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Weight Gain Among Elderly Women as Risk Factor for Disability: Health, Well-Being and Aging Study (SABE Study)

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Abstract

Objective: To examine the association between weight change and the incidence of disability in activities of daily living (ADL) among elderly women. **Method:** In 2006, 227 women aged ≥75 years and independent in ADL were selected from SABE Study (Health, Well-being, and Aging) in Sao Paulo, Brazil. The dependent variable was the report of difficulty on ≥1 ADL in 2009. Differences in weight were calculated between baseline and second interview, and converted to percentage change in relation to initial weight. A change (gain or loss) ≥5% was considered significant. A logistic regression analysis was performed including sociodemographic and health-related variables. **Results:** After adjusting, weight gain remained associated to disability (OR = 2.42; p = .027), whereas weigh loss lost significance (OR = 1.66;

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p = .384). **Discussion:** Weight loss is generally considered more worrisome than weight gain in elderly. However, weight loss alone was not a risk factor for disability in our study.

Keywords

weight, elderly, nutrition, ADL, disability, SABE Study

Introduction

Disability increases with age, especially among elderly individuals aged 75 years or older, diminishing autonomy and quality of life. Disability is also predictive of hospitalization, institutionalization, and death and therefore increases the demand for health services and burden the health care system as a whole. Thus the identification of factors associated with disability is important to researchers and health care professionals for the establishment of prevention strategies and public policies (Andrade, Guevara, Lebrão, Duarte, & Santos, 2011; Li, 2005).

According to the literature, women are more prone to report disabilities in activities of daily living (Al Snih et al., 2005; Oman, Reed, & Ferrara, 1999). Results of the SABE (acronym in Portuguese and Spanish for Saúde, Bem-Estar e Envelhecimento [Health, Well-being, and Aging]) survey with regard to urban centers in Latin America and the Caribbean (Zunzunegui, Alvarado, Bèland, & Vissandjee, 2009) as well as the population of the city of Sao Paulo (Brazil) reveal that women have a greater prevalence of disability, as determined through both self-reports and objective physical tests (Barbosa, Souza, Lebrão, Laurenti, & Marucci, 2005). Moreover, despite their longer life expectancy, women experience more severe and prolonged disabilities than men (Andrade et al., 2011).

Excess weight and obesity are associated with a number of comorbidities in all phases of life, especially chronic diseases, such as diabetes, hypertension, heart disease, cancer, and osteoarthritis, and are also associated with a higher mortality rate and shorter life expectancy (Bray, 2004; Peeters et al., 2003; Manson et al., 1995; Must et al., 1999; Pi-Sunyer, 2002; Zamboni et al., 2005). Among elderly individuals, such chronic conditions can cause a greater occurrence of disabilities. Recent studies have demonstrated that excess weight is independently associated with limitations to mobility, which signifies difficulties in the performance of activities of daily living (Galanos, Pieper, Cornoni-Huntley, Bales, & Fillenbaum, 1994; Jensen & Friedmann,

2002; Lang, Llewellyn, Alexander, & Melzer, 2008; Launer, Harris, Rumpel, & Madans, 1994; Vincent, Vincent, & Lamb, 2010; Wee et al., 2011; Weil et al., 2002). On the other hand, progressive weight loss that increases with age is frequent, especially among very old people and is described as an important risk factor for adverse outcomes, including a greater risk of death.

While associations between nutritional status and illness among elderly individuals are widely described, the investigation into the association between disability and a change in weight over time is more recent. Some studies have demonstrated that weight fluctuations are associated with mortality to an equal or greater extent than nutritional status (Harris et al., 1997; Newman et al., 2001; Peters et al., 1995; Zamboni et al., 2005). More recent studies have investigated the association between weight fluctuations and disability (Al Snih et al., 2005; Chen, Bermudez, & Tucher, 2002; Fine et al., 1999; Launer et al., 1994). Some of these studies show that overweight elderly could benefit from some weight loss but some other studies show some controversy. Fine et al. (1999), for example, found that weight loss led to an improvement in physical function among women with a BMI above 30.0 kg/m², but a decline among those with a BMI < 25.0 kg/m². The opposite, in general, is hardly discussed—the effect of weight gain in older adults is unclear, except those with significant malnutrition.

