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Socioeconomic determinants of abdominal obesity in Medellín, Colombia

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KEYWORDS

Nutritional status;
Abdominal obesity;
Waist circumference;
Socioeconomic Factors;
Social determinants of health;
Health inequalities;
Medellín;
Colombia.

ABSTRACT

Introduction: Excess weight associated with the distribution of body fat is one of the major risk factors for morbidity and mortality. This study analyzes data obtained from the survey "Food and Nutritional Profile of Medellín" carried out in 2010, aimed to establish some socio economic determinants of abdominal obesity.

Material and Methods: Study descriptive, cross-sectional, the sample consisted of 2719 households and 5556 adults, ages 18 to 64. Abdominal obesity was assessed as >80cm for females and >94 cm for males. The social and economic determinants analyzed were family monthly income measured as the capacity to cover a basic food basket (>USD777), educational level, social stratum measured by the house and neighborhood characteristics and occupational activity as measured by the National Department of Statistics of Colombia.

Results: The prevalence of abdominal obesity was 45%, higher in women than in men (55% *vs* 27%). Related to social determinants, abdominal obesity is higher in persons of low (OR 1,8; CI95% 1.4-2.2) and medium stratum (OR 1.6; CI95% 1.3-2.0). It affects persons with primary/ elementary educational levels (OR 1.9; CI95% 1.7-2.3) more than those of high school education (OR 1.5; CI95% 1.3-1.7). Likewise abdominal obesity is higher among those with a family income less than (USD777) –not enough to acquire the basic food basket– (OR 1.6; CI95% 1.3-1.9). In men family income shows no association with abdominal obesity.

Conclusions: For this population some social determinants of abdominal obesity are level of education, social stratum and family income.

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Determinantes socioeconomicos de la obesidad abdominal en Medellín, Colombia

PALABRAS CLAVE

Estado nutricional;

Obesidad abdominal;

Circunferencia de cintura;

Factores socioeconómicos;

Determinantes sociales de la salud;

Desigualdades en salud;

Medellín;

Colombia.

RESUMEN

Introducción: El exceso de peso asociado con la distribución de la grasa corporal es uno de los principales factores de riesgo para la morbilidad y mortalidad. Este estudio analiza los datos obtenidos de la encuesta "Perfil alimentario y nutricional de Medellín 2010", para establecer algunos determinantes socioeconómicos de la obesidad abdominal.

Material y Métodos: Estudio descriptivo, transversal: muestra conformada por 2.719 hogares y 5.556 adultos, entre 18 y 64 años. La obesidad abdominal se evaluó como >80cm para mujeres y >94 cm para hombres. Los determinantes sociales y económicos analizados fueron: ingreso mensual familiar medido por la capacidad para cubrir una canasta básica de alimentos (>USD777); el nivel educativo; el estrato social, medido por condiciones de la vivienda; la ocupación según la clasificación del Departamento Nacional de Estadística de Colombia.

Resultados: La prevalencia general de obesidad abdominal fue 45%, mayor en mujeres que en hombres (55% *vs* 27%); la obesidad abdominal fue mayor en personas de estrato bajo OR 1,8 (IC 95% 1,4-2,2) y medio OR 1,6 (IC 95% 1,3-2,0). Afecta a las personas con nivel educativo primaria OR 1,9 (IC95% 1,7-2,3) más que a aquellos con educación secundaria OR 1,5 (IC95% 1,3-1,7). También es mayor entre los que tienen un ingreso familiar inferior a (USD777) OR 1,6 (IC 95% 1,3-1,9). En los hombres la variable ingresos familiares no muestra asociación con la obesidad abdominal.

Conclusión: Para esta población, algunos determinantes sociales de la obesidad abdominal son el nivel de educación, el estrato social y el ingreso familiar.

CITA

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INTRODUCTION

Obesity constitutes an important risk factor in the development of cardiometabolic-related diseases. This is evident in the increase of different pathologies of chronic types, such as coronary heart disease, hypertension, diabetes mellitus, dyslipidemias, and various types of cancer[1,2]. In the last years abdominal obesity has became focus of analysis due to its association with most cardiovascular diseases as well as with all causes of mortality[3,4].

