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ORIGINAL COMMUNICATION

Obesity and socioeconomic position measured at three stages of the life course in the elderly

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Objective: To investigate the association between socioeconomic position, measured at three stages of the life course, and obesity in the elderly.
Design: Cross-sectional study carried out in 2000–2001.
Subjects: In total, 4009 subjects aged 60 y and older, representative of the Spanish noninstitutionalised population.
Research Methods and Procedures: We estimated body mass index (BMI) and waist circumference (WC) by social class in childhood, by educational level and by adult social class, as well as the association between these two obesity measures and each socioeconomic characteristic after adjusting for the other two.
Results: In men, no relation was found between the two measures of obesity studied and socioeconomic circumstances throughout the life course. Nor was any relation found in women between social class in childhood and the two measures of obesity after adjusting for the other two socioeconomic variables. In contrast, BMI and WC in women showed a statistically significant inverse gradient with educational level and with adult social class after adjusting for age and the rest of the socioeconomic variables.
Conclusions: In general, these results support the small amount of existing evidence on the association between obesity and abdominal obesity and socioeconomic position by educational level and adult social class. The results for social class in childhood do not support the existing evidence, and suggest that this association may depend on specific historic and cultural circumstances.
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Keywords: obesity; body mass index; waist circumference; educational level; social class; socioeconomic life course

Introduction

During the last decades of the 20th century, a number of studies in the developed countries have shown an inverse association between socioeconomic status in adulthood and the prevalence of obesity. This gradient has been observed in both men and women, although the association has been weaker and less consistent in men (Sobal & Stunkard, 1989). These results have been observed with both educational level and occupation as the basis for social class, and in different age groups (Wamala *et al*, 1997; Ball *et al*, 2000; Lahmann *et al*, 2000; McMurray *et al*, 2000; Rosmond & Björntorp, 2000; Van Lenthe *et al*, 2000; Wardle *et al*, 2002).

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Other studies that have looked at the possible association between socioeconomic circumstances in childhood and the development of obesity in adulthood have also found that adverse socioeconomic conditions in childhood are associated with an increased prevalence of obesity in adulthood (Power *et al*, 1997; Hardy *et al*, 2000). For example, the classical study of social factors and obesity carried out in the adult population in the United States found an inverse association between socioeconomic level in childhood and the prevalence of obesity in adulthood (Goldblatt *et al*, 1965). This inverse association has also been observed in longitudinal and cross-sectional studies carried out in adolescents, young adults and older people (Bradon *et al*, 1986; Peckham *et al*, 1993; Blane *et al*, 1996a; Power & Matthews, 1997; Power *et al*, 1997; Brunner *et al*, 1999; Hardy *et al*, 2000; Lawlor *et al*, 2002).

Although few studies of this issue have been made in Spain, the results that have been found for educational level

and social class in adulthood confirm the conclusions of these investigations. Spanish studies of obesity, or of a closely related disease such as diabetes mellitus, show a strong inverse association in women: a higher prevalence of obesity and greater morbidity and mortality from diabetes mellitus in women with lower educational level and in women belonging to a low social class. In men, on the other hand, educational level and occupation-based social class show little or no association with obesity or with morbidity and mortality from diabetes mellitus (Gutiérrez-Fisac *et al*, 1996; Gutiérrez-Fisac *et al*, 2002; Regidor *et al*, 2002a, 2003). However, no studies have been carried out that evaluate the relation between socioeconomic circumstances in childhood and obesity in adulthood. Nevertheless, indirect evidence indicates that the relation found in other studies may not be confirmed in persons living in Spain. Specifically, one study found no relation between mortality from diabetes mellitus and socioeconomic circumstances in childhood (Regidor *et al*, 2002b).

To clarify the specific contributions of the different socioeconomic factors that act throughout life on obesity, it is necessary to carry out studies with information on socioeconomic circumstances at different periods in the life course. In this study, we investigate the association between socioeconomic circumstances in three periods of the life course and two measures of obesity in a sample of Spanish men and women aged 60 y and older.