The aim of the present study was to examine the association between changes in weight and the incidence of incapacity on activities of daily living (ADL) among elderly women in a representative population of the city of Sao Paulo, Brazil.

Method

Sample and Procedures

The data came from the SABE survey, which is a longitudinal study that began in 2000, involving a multiple-stage probabilistic sample of elderly individuals aged 60 years or older residing in the city of Sao Paulo (n = 2,143). In 2006, a second wave of the study was carried out, in which 1,115 of the participants from the first wave were interviewed again. Details on the methodology of the study are described elsewhere (Andrade et al., 2011; Lebrão & Laurenti, 2005).

In this second wave of the study, a subsample of 688 individuals aged 75 years or older was selected for a frailty study, which had a 3-year follow up, with an interview held in 2008 and another held in 2009. A total of 433 of these elderly individuals were women, 227 of whom had no limitations

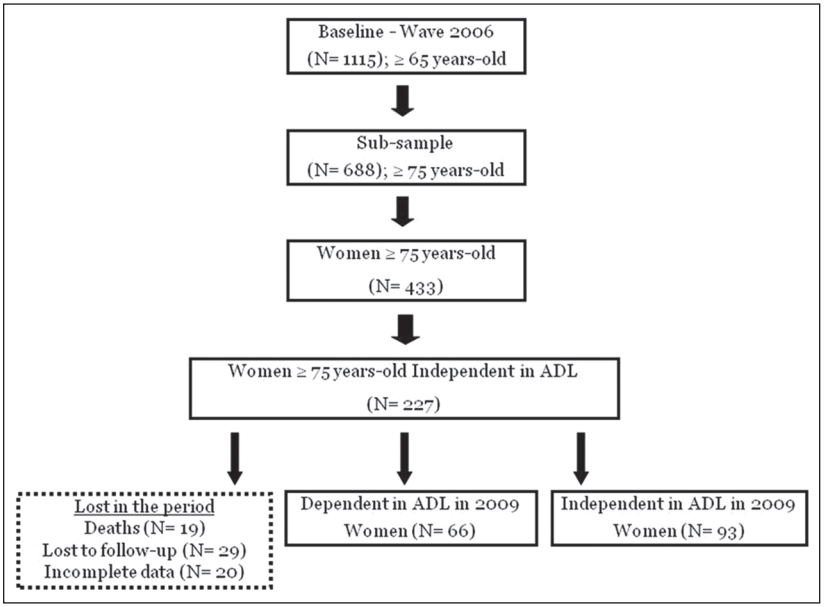

Figure 1. Status of the sample of older women, participants of SABE Study, from 2006 baseline to the end of follow-up

regarding ADL. Figure 1 displays the description of the final sample. From those individuals selected in baseline, 5 were excluded because they did not have complete anthropometric data.

The present study received approval from the Human Research Ethics Committee at the School of Public Health, University of Sao Paulo, and the National Committee for Research Ethics (CONEP). Participation was voluntary and all participants signed a statement of informed consent.

Measures

Disability was the dependent variable and was recorded when the participant reported difficulty on one or more ADL in 2009 for which no difficulty was reported in 2006 (baseline). The activities of daily living analyzed were walking across a room, dressing, bathing, feeding, transferring, and toileting. Despite its important with regard to functionality among elderly individuals, incontinence was not included because it does not necessarily imply physical limitation (Guralnik & Simonsick, 1993).

Body mass was measured by a trained interviewer using a calibrated scale, with the individual barefoot and wearing light clothing. Differences in weight were calculated between baseline, the 2008 interview and 2009 interview and converted to percentage change in relation to initial weight. A change (gain or loss) of 5% or more was considered significant. Changes of less than 5% were considered stable weight throughout the period (reference category).

