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Original article

# Contribution of lifestyle factors to educational differences in abdominal obesity among the adult population

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SUMMARY

*Background & aims:* This is the first study to systematically examine the behavioral factors that may explain the inverse association between education and abdominal obesity in adults.
*Methods:* Cross-sectional study conducted among 3541 men and 3564 women representative of the population aged 25–64 years in Spain. Abdominal obesity was defined as waist circumference >102 cm in men and >88 cm in women. Analyzes were performed with logistic regression, with progressive adjustment for obesity-related behaviors.
*Results:* The age-, sex- and town size-adjusted odds ratios for abdominal obesity were 1.69 in men and 1.85 in women among individuals with lowest versus highest education. After adjustment for all the studied behaviors, the odds ratio was reduced to 1.49 in men and to 1.45 in women. The factors with the largest contribution to the higher prevalence of abdominal obesity in individuals with lowest versus highest education were more time spent watching TV and less time spent in exercising, as well as a higher energy intake in women. Tobacco and alcohol consumption, physical activity at home, leisure walking, sedentary behaviors other than TV watching, and sleep duration did not explain the educational gradient in abdominal obesity.
*Conclusion:* Watching TV, physical exercise and energy intake explain a substantial part of the inverse association between education and abdominal obesity.


## 1. Introduction

Obesity is an important public health problem because of its high prevalence[1] and its association with a greater risk of many chronic diseases, disability and premature death.[2] However, obesity does not affect all population groups equally. In developed countries, including Spain, the frequency of obesity is particularly high among individuals with lower educational level (EL).[3–7]

Several conceptual frameworks have summarized the potential pathways linking lower EL and other indicators of low socioeconomic status (SES) with obesity.[7–10] In these frameworks, SES influences cultural and other contextual factors (e.g. values and beliefs about food and physical activity, price of food, social support, urban planning, etc.) which, in turn, affect specific behaviors that determine the altered energy balance resulting in weight gain.[7–9] In principle, the inverse association between EL and obesity could be explained by those behavioral risk factors for obesity that are more frequent in individuals with lower EL. These behaviors include tobacco and alcohol consumption, physical activity and sedentariness in different life domains, eating habits and diet quality, among others.[11,12]

Only a few studies have examined the behavioral factors that may explain the association between EL and obesity in adults.[13–19] Moreover, most of these studies included only a few lifestyle parameters, and none of them assessed the role of sedentary behavior. Sedentariness is distinct from lack of physical activity because the former refers to too much sitting rather to too little exercise[20]; also,

*Abbreviations:* EL, educational level; SES, socioeconomic status; WC, waist circumference; MD, mediterranean diet; MEDAS, Mediterranean Diet Adherence Screener; AE, association explained.

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there is evidence that sedentary behavior is an important risk factor for obesity.[21] Lastly, to our knowledge, no previous research has focused on abdominal obesity, which is the type of obesity that best predicts cardiometabolic risk and mortality.[22,23] While body mass index reflects fat mass in addition to lean mass, which is increased by physical activity, waist circumference (WC) only reflects fat mass; thus, abdominal obesity, as defined by a large WC, is particularly well suited to assess the role of different types of physical activity and sedentary behavior on the association between EL and obesity.

Accordingly, we have examined the contribution of a substantial number of behaviors to the educational differences in abdominal obesity in the adult population of Spain. This study is of interest because it may suggest some ways to reduce the educational disparities in obesity and, thus, to decrease the obesity burden in the population.

## 2. Methods

### 2.1. Study design and participants

The data were taken from the ENRICA study, whose methods have been reported elsewhere.[24] In brief, this is a cross-sectional study conducted from June 2008 to October 2010 among 12,948 persons who were representative of the population aged 18 years and older in Spain. Data collection was performed by trained and certified staff through a telephone interview on health status, lifestyle and health service use, a physical exam to obtain anthropometry, and a computerized dietary history to assess usual food consumption and eating habits.

Study participants provided written informed consent. The ENRICA study was approved by the Clinical Research Ethics Committees of the University Hospital La Paz in Madrid and the Hospital Clinic in Barcelona.