Materials and methods

Source of data

The study was made in a sample of men and women representative of the Spanish noninstitutionalised population aged 60 y and older. Study subjects were selected through probabilistic multistage cluster sampling. Census sections were selected at random in each cluster, followed by individual households where information was then obtained from residents. A total of 4009 subjects (76% of those invited) participated and baseline data were collected between October 2000 and February 2001. There were no important differences between responders and a random sample of nonresponders in age (mean age 71.9 and 72.5 years, respectively), sex (56.6 and 59% of females, respectively) or educational level (percentage with primary studies or less 92 and 93%, respectively). The information was collected by personal interview using a structured questionnaire, followed by a physical examination to measure blood pressure and anthropometric characteristics. The study was approved by the Clinical Research Ethics Committee of the 'La Paz' 'University Teaching Hospital'.

Measures

The measures analysed in this study were body mass index (BMI) and waist circumference (WC). The BMI was calculated as weight (in kilograms) divided by height (in metres) squared. The anthropometric measurements, including weight, height and WC, were obtained by trained interviewers using standardised equipment and techniques (WHO, 1995a). Weight was measured to the nearest 0.1 kg using a calibrated electronic scale, with the subject wearing light clothing and in stocking feet. Height was measured to the nearest 0.1 cm using a portable wall stadiometer, with the subject in stocking feet. WC was obtained using a flexible, nonelastic belt-type tape, and was measured with the subject wearing light clothing. These anthropometric measures were validated by the investigators in a random sample of 100 persons. The intraclass correlation coefficients were 0.97 for weight, 0.92 for height and 0.89 for WC.

Socioeconomic circumstances

The variable used to reflect socioeconomic circumstances in childhood was father's occupation, which was grouped into four categories: (I) professional, managers, proprietors and clerical workers; (II) land owners; (III) skilled and unskilled blue collar workers and (IV) paid farm workers. The second variable was highest educational level attained by the subject. Educational level is an important marker of socioeconomic position, which reflects the transition from childhood and adolescence to adulthood and to a person's incorporation into the labour market (Lynch & Kaplan, 2000). Some authors consider it to be an indicator of material circumstances in childhood since educational level is strongly associated with parent's socioeconomic status (Davey Smith & Hart, 1998). However, education also acts as a predictor of a wide range of material and psychosocial conditions during adulthood (Ross & Wu, 1995; Blane *et al*, 1996b). Educational level was grouped into three categories: low, which included illiterate individuals and those who had not completed primary level education; medium, which included those who had completed primary level education; and high, which included those who had completed secondary or higher level education. The third variable, chosen to reflect adult socioeconomic circumstances, was the study subject's own (current or most recent) occupation. In women who had no occupation, the husband's occupation was used. Adult occupation was grouped into the same categories as father's occupation.

Of the 1741 men and 2268 women who participated in the study, only those with complete information on the three socioeconomic variables and the two measures of obesity were included in the analysis. The analysis of BMI included 90% of men and 84% of women, while the analysis of WC included 85% of men and 78% of women.

Statistical analysis

We first estimated the mean BMI and mean WC by each of the socioeconomic characteristics analysed. To evaluate the association between BMI and WC and each of the socio-

economic measures, we estimated the age-adjusted difference in BMI and the age-adjusted difference in WC by each socioeconomic variable as well the difference after adjusting for age and the rest of the socioeconomic variables. This difference was estimated by linear regression after transforming the variables into dummy variables. The 95% confidence intervals around the mean differences were estimated by multiplying the *z* score of the standardised normal deviation by the standard error of regression coefficients. Finally, we analysed social class and educational level as continuous variables, and we estimated the adjusted difference per increase in social class or educational level grade.

Results

The three socioeconomic measures used show little association, as can be seen in Table 1. Table 2 shows the mean and the mean difference of BMI and WC circumference by social class in childhood. In men, social class in childhood was not associated with either BMI or WC. In women, belonging to lower social classes in childhood was linearly associated with increased BMI and WC after adjusting for age, but the association disappeared after adjusting for the rest of the socioeconomic variables.