Height was measured using stadiometer fixed to a plain wall, with the individual barefoot and wearing light clothing. Body mass index (BMI) was calculated by dividing body mass (in kilograms) by height (in meters) squared (Kg/m^2).

Grip strength was measured using a dynamometer (Takei Kiki Kogyio TK 1201, Japan), which was individually adjusted for hand size. The test was performed twice with the dominant upper limb, with a 1-min rest interval between tests. The larger of the two values was used for the analysis.

Sociodemographic and health-related variables measured at baseline were also included in the analysis.

Health status was assessed based on self-reported diabetes, hypertension, cancer, cardiovascular disease, osteoarticular conditions, chronic respiratory disease, stroke, and osteoporosis. These conditions were grouped into a morbidity load variable and categorizes as "no conditions," "one condition," and "two or more conditions."

Symptoms of depression were determined using the Geriatric Depression Scale, which has been validated for used on the Brazilian population, with the cutoff point set at ≥ 5 (Paradela, Lourenço, & Veras, 2005; Sheikh & Yesavage, 1986). Cognition was assessed using the translated version of the Mini-Mental State Exam (MMSE; Folstein, Folstein & McHugh, 1975). Cognitive decline was considered when the participant did not achieve the minimal expected score for her level of schooling, according to a score proposed specifically for the Brazilian population (Herrera-Junior, Caramelli, & Nitrini, 1998). The cutoff was 19 points for illiterate elderly; 23 points for those with 1 to 3 years of education; 24 points for those with 4 to 7 years of education; 28 points for those with 8 years of education or more. Difficulties regarding instrumental activities of daily living (IADL) were also included in the analysis and considered dichotomously (absence or presence), for which disability was recorded when the participant reported difficulty on one or more of the following items: using transportation, shopping, administering one's own money, using a telephone, controlling one's own medications, preparing hot meals, and performing household chores.

An additional variable was added to the analysis through the following question: "Have you lost weight in the last 12 months without dieting?"

"Unintentional weight loss" was recorded when participants answered affirmatively to the question and reported weight loss of three or more kilograms. Those who responded negatively to the question or had lost less than 3 kg did not receive this classification. This variable was collected at baseline and after the follow-up period, and the option to use at the follow-up is that it is referring to the same period in which weight change was evaluated in this study. We included this variable to adjust the regression model because other studies have shown that unintended loss can be associated with disability (Lee et al., 2005; Wannamethee, Shaper, Whincup, & Walker, 2000).

Statistical Analysis

For the descriptive analysis, mean and standard error values were calculated for the continuous variables and proportions were calculated for the categorical variables. Differences between groups were estimated using the Wald test of mean equality and the Rao-Scott correction, which considers sample weights for estimates with population weights (Rao & Scott, 1984).

The crude density of the incidence of disability in the 3-year period was calculated according to the weight change categories considering the participants who did not exhibit disability at baseline. For the calculation of incidence density, the numerator was made up of the number of individuals who developed difficulty on one or more ADL in the period studied and the observation times were summed in the denominator. In cases of death, the observation time was the interval between the 2006 interview and the date of death. For deaths with an unknown date, the observation time was the interval between the 2006 interview and a date attributed to the death based on the mean date of death of known cases in the same age group and gender. For those who did not develop disabilities, the observation time was the interval between the 2006 interview and the 2009 interview. For those who developed disabilities, the observation time was half the period between the 2006 and 2009 interviews. Refusals to participate, cases of institutionalization, and nonlocated individuals were excluded from the analysis.

Forward stepwise logistic regression analysis was performed for the assessment of factors associated to the development of disability in the period studied, incorporating those variables having achieved a p value $< .20$ in the univariate regression. Variables that remained significant ($p < .05$) or adjusted the odds ratio (OR) by at least 10% were maintained in the model. The inferences considered the design effect. The data analysis was performed using the Stata® program version 11.