### 2.2. Study variables

#### 2.2.1. Education and abdominal obesity

Participants reported the highest EL achieved and were classified into three groups: primary, secondary, and university studies. WC was measured with participants lightly clothed using a flexible, inelastic belt-type tape. WC was deemed to be located at the midpoint between the lowest rib and the iliac crest, and was measured with standardized procedures.[24] Abdominal obesity was defined as WC $>$ 102 cm in men and $>$88 cm in women.[7]

#### 2.2.2. Lifestyles that may link educational level with abdominal obesity

In addition to age, sex, and size of the town of residence, we selected for this analysis a number of variables known to be associated with EL and obesity. Study participants were asked to report the consumption of tobacco (never, former, and current smoking) and alcoholic beverages. The average intake of alcohol was estimated using a validated computerized diet history, developed from that used in the EPIC-cohort study in Spain, which assesses the consumption of various alcoholic beverages in the preceding year.[24] Beverages considered were beer, wine, champagne, cider, sweet liqueurs, vermouth and the like, and spirits. For each type of beverage, a standard volume and mean alcoholic content were established. Binge drinking was defined as the intake of $\geq$80 g of alcohol in men and $\geq$60 g in women at any given drinking session (one evening or night) during the preceding 30 days.

We used the questionnaire of the EPIC-cohort study in Spain to assess physical activity at work, in leisure time, and at home. This questionnaire includes four categories of physical activity at work: sedentary occupation, standing, manual with some physical effort, and heavy manual. Physical activity in leisure time includes walking and the following types of exercise: running, cycling, football, aerobics, swimming, tennis, and gymnastics, while physical activity at home includes gardening, do-it-yourself operations, and various household chores such as cleaning, washing, cooking and caring for children. Finally, we also asked about the number of flights of stairs that the study participants usually climbed per day. To assess sedentary behavior, we used the Nurses' Health Study questionnaire, validated in Spain; this instrument asks about the time spent watching TV, seated in transportation, reading, and listening to music. We also asked about usual duration of night sleep.

Habitual food consumption in the previous year was ascertained with a computerized diet history.[24] Total energy intake was calculated using standard food composition tables. To assess accordance with the Mediterranean diet (MD) we used the Mediterranean Diet Adherence Screener (MEDAS). The MEDAS consists of 12 items with targets for food consumption, and another 2 items with targets for food intake habits characteristic of the MD in Spain. One point is given for each target achieved. The total MEDAS score ranges from 0 to 14, with a higher score indicating better MD accordance. Moreover, we asked about eating while watching TV and following a diet to lose weight.

Lastly, we also collected information on several variables that may modulate obesity-related behaviors,[8] including marital status, parity (in women), some eating habits (skipping meals, eating away from home, snacking), self-reported depression, and the mental summary dimension of the SF-12, a validated instrument to assess health-related quality of life.

### 2.3. Statistical analysis

Of the 12,948 study participants, we selected the 8142 individuals aged 25–64 years. This allows for a better evaluation of the association between EL and obesity, because the youngest participants may not have completed their studies and many older adults could not pursue a higher education, regardless of their SES, due to the harsh living conditions, including a civil war, during the first half of the XX century in Spain. We also excluded 193 individuals who could not read and write or had not completed primary education, and 844 with no information on some of the study variables. Therefore, the analyzes were conducted with 7105 individuals (3541 men and 3564 women).

To identify potential mediators of the association between EL and obesity, we examined whether the studied behaviors varied across the three categories of EL. We also assessed the association between each of the behaviors and obesity, by means of logistic regression. Only those behaviors that were simultaneously associated with EL and obesity may account for the EL–obesity association.

The association between EL and abdominal obesity was summarized with odds ratios (OR) and their 95% confidence interval (CI) obtained from logistic regression. University education was used as the reference category in the analyzes. First, we built a basic model with adjustment for sex, age and size of town of residence. Then we built a series of models with progressive adjustment for the following groups of behaviors: tobacco and alcohol consumption (average alcohol intake and binge drinking), physical activity (at work, leisure time, and at home), sedentary behavior (time spent seated while watching TV, in transportation, reading, and listening to music), sleep duration at night, and food consumption and eating habits (energy intake, accordance with MD, eating while watching TV, and dieting). Continuous variables were modeled in sex-specific quartiles.