The results by educational level are shown in Table 3. In men, neither BMI nor WC was associated with educational level. In women, lower educational level was linearly associated with increased BMI and WC after adjusting for age. The association remained even after adjustment for social class in childhood and adulthood. The difference per increase in educational level grade, after adjusting for age and social class in childhood and adulthood, was 0.41 kg/m^2 for BMI and 1.30 for WC.

Table 4 shows the results obtained by social class in adulthood. Social class in adulthood showed no association with BMI or WC in men. In women, belonging to lower social classes in adulthood was linearly associated with increased BMI and WC after adjusting for age and for the other socioeconomic variables: the difference per increase in level of social class in adulthood was 0.39 kg/m^2 for BMI and 0.89 for WC.

Table 1 Spearmen correlation coefficients matrix for socio-economic variables*

	Men	*Women*
Childhood social class with educational level	0.25	0.20
Childhood social class with adult social class	0.36	0.31
Educational level with adult social class	0.37	0.24

*P for all figures <0.001.

Discussion

In Spanish men aged 60 y or older, no association was found between the two measures of obesity studied and socio-

Table 2 BMI and WC by childhood social class

	BMI (kg/m^2)				*WC (cm)*			
Childhood social class[a]	*Number of people*	*Mean*	*Age-adjusted difference (95% CI)*	*Age and SES adjusted difference (95% CI)*	*Number of people*	*Mean*	*Age-adjusted difference (95% CI)*	*Age and SES adjusted difference (95% CI)*
Men								
I	447	28.3	0.00	0.00	416	106.1	0.00	0.00
II	454	28.0	−0.32 (−0.91, 0.28)	−0.09 (−0.75, 0.57)	417	105.4	−0.78 (−2.15, 0.59)	−0.51 (−2.05, 1.03)
III	384	28.0	−0.44 (−1.04, 0.17)	−0.36 (−1.00, 0.28)	364	105.6	−0.67 (−2.10, 0.75)	−0.43 (−1.92, 1.06)
IV	298	28.8	0.51 (−0.14, 1.16)	0.57 (−0.15, 1.30)	280	107.1	0.95 (−0.58, 2.48)	0.87 (−0.84, 2.57)
Difference (95% CI) per increase in social class grade			0.10 (−0.10, 0.30)	0.10 (−0.12, 0.33)			0.23 (−0.25, 0.70)	0.21 (−0.31, 0.73)
Women								
I	525	29.2	0.00	0.00	491	110.0	0.00	0.00
II	562	29.2	−0.07 (−0.68, 0.53)	−0.50 (−1.16, 0.16)	501	109.9	−0.02 (−1.39, 1.35)	−1.13 (−2.63, 0.36)
III	490	29.6	0.20 (−0.42, 0.82)	−0.15 (−0.79, 0.49)	447	110.4	0.16 (−1.25, 1.58)	−0.63 (−2.08, 0.82)
IV	338	30.3	0.92 (0.23, 1.61)	0.15 (−0.59, 0.90)	316	112.3	2.11 (0.55, 3.67)	0.31 (−1.38, 1.99)
					1755			
Difference (95% CI) per increase in social class grade			0.28 0.06 0.49	0.06 −0.17 0.28			0.58 0.10 1.06	0.07 −0.45 0.59

[a]I. Professionals, managers, proprietors and clerical workers; II. land owners; III. skilled and unskilled blue-collar workers; IV. paid farm workers.
SES: educational level and adult social class.