Results

Table 1 displays the characteristics of the participants at baseline. Mean age was 80.9 years, BMI was 25.6 kg/m^2 and the participants had an average of 3.4 years of schooling. More than half had two or more diseases. Among the independent elderly women in 2006, 159 were followed through to the 2009 interview. No statistically significant differences were found in the characteristics of the individuals who were followed up through to the end of the study and those who were not.

The incidence density of disability was 192/1,000 women per year among those who had lost 5% or more of their baseline body mass, 171/1,000 women per year among those who had gained 5% or more of their baseline body mass and 103/1,000 women per year among those who had maintained their weight throughout the study period.

Table 1 displays the baseline characteristics of the women who had no difficulties on ADL and were followed up through to the end of the study period according to weight change classification. The majority of women maintained stable weight (57.2%), 15.1% lost 5% or more, and 27.7% gained 5% or more. The women who lost 5% or more of their baseline body weight were older and had less grip strength. Those who maintained their weight weighed more at baseline and had a lower frequency of depressive symptoms and hospitalizations in the previous year. Among those women who lost weight, 42, 7% referred unintentional weight loss in the 12 months preceding the follow-up. Among the weight change groups, few differences in baseline characteristics were found between the individuals who developed disability and those who remained independent (Table 2). Within the group with stable weight, the proportion of depressive symptoms at the beginning of the study was significantly higher among those who developed disability. In the group that lost weight, the proportion of individuals with cognitive decline was higher among those who did not develop disability (although this difference did not achieve statistical significance) and none of the individuals who developed disability had any chronic diseases at baseline. In the group that gained weight, the proportion of individuals with cognitive decline was greater among those who developed disability. The baseline hand grip strength was slightly lower in those women who developed disability, but this difference was not significant.

The incidence of disability was greater with regard to dressing (28.0%), followed by transferring oneself from a bed or chair (18.5%), walking across a room (17.2%), bathing (11.7%), toileting (7.1%), and feeding (4.6%). In

Table 1. Descriptive Sample Characteristics at the Baseline by Follow-Up Status (n = 227). São Paulo City, SABE Study, 2006

	Total (n = 227)	Followed (n = 159)	Died (n = 19)	Lost in period (n = 49)
Age, mean (IC95%)	80.9 (80.1-81.7)	79.6 (78.8-80.5)	80.6 (78.6-82.6)	80.0 (70.3-81.8)
Living alone (%)	28.4	26.5	56.6*	23.6
Education (years), mean (IC95%)	3.4 (2.7-4.1)	3.5 (2.7-4.3)	3.3 (1.5-5.1)	2.4 (1.2-3.7)
Body weight (kg), baseline, mean (IC95%)	59.3 (57.6-61.0)	59.9 (57.8-61.9)	52.6 (47.8-57.3)*	60.3 (53.1-67.5)
BMI (kg/m^2), baseline, mean (IC95%)	25.6 (24.9-26.4)	25.8 (25.0-26.7)	23.3 (21.3-25.4)*	25.9 (23.6-28.2)
Hand grip strength (kg), mean (IC95%)	17.3 (16.6-18.0)	17.4 (16.6-18.2)	16.4 (13.6-19.1)	17.3 (15.7-18.8)
Cognitive decline (%)	37.9	37.9	43.8	34.1
Depressive Symptoms (%)	9.8	9.1	2.7	18.0
Number of chronic conditions (%)				
No disease	18.2	16.9	30.2	18.7
One disease	29.6	29.2	21.3	38.5
Two or more diseases	52.2	54.0	48.5	42.7
Hospitalization, last 12 months, yes (%)	7.4	8.5	8.6	0.0*
Unintentional weight loss in follow up (%)	42.7	42.7	–	–

Note: Rao Scott and Wald tests were used. IC95% = Confidence interval (95%); BMI = body mass index.
*p < .05, difference in relation to followed group.

nearly all of these activities, the frequency of difficulty in 2009 was similar in the groups with weight gain and weight loss, except dressing, for which disability occurred in 44.3% of the women who had lost weight, 36.1% of those who had gained weight and 19.7% of those who had maintained their weight (p = .01).