For classification of the nutritional status, the World Health Organization (WHO) recognizes Body Mass Index or BMI (obtained by dividing a person's weight in kilograms by the square of your height in meters: kg/m^2) as the gold standard to identify people at increased risk of adverse health effects associated with adiposity[2]. According to the WHO, *"overweight and obesity are the fifth highest risk factor of death worldwide, causing premature death in at least 2.8 million adults."* Moreover, 44% of the burden associated with diabetes is attributable to overweight and obesity; 23% of the burden at ischemic heart disease; and between 7% and 41% of that due to some cancers. In 2008, 1.5 billion adults (20 and older) were overweight *"In this group, more than 200 million men and some 300 million women were obese."*[5]

The fat body distribution is also an important risk factor of obesity-related diseases. Excess abdominal fat is associated with higher risk of cardiovascular disease and its assessment, using Waist Circumference (WC) indicators in centimeters, is an indirect marker of the abdominal fat mass (subcutaneous and intra-abdominal)[6,7]. The WC can help identify people who have an increased risk of cardiometabolic disease associated with obesity better than, solely, from a BMI measurement[7,8].

Although the literature reports extensive documentation on the growing prevalence of overweight and obesity, relative to BMI, there is not sufficient data concerning the WC and its determinants, which is a criterion of acknowledged

importance in the assessment of various diseases of chronic type[7-9]. Consequently, furthering the knowledge on this subject is of particular relevance from the public health perspective[10], given the implications in the profile of morbidity, mortality and quality of life of the population.

From an ecological perspective, it is probable that the "obesogenic" environment is the primary cause of recent obesity trends and its health disparities. The findings of the studies demonstrate the different prevalences of obesity by age groups, sex and socio-economic position; according to which, groups in unfavorable conditions are more likely to be affected negatively, relative to those with higher education level, type of occupation and family income[11].

Bearing in mind that the problems of excess weight are associated with various chronic diseases such as hypertension, dyslipidemias, insulin resistance, type 2 diabetes, coronary heart disease, osteoarthritis, and various types of cancers, we can say that the socio-economic differences in obesity contribute to the broadening of socio-economic health inequalities, with subsequent differentiation in health care costs, the loss of human capital and the decline in quality of life.

The nutritional status of the individual is part of their overall welfare, and any alteration influences in its integral functionality, in terms of physical performance, intellectual capacity, resistance to diseases, psychological status and, consequently, social interaction[12]. It transforms the nutritional condition into social disadvantage and inequality, if we take into account that the higher prevalence of under nutrition and overweight manifests itself in the poorest socio-economic class of the population[13]. So, in depth knowledge of the relationship between socio-economic and demographic variables and the prevalence of obesity increasingly becomes of greater interest. Inequalities in income, education and other socioeconomic indicators predict various sources of morbidity and mortality, as well as other risk factors relative to biologic and behavioral health related problems.

Some research has found inverse association between central obesity and Socio-Economic Status (SES), with stronger results in women than in men[14–16]. In other studies, however, association between major SES and greater central obesity has been found positive[17,18].

In Europe, a multicenter study in 10 countries (EPIC-PANACEA), found an inverse association in women between waist circumference and education level; with a mean less than 5.2cm in women with high educational level compared to those of lower education[14]. A similar situation is present in France (French Nutrition and Health Survey 2006), where women with lower educational level had higher risks of overweight, obesity and central obesity[15].

In Latin America, in a transversal study (Carmela), conducted in 7 capital cities, analysis of educational attainment in relation to the BMI and waist circumference revealed that women in countries with high Human Development Index (HDI) were shown to be in an inverse gradient between socio-economic level and abdominal obesity/body mass index. Accordingly, in countries with average HDI, results were not uniform; two cities showed an inverse gradient, while than two other cities had not[16].

According to results presented in Colombia by the National Survey of the Nutritional Situation[19], augmented waist cut-off points were recorded as: men ≥90cm and women ≥80cm; prevalences of abdominal obesity were found of 62% for women and 40% for men in the age group from 18 to 64 years. These sex differences are maintained, and increase with age and are higher in the population of 50 and 64 years (84.1% women compared to 60.1% men). Inequalities relative to obesity worsen for women when the socio-economic position is measured as educational attainment.

Central obesity and SES research seems to follow a path similar to that found by studies on BMI and SES, in reference to the level of development of the country, a trend that has associated low socio-economic status groups with obesity. Figueroa on the subject of BMI and SES proposed that the stage of development of each country (Gross Domestic Product) correlates with the probability of finding results that indicated inverse association, showing higher probability in the more developed countries[20].