Table 3 BMI and WC by educational level

Educational level	BMI (kg/m^2)				WC (cm)			
	Number of people	Mean	Age-adjusted difference (95% CI)	Age and SES adjusted difference (95% CI)	Number of people	Mean	Age-adjusted difference (95% CI)	Age and SES adjusted difference (95% CI)
Men								
High	294	28.4	0.00	0.00	275	106.5	0.00	0.00
Middle	579	27.9	−0.46 (−1.09, 0.17)	−0.31 (−0.99, 0.36)	538	105.2	−1.39 (−2.86, 0.07)	−1.19 (−2.78, 0.39)
Low	710	28.4	0.08 (−0.54, 0.69)	0.18 (−0.51, 0.87)	664	106.3	−0.15 (−1.57, 1.28)	−0.12 (−1.73, 1.50)
Difference (95% CI) per increase in educational level grade			0.12 (−0.17, 0.42)	0.17 (−0.16, 0.50)			0.15 −0.54 0.84	0.18 −0.59 0.95
Women								
High	157	27.9	0.00	0.00	152	107.3	0.00	0.00
Middle	658	29.7	1.83 (0.97, 2.69)	1.59 (0.70, 2.48)	606	110.2	2.94 (0.99, 4.90)	2.39 (0.37, 4.41)
Low	1100	29.6	1.85 (1.03, 2.68)	1.51 (0.63, 2.38)	997	111.1	4.05 (3.18, 4.93)	3.23 (1.23, 5.23)
Difference (95% CI) per increase in educational level grade			0.57 0.22 0.92	0.41 0.04 0.78			1.67 0.87 2.46	1.30 0.45 2.14

SES: childhood and adult social class.

Table 4 BMI and WC by adult social class

Adult social class[a]	BMI (kg/m^2)				WC (cm)			
	Number of people	Mean	Age-adjusted difference (95% CI)	Age and SES adjusted difference (95% CI)	Number of people	Mean	Age-adjusted difference (95% CI)	Age and SES adjusted difference (95% CI)
Men								
I	559	28.4	0.00	0.00	522	106.1	0.00	0.00
II	191	27.7	−0.63 (−1.37, 0.11)	−0.71 (−1.54, 0.12)	183	105.4	−0.62 (−2.33, 1.08)	−0.38 (−2.30, 1.54)
III	699	28.2	−0.19 (−0.69, 0.31)	−0.20 (−0.75, 0.35)	647	105.7	−0.41 (−1.57, 0.75)	−0.28 (−1.56, 1.00)
IV	134	28.4	0.16 (−0.70, 1.01)	−0.34 (−1.29, 0.61)	125	107.1	1.04 (−0.93, 3.02)	0.39 (−1.84, 2.61)
Difference (95% CI) per increase in social class grade			−0.02 (−0.23, 0.20)	−0.08 (−0.32, 0.17)			0.04 (−0.46, 0.54)	−0.02 (−0.59, 0.54)
Women								
I	655	28.9	0.00	0.00	614	109.1	0.00	0.00
II	271	29.3	0.62 (−0.10, 1.33)	0.64 (−0.14, 1.43)	253	110.3	1.65 (0.04, 3.27)	1.64 (−0.13, 3.40)
III	801	29.7	0.75 (0.23, 1.27)	0.55 (0.00, 1.09)	717	111.0	1.80 (0.61, 2.98)	1.39 (0.15, 2.63)
IV	188	30.9	2.08 (1.26, 2.91)	1.70 (0.81, 2.59)	171	113.7	4.66 (2.80, 6.53)	3.67 (1.65, 5.69)
Difference (95% CI) per increase in social class grade			0.51 0.30 0.73	0.39 0.15 0.62			1.18 0.69 1.67	0.89 0.36 1.43

[a] See Table 2.
SES: childhood social class and educational level.

economic circumstances throughout the life course. Nor did we find any association between social class in childhood and the two measures of obesity in Spanish women aged 60 y or older after adjusting for the other two socioeconomic variables. On the other hand, both BMI and WC in women showed an inverse gradient with educational level and with social class in adulthood after adjusting for age and the rest of the socioeconomic variables.