Table 3 displays the results of the logistic regression. Both weight loss (OR = 3.38; p = .01) and weight gain (OR = 2.71; p = .01) were associated with a risk of disability. After adjusting for age, cognitive decline, difficulties on IADL, depression and unintentional weight loss, weight gain remained an independent factor associated with disability (OR = 2.42; p = .027), whereas weight loss lost its significance (OR = 1.66; p = .384).

Discussion

In the present study, weight loss was associated with the incidence of disability among elderly women but lost its significance when controlled for

Table 2. Descriptive Baseline Characteristics by 3-Year Weight Change and Incidence of ADL Disability in Nondisabled Older Women (*n* = 159). São Paulo City, SABE Study, 2006-2009

	Stable weight (*n* = 81)			≥ 5% weight loss (*n* = 28)			≥ 5% weight gain (*n* = 39)		
	Remained independent (*n* = 53)	Developed disability (*n* = 28)	*p* value	Remained independent (*n* = 14)	Developed disability (*n* = 14)	*p* value	Remained independent (*n* = 19)	Developed disability (*n* = 20)	*p* value
Age, mean (IC95%)	78.4 (77.2-79.5)	79.5 (77.6-81.3)	.271	83.1 (79.8-86.4)	84.0 (81.0-86.9)	.595	78.3 (76.9-79.8)	79.6 (77.3-82.0)	.292
Living alone (%)	23.0	36.7	.302	18.7	13.6	.729	23.2	24.0	.959
Education, years, mean (IC95%)	3.6 (2.9-4.4)	3.7 (2.1-5.4)	.947	3.5 (0.7-6.3)	2.2 (1.0-3.3)	.390	2.4 (1.0-3.9)	3.0 (1.4-4.5)	.608
Body weight (kg), mean (IC95%)	61.1 (57.8-64.3)	62.5 (56.1-68.9)	.697	63.3 (55.9-68.9)	54.0 (46.0-62.1)	.103	56.3 (51.6-60.9)	58.3 (51.5-65.1)	.606
BMI (kg/m^2), mean (IC95%)	26.3 (25.1-27.6)	27.0 (24.3-29.7)	.656	28.1 (24.1-32.1)	23.3 (20.0-26.5)	.067	24.4 (21.9-26.8)	25.3 (22.2-28.4)	.615
Hand grip strength (kg), mean (IC95%)	18.6 (17.1-20.2)	18.5 (17.3-19.8)	.922	15.6 (12.1-19.1)	14.4 (12.0-16.7)	.489	19.0 (16.4-21.7)	16.0 (13.8-18.1)	.090
Cognitive decline (%)	34.2	38.7	.703	65.6	35.2	.171	5.1	48.0	.008
Depressive Symptoms (%)	0.8	16.0	.001	18.8	7.3	.141	8.3	19.7	.241
Number of chronic conditions (%)			.293			.584			.813
No disease	12.5	16.6		5.1	0.0		27.0	23.5	
One disease	38.2	19.4		39.8	34.7		17.4	11.1	
Two or more diseases	49.3	64.0		55.0	65.3		55.6	65.4	
Hospitalization, last 12 months, yes (%)	3.5	6.6	.468	10.1	15.9	.713	8.7	26.0	.177
Unintentional weight loss in follow up (%)	13.1	21.9	.412	43.8	48.3	.821	0.0	11.1	.203

Note: Rao Scott and Wald tests were used. IC95% = Confidence interval (95%); BMI = body mass index.