In this study, we analyzed data from the study called "Food and Nutritional Profile of Medellín 2010" for the purpose of establishing in our own population whether the socio-economic variables determine differences in cardiometabolic risk, relative to abdominal obesity in adults. The study hypothesizes that abdominal obesity is associated with unfavorable socio-economic conditions measured by family income, education, occupation and socio-economic stratum.

MATERIAL AND METHODS

Medellín is the second largest city of Colombia, with a population of 2.2 million. It is territorially divided into two areas: urban and rural. The urban area is made up of *comunas* (similar to districts) which are the basic administrative and territorial unit. The rural areas are made up of small towns or *corregimientos*, which are spread out with an urban shell.

The city has 16 *comunas* (urban area) and five small towns (rural area).

Data were drawn from the "Food and Nutritional Profile of Medellín" study, conducted in 2010 by the local government of Medellín (Alcaldía Municipal) and Universidad de Antioquia. The type of the study was descriptive cross-sectional: the sampling process was multi-stage, stratified, and representative of the *comunas* and small towns *(corregimientos)* of Medellín. The study was carried out during the first half of 2010. The total sample consisted of 2719 households and 5556 adults between the ages of 18 to 64 (women 3431 and men 2125).

Each household was visited and a survey was administered to capture individual and socio-economic status data. The waist circumference (WC) and participants' age data was taken to all the present family members; and a follow-up visit was scheduled to take data from absent household members. The information was collected by students in eighth semester of the school of nutrition and dietetics, who received training for three weeks.

The waist circumference was measured with a nonretractile metric tape (MABIS), with a length of 150cm and a sensitivity of 0.1cm. This measurement was taken by marking the last rib and the top edge of the iliac crest on both sides, and at the midpoint of these two points the tape was situated, without squeezing the tissue of the skin. The reading of the measurement was conducted in an expiratory state.

To determine whether there was abdominal obesity, values were taken as a reference proposed by the WHO which defines normal values as "up to 79 cm for women and 93 cm for men"; high risk of metabolic complications values as between 80 and 87 for women and 94 to 101 for men. Further, higher values than those stated were considered very high risk of metabolic complications[21].

Explanatory variables

Socio-economic status was measured by the following: the educational level, occupation, family income and the social stratum. The level of education was established considering the highest degree completed, according to the following three groups: low (primary/elementary), medium (secondary/high school) and high (University and technological schooling complete or incomplete) respectively.

The occupation category was established according to the classification used by the National Department of Statistics (DANE) of Colombia in all the governmental surveys[22]; activities were grouped into the following sub-categories: worker without remuneration (informal/nonprofit); formal worker (income earners), employers, unemployed workers, students, home workers, retired, disabled and others.

The social stratum is a classification applied in all the Colombian cities, and it divides the population into six groups called strata, according to the characteristics of housing (construction materials) and the neighborhood environment (roads, public parks, transportation)[23]. The order sort is ascending: in "stratum one" are grouped homes and neighborhoods in most precarious conditions whereas those in "stratum six" are the better off. Information regarding the stratum, in which a family in Colombia falls under, is used to determine public utility pricing rules, the amount of tax to housing and state subsidies. In this study the six social strata were classified into three groups: low (strata 1 and 2), medium (strata 3 and 4) and high (strata 5 and 6).

The family's income is grouped into two categories: (i) below 1400.000 Colombian pesos at month (USD 777/month); (ii) those earning above 1400.000/month. The reason for utilizing this figure is because the price of the basic food basket in Medellín, for the 2010 year, is calculated at 570,000 Colombian pesos. According to Economic Commission for Latin American and Caribbean (stands for CEPAL in Spanish) Colombian families allocate between 30-40% of their income towards food[24]; thus, a family requires a monthly income of at least $1400.000 equivalent to (USD 777) to buy a basic food basket. The synthesis of the analyzed variables and its operation is presented in Table 1.

Ethical considerations

Protocol was reviewed and approved by the Comité de Bioética of Facultad de Odontología de la Universidad de Antioquia and Comité de Bioética Metrosalud (Municipal government of Medellín).