Comparison with other studies and possible explanations

Most studies have found an inverse association between socioeconomic level in childhood and obesity in adulthood after adjusting for socioeconomic circumstances in adulthood. The results of our study do not confirm the available evidence. It has been noted that circumstances in childhood can condition the appearance of obesity in adolescence and young adulthood as a result of certain lifestyles acquired in early life related with food intake and physical activity (Bradon *et al*, 1986; Power & Matthews, 1997). However, excessive food intake and, consequently, a positive energy balance, is subject to the availability of food. In our study, 85% of subjects were born between 1920 and 1940; thus, they were adolescents and young adults during a period of major rationing of basic food products due to Spain's economic stagnation between the Civil War in 1936–1939 and the end of the 1950s (Alonso & Conde, 1994). When food availability again increased beginning in the 1960s (Rodríguez Artalejo *et al*, 1996), the metabolic pattern of energy intake and expenditure in persons in the age cohorts studied was probably already established. This may explain the lack of an association between BMI and socioeconomic circumstances in childhood.

The factor that explains the largest proportion of the social variation in the prevalence of obesity in women is their reproductive history (Wamala *et al*, 1997), and in the age cohorts analysed in this study, women in the lowest educational levels had the highest fertility rate (Instituto Nacional de Estadística, 1995). This circumstance could also be one explanation for the results regarding BMI by educational level in women. Other circumstances that might have influenced the results observed should also be pointed out, such as physical activity, certain social and cultural factors, and a possible social mobility bias. High educational level has been shown to be strongly associated with leisure time physical activity (Shea *et al*, 1991; Luepker *et al*, 1993). It has also been suggested that family and social pressures to maintain a body image in accordance with predominant social values valuing slimness would exert a stronger effect in women with higher educational level (Sobal & Stunkard, 1989). In addition, different studies have shown that, regardless of social origin, women who are obese in adolescence attain a lower educational level than nonobese adolescents (Gortmaker *et al*, 1993; Sargent & Blanchflower, 1994).

With regard to the association between social class in adulthood and BMI, most studies that have examined this association in the adult population have consistently showed an inverse association between social class based on occupation in women and an ambiguous or lack of association in men (Sobal & Stunkard, 1989; Croft *et al*, 1992; Helmert *et al*, 1992; Blane *et al*, 1996a; Brunner *et al*, 1999; Ball *et al*, 2002). Similar to the results found in our study, an inverse association in women aged 60–79 y has also been shown between BMI and husband's occupation or own occupation if single, after adjusting for social circumstances in childhood (Lawlor *et al*, 2002).

In contrast, a lack of association between BMI and social class in adulthood was observed in men. Although the results were not statistically significant, men who were in social class I had the lowest BMI after adjusting for the other two socioeconomic variables. Similar results were found in a Spanish study that evaluated the association between occupation and mortality from ischaemic heart disease in men, when most of this age cohort was 20 y younger (Lostao *et al*, 2001). The relative risk of mortality from ischaemic heart disease in men 45–64 y of age in 1980 was 1.00 in upper level white-collar workers, 0.74 (CI 0.60–0.91) in lower level white-collar workers, 0.78 (CI 0.64–0.94) in manual workers and 0.51 (CI 0.42–0.63) in agricultural workers. In Spain today, as in most industrialised countries, ischaemic heart disease in men is more frequent in manual workers than in lower or upper level white-collar workers. Some authors maintain that the change in this association is probably due to the fact that manual workers used to be physically very active at work, which protected them against the disease; however, with increasing work automation, many of these occupations have become more sedentary (Kawachi & Marmot, 1998).

Some authors have noted that the physical activity required in manual occupations is responsible for the fact that the association between occupation-based social class and obesity is small or absent in men (Wardle *et al*, 2002). In women, there is a smaller gradient of physical activity by occupation, which does not offset the strong inverse association between occupation-based social class and obesity. In our study, this explanation may have contributed in greater measure to the results, given the low employment rate of Spanish women aged 60 y and above (Instituto Nacional de Estadística, 1995).