Table 3. Logistic Regression Model for Incidence of ADL Disability of 3-Year Weight Change in Nondisabled Subjects at Baseline (n = 159). São Paulo City, SABE Study, 2006-2009

Variables	Unadjusted OR (IC95%)	Adjusted OR (IC95%)
Weight change		
Stable weight	1.00	1.00
≥ 5% weight loss	3.02 (1.22-7.48)	1.66 (0.52-5.36)
≥ 5% weight gain	2.42 (1.14-5.15)	2.42 (1.11-5.29)*
Age	1.10 (1.02-1.18)	1.05 (0.97-1.13)
IADL disability	2.14 (1.18 - 3.87)	1.67 (0.83-3.39)
Cognitive decline	1.50 (0.88-3.30)	1.21 (0.51-2.87)
Depressive Symptoms	4.05 (1.15-14.22)	2.87 (0.64-12.71)
Unintentional weight loss	1.92 (0.80-4.62)	1.77 (0.59-5.31)

Note: IC95% = Confidence interval (95%); OR = odds ratio; BMI = body mass index.
*$p < .05$.

other important factors, such as cognitive deficit, difficulties in the performance of IADL, depressive symptoms, unintentional weight loss, and age. In contrast, weight gain proved to be significant even after adjusting for these factors.

Currently, the same recommendation of weight loss is given to elderly individuals and young adults with excess weight. A number of studies have demonstrated that such a reduction may be beneficial for overweight elderly individuals. A study addressing indicators of cardiovascular risk found that individuals who lost weight exhibited improvement with regard to biochemical markers but a reduction in self-rated health status (Harris et al., 1997). Another study analyzing a cohort of approximately 40,000 nurses in the United States found that weight loss led to an improvement in physical function among women with a BMI above 30.0 kg/m², but a decline among those with a BMI < 25.0 kg/m² (Fine et al., 1999).

Other studies assessing changes in weight among elderly individuals contribute toward the controversial nature of the recommendation of weight loss in this age group. The long-term effects of weight loss among elderly individuals remain unknown, even among those who are overweight (Heiat, Vaccarino, & Krumholz, 2001; Somes et al., 2002; Willet, 1997). Researchers have found that the incidence of mobility limitations is greater among elderly individuals with unintentional weight loss, followed by those who experience fluctuations in weight, intentional weight loss, and weight gain (Lee et al.,

2005). The authors cited also state that weight loss apparently does not offer health benefits to elderly individuals, even those with excess weight at baseline, as those who maintain a stable weight have a lower incidence of disability.

The focus of most studies is the unfavorable effect of weight loss on the health of elderly individuals, especially very elderly individuals. Attention is not always given to weight gain in this group, which, based on the results of the present study, appears to be as worrisome as weight loss with regard to the development of disability. These results are in agreement with those reported in previous studies (Al Snih et al., 2005; Fine et al., 1999; Launer et al., 1994). A study involving a Latin population carried out in the United States reports a U curve between weight gain and disability among women, in which a weight gain of ≥ 0.23 kg per year was associated with a twofold greater risk of disability (Chen et al., 2002).

The mechanism by which fluctuations in weight may be involved in worsening the health and/or survival of elderly individuals remains unclear. An increase in body mass occurs beginning in middle age, especially among postmenopausal women. However, this weight tends to stabilize in elderly women, with a reduction occurring at older ages (Williamson, Kahn, Remington, & Anda, 1990). It is not known whether changes in weight in adult life are involved in this metabolic process. A study involving two groups of women (one aged 45 to 59 years and the other aged 60 to 74 years) found an association between a change in weight and disability only in the elderly group and not in the younger group (Launer et al., 1994). The sample in the present study was made up of women aged 75 years or older, which is an age group in which weight loss was expected. However, the proportion of women with weight gain in the period analyzed was greater than the proportion of those with weight loss. As the past weight history of the participants was unknown, the risk may be associated only with the change occurring at more advanced ages.

