression analysis (Table 2), the risk of experiencing weight loss was greater among edentulous participants (relative risk ratio [RRR], 2.11; 95 percent CI, 1.35-3.30) and those who reported less than 150 minutes of physical activity per week (RRR, 1.72; 95 percent CI, 1.00-2.96). Dental status was not associated with weight gain. The results show a lower risk of gaining weight with increasing age.

Table 3 displays the final multinomial logistic regression model for variables associated with changes in WC. The risk of WC loss was greater among participants with four to seven years of education (RRR, 1.73; 95 percent CI, 1.07-2.80) and among edentulous participants (RRR, 2.54; 95 percent CI, 1.45-4.45). WC gain was lower among

TABLE 4

Comparisons between study sample and participants who were lost to or excluded from follow-up.

VARIABLE	PARTICIPANTS LOST TO OR EXCLUDED FROM FOLLOW-UP	
	OR* (95% CI†) for Weight	OR (95% CI) for WC‡
Age, in Years (Reference, 60-69)		
70-79	1.40 (1.02-1.91)	1.40 (1.03-1.91)
≥ 80	4.39 (3.13- 6.16)	4.09 (2.91-5.75)
Education, in Years (Reference, 0-3)		
4-7	0.98 (0.76-1.25)	1.00 (0.78-1.28)
≥ 8	1.17 (0.83-1.65)	1.19 (0.85-1.67)
Male	1.51 (1.18-1.94)	1.53 (1.19-1.97)
Smoking (Reference, Current Smoker)		
Former smoker	0.78 (0.55-1.10)	0.77 (0.54-1.10)
Never smoked	0.58 (0.41-0.83)	0.57 (0.40-0.82)
Diseases (Reference, 0-1)		
≥ 2	1.11 (0.83-1.47)	1.09 (0.82-1.44)
No Physical Activity	1.95 (1.41-2.70)	1.93 (1.40-2.67)
Edentulism	1.58 (1.20-2.09)	1.56 (1.18-2.06)
Need for Dental Prostheses	1.06 (0.81-1.38)	1.04 (0.79-1.36)
Weight and WC	0.99 (0.98-1.00)	1.00 (1.00-1.01)
* OR: Odds ratio.		
† CI: Confidence interval.		
‡ WC: Waist circumference.		

participants with a higher level of education (RRR, 0.47; 95 percent CI, 0.26-0.85) and those 80 years or older (RRR, 0.52; 95 percent CI, 0.29-0.94).

The figure displays the estimated probabilities of experiencing losses in body weight and WC. The discrete difference in the probability of weight loss between dentate participants and edentulous participants was about 16 percentage points, and it was about 10 percentage points for WC.

DISCUSSION

The results of this study reveal that the incidence of weight and WC gain was higher than that of loss, which is in agreement with data showing a worldwide increase in obesity.[21] The findings also suggest that edentulism is an important predictor of weight and WC loss among community-dwelling older adults.

Investigators in previous studies used a cross-sectional design to evaluate the association between oral health and weight and WC,[22-24] with special attention given to obesity. However, the evidence from these studies is inconclusive. Some investigators found that dental status is an independent factor for obesity[23] or underweight,[25] whereas others found no independent associa-

tions.[24,26] Methodological differences may explain, in part, the inconsistent results in these studies. However, Östberg and colleagues[23] found an association between oral health and obesity irrespective of the number of teeth and obesity measure. To the best of our knowledge, no researchers have investigated the association between dental status and changes in WC prospectively, and researchers in only a few studies have addressed changes in body weight.

Although differences in time to follow-up and the percentage of change in weight and WC need to be taken into account, our findings are in agreement with data reported in studies in which researchers found an association between dental status and body weight.[14,16] Ritchie and colleagues[14] found that edentulism was an independent risk factor for significant weight loss over a one-year period after controlling for age, sex, dependency and comorbidities. Sullivan and colleagues[16] reported that an increase in the number of oral health problems increased the probability of participants' losing more than 10 percent of body weight in the year before hospital admission; however, they did not find any relationship between the presence of any specific oral health problem and weight loss.

According to our study results, there was no significant association between weight and WC changes and the need for dental prostheses among participants; thus, prosthetic rehabilitation alone did not prevent weight and WC changes over time after we adjusted for sociodemographic and general health factors. A possible explanation for this may be that, when not accompanied by dietary counseling, prosthetic rehabilitation is not significantly associated with changes in dietary quality[27]; Castrejón-Pérez and colleagues[12] suggested that this was one of the mechanisms underlying the association between oral health and changes in weight and WC. Hung and colleagues[13] conducted a longitudinal study, the results of which showed that tooth loss was associated with detrimental changes in diet, such as decreased consumption of fruits and vegetables. Other researchers found that the ability to eat with removable dental prostheses is not equivalent to that with natural teeth, as participants with removable dental prostheses demonstrated poorer nutrient intake in comparison with those who had natural teeth.[28]

With regard to weight and WC gain, our findings do not agree with those of Lee and colleagues,[15] who reported that edentulism was associated with weight gain of more than 5 percent in a one-year period after controlling for confounders. However, these confounders were not stated clearly and no mention was made of having adjusted for baseline weight. Bernardo Cde and colleagues[24] found that the association between number of teeth and both general and central obesity was independent of sex, monthly per capita income, self-reported diabetes and education; however, the statistical significance was lost after adjustment for age.

The main strength of our study lies in the prospective nature of the SABE study, which allowed investigation of predictors of changes in weight and WC. Moreover, we considered the selection of covariates that are common sociodemographic determinants of general and oral health to be appropriate; their use had an impact on the adjustment of the models and assisted us in identifying the role of oral health in the study outcomes. However, this study is limited by differences between the participants included in the analyses and those lost to followup, which may introduce bias when generalizing the findings. We found no differences in relationship to education, presence of diseases, weight and WC, but more participants who were lost to follow-up were older, male, smokers, inactive and edentulous than were participants included in the study analyses (Table 4).

CONCLUSION

Our study findings show that oral health status, as represented by edentulism, was an important, independent predictor of weight loss in older adults. Thus, although older adults may compensate for poor oral health in the presence of general health deterioration, edentulism may become a significant factor that contributes to weight loss.[16] Such weight loss leads to greater vulnerability to illness and mortality among older adults, because both weight loss[5] and poor oral health[29,30] have been reported to be risk factors for these adverse outcomes. ■

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