Very few studies have looked at the association between socioeconomic circumstances and WC and/or abdominal obesity. The 1992 Health Survey for England provided results on the population distribution in different age groups by waist-to-hip ratio, another indicator of abdominal obesity. The prevalence of abdominal obesity (male: waist-to-hip ratio >0.95; female: waist-to-hip ratio >0.8) in the population aged 65 y and older showed an inverse association with educational level and with social class in women, but this association was less clear or absent in men (Breeze *et al*, 1994). A recent study in British women aged 60–79 y did not

find an association between abdominal obesity and socioeconomic circumstances in childhood, but did find an inverse gradient with socioeconomic circumstances in adulthood (Power & Matthews, 1997). In addition, socioeconomic circumstances in childhood and adulthood showed an inverse association with waist size in adult women in a British study based on the Whitehall II cohort born between 1930 and 1953 (Brunner *et al*, 1997, 1999). In men, no association was observed with childhood socioeconomic circumstances, and the association with adult socioeconomic circumstances disappeared after adjusting for conditions in childhood (Brunner *et al*, 1997). In another study made in the adult population in Australia, the prevalence of abdominal obesity also showed an inverse association with socioeconomic circumstances in adulthood in women, but no association in men (Ball *et al*, 2002).

Our study confirms these findings to some degree: we found an association only with educational level and adult socioeconomic conditions in women. A study in the Spanish cohort between 26 and 69 y of age in the European Prospective Investigation on Cancer and Nutrition found that the variables that most strongly predict abdominal obesity are BMI and age (González *et al*, 2000). In this regard, our results on WC would be only an approximate reflection of the results found in the prevalence of obesity based on BMI.

Limitations of the study

This study evaluates the association between different socioeconomic circumstances throughout the life course and the prevalence of obesity in the population aged 60 y or older. With the information available, it was possible to estimate the effect of each socioeconomic variable after adjusting for the other two. Nevertheless, the variation in the socioeconomic characteristics used is small and, consequently, these socioeconomic variables may not be the most appropriate indicators to reflect the variation in socioeconomic circumstances throughout life in the elderly population (Barney & Blane, 1997). On the other hand, some subjects were excluded due to lack of information on all the socioeconomic variables—especially women, many of whom had no information on social class in adulthood. However, the estimates were similar when persons with missing information were included as an independent category in the analyses (data not shown).

Another limitation refers to the cross-sectional nature of the study. The differences in BMI and WC observed in persons aged 60 y and over are very small in relation to studies carried out in the adult population under 60 y of age. Given the association between obesity and mortality (Stevens *et al*, 1998), those who survive to 60 y of age or more may have a lower BMI and WC and, therefore, the probability of finding socioeconomic differences among these healthier subjects is relatively small.

Muscle mass usually decreases with ageing and, therefore, it might be questioned whether BMI and WC are appropriate measures of body weight in the elderly. Although this is a relatively new instrument and its interpretation may be more complex than in other populations, the use of anthropometry in the elderly is widely accepted (WHO, 1995b; Goodman-Gruen & Barrte-Conner, 1996; The Expert Subcommittee on the use and interpretation of anthropometry in the elderly, 1998), and it has been used in the most important nutritional studies (Fanelli *et al*, 2000).

The possible effects of other variables such as marital status, serious illness, and smoking and drinking habits are unknown in our study. However, the influence of lifestyles such as smoking and drinking must have been small: on the one hand, these social habits vary little among Spanish men aged 60 y or over and, on the other, the percentage of Spanish women in this age group who smoke or consume excessive amounts of alcohol is insignificant (Regidor & Gutiérrez-Fisac, 1999; Regidor *et al*, 2001).

In conclusion, this study shows a lack of association between socioeconomic circumstances throughout the life course and obesity in Spanish men aged 60 y or older. Obesity in Spanish women in this age group showed an inverse association with educational level and social class in adulthood and the lack of association with social class in childhood. The results regarding social class in childhood do not support existing evidence and suggest that this association may differ among places, depending on specific historic and cultural circumstances.

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