The role of weight gain in the disablement process in older people is not clear yet, although it is an important step toward early identification of those older people at highest risk of disability (Al Snih, Raji, Markides, Ottenbacher, & Goodwin, 2005). It has been suggested that the weight gain could contribute to disability through their associations with chronic conditions, but the associations found in our data are independent of this factor.

Fine et al. (1999) found that weight gain was associated with decreased physical function and vitality, and increased bodily pain among women of all ages and baseline, regardless of baseline weight and including women of normal weight. This increase in pain could be a mediator of the increased

difficulty in performing activities of daily living. Besides, weight gain in old people generally reflects a higher amount of total fat because of age-dependent loss of lean body mass (Zamboni et al., 2005). So, another possible pathway operating in this case could be this fat increase concomitantly with the loss of lean body mass, resulting in lower strength and greater difficulty for the motor performance of ADL disability. In our analysis, handgrip strength was not a significant predictor for disability although the grip strength of disability elderly was lower than those elderly that remained independent in the group that gained weight, as seen in Table 2.

The variables incorporated into the multiple logistic regression model were adjustment factors for the effect of a change in weight among the elderly women. Age was an important adjustment factor, as the increase in age per se is known to be one of the most important risk factors for disability (Beckett et al., 1996; Kaplan, Haan, & Wallace, 1999). Cognitive decline (as determined by the MMSE) was included as an indicator of mental health status. There is evidence in the literature of an association between cognitive impairment and the subsequent development of disability (Raji et al., 2004; Stuck et al., 1999). Moreover, symptoms of depression were included due to the very important statistical association in the univariate regression analysis and the fact that such symptoms are widely discussed as important risk factors for disability, even when controlled for other factors, especially the female gender (Bruce, Seeman, Merrill, & Blazer, 1994; Penninx et al., 1998; Stuck et al., 1999). Depression is also considered a determinant of changes in weight and one of the most important causes of weight loss among elderly individuals (Lankisch, Gerzmann, Gerzmann, & Lehnick, 2001; Wannamethee et al., 2000).

Disability on IADL normally occurs before the report of difficulties regarding ADL, as these activities are complex and involve multiple interlinked systems (Ramos, Perracini, Rosa, & Kalache, 1993). This variable demonstrated a statistically important association in the univariate analysis and was therefore maintained in the final model as an adjustment factor to control for the effect of the existing risk for the development of difficulties regarding ADL in the presence of previous impairment regarding IADL.

Weight loss among elderly individuals may or may not be intentional. Unintentional weight loss, which may stem from consumptive diseases or acute conditions, is associated with a greater risk of death and disability (Gregg, Gerzoff, Thompson, & Williamson, 2003; Wannamethee et al., 2000). Thus, this variable was included in the final model to control the possible confounding bias.

In the present study, baseline BMI was not associated with the incidence of disability, as reported in a number of studies cited herein. The incorporation of this control variable did not adjust or alter the results of the regression model. Thus it appears that weight gain per se may be harmful to the functional capacity of elderly individuals. The study carried out with a cohort of nurses (Fine et al., 1999) found a reduction in physical function with weight gain regardless of the initial weight or BMI.

The present study has limitations that should be addressed. Disability was measured based on self-reported information. While this may be a source of bias, a number of methodological studies have demonstrated that self-reported data on disability offer adequate validity and are consistent with medical diagnoses and/or the results of physical tests (Reuben, Siu, & Kimpau, 1992). Another limitation was the high proportion of losses throughout the study period. However, no statistically significant differences were found in the baseline characteristics of the women followed through to the end of the period and those lost during the study. Furthermore, it is not possible to know if caloric intake was constant, since food intake data were not quantitative in the questionnaire applied in baseline.

Conclusion

Weight gain is associated with a risk for disability in ADL among elderly women, independently of other risk factors. Health care professionals generally consider weight loss in elderly to be more worrisome than weight gain. However, weight loss alone did not constitute a risk factor for disability in the present study.

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