Data analysis

Statistical analysis was performed using the SPSS 17 program. Specific prevalences were identified for each of the explanatory variables. Initially, influences of each variable was established, and isolated. For this purpose, stratified ORs (Odds Ratio) were established, crude and adjusted by age, each with its corresponding confidence interval (95%). In each of the variables, a reference group was established that had a lower likelihood of suffering from abdominal obesity. To establish the social and economic determinants of abdominal obesity a logistic regression model was constructed, including the explanatory variables: educational level, family income; social stratum (housing conditions); occupation; adjusting by age and sex, with

Table 1. Description of the analyzed variables.

Variable	Operation
Age	18-30 (years) 31-44 45-64
Sex	Male Female
Educational level	Low (Elementary, completed or incompleted) Medium (High school, completed or incompleted) High (University/Technical college, completed or incompleted)
Family income	Below 1400000 (without food security) Above 1400000 (with food security)
Socioeconomic stratum	High (stratus five and six) Medium (stratus four and three) Low (stratus one and two)
Occupation	Student Informal worker (nonprofit) Employer Formal Worker (blue and White collar) Unemployed Retired Home worker Disabled/others

abdominal obesity as a dependent variable. A significance level of 0.05 was used.

The "Introduction" or "enter" method was used for the construction of a logistic regression model, in which the selection process of the variables was manual. In this method an initial model is set up, in which all the selected variables must be entered; evaluating and, consequently, removing the variable that least participated, reconstructing a new regression model by applying the same technique, excluding the selected variable and applying the same selection process. This process is repeated until it is considered that the retrieved model better fits the imposed conditions, and that no one variable can be deleted from that which composes it[25].

RESULTS

The sample mean age was 40 ± 15 SD. Abdominal obesity affects 45% of the population, ages 18 and 64. When compared by sex, prevalence is higher among women (55%) than men (27%). Women, also, showed to have greater prevalence of very high risk of metabolic complications, due to abdominal obesity (31%) (CI95% 29.6-32.7), relative to the high risk level (24%) (CI95% 22.8-25.7). In men, the proportion of high risk is greater (16%) (IC14, 6-17.8), relative to the very high risk level (11.4%) (CI95% 10.0-12.7). (Table 2)

Table 2. Descriptive characteristics.

Variable		Risk of metabolic complications					
		Normal		High risk		Very high risk	
		n	%	n	%	n	%
Sex	Male	1519	72,3	342	16,3	239	11,4
	Female	1489	44,5	812	24,3	1043	31,2
Age	18-30	1429	79,2	213	11,8	163	9
	31-44	725	53,2	344	25,2	295	21,6
	45-69	854	37,5	597	26,2	824	36,2
Socioeconomic stratum	Low	1441	54	550	20,6	677	25,4
	Medium	1243	54,9	489	21,6	534	23,6
	High	324	63,5	115	22,5	71	13,9
Educational level	Low	891	54,5	353	21,6	391	23,9
	Medium	1227	55,5	467	21,1	518	23,4
	High	706	56,8	251	20,2	286	23
Family income	> USD 777	848	60,9	296	21,2	249	17,9
	≤ USD 777	2144	53,3	854	21,2	1026	25,5
BMI status	Underweight	182	99,5	1	0,5	0	0
	Normal weight	2158	86,2	302	12,1	43	1,7
	Overweight	641	34	744	39,5	499	26,5
	Obesity	27	3,1	107	12,2	740	84,7

With regard to social and economic determinants, abdominal obesity is higher in persons of low (OR 1.8 CI95% 1.4-2.2) and medium stratum (OR 1.6 CI95% 1.3-2.0), related to those of high stratum. Differences exist between women and men. In men, adjusting for age, the medium stratum shows no association. Abdominal obesity affects persons with primary/elementary educational levels (OR 1.9; CI95% 1.7-2.3) in greater proportion than to those of high school education (OR 1.5; CI95% 1.3-1.7), and more so than those of highest education. Men in any of the categories show association. The probability of suffering from abdominal obesity is higher among those with a family income less than 1400.000 (USD777) –not enough to acquire the basic food basket– (OR 1.6; CI95% 1.3-1.9) in relation to those that earn higher incomes. In men family income shows no association with abdominal obesity. These results reveal a social gradient of abdominal obesity relative to the level of education, the social stratum and the family income affecting more women than men. (Table 3)

In relation to occupation, "student" was considered as a reference category. We found that even after controlling by age and sex, home workers (OR 4.2; CI95% 3.1-4.8) and those retired or disabled (OR 3.3; CI95% 2.2-4.9) show a greater risk of abdominal obesity. This behavior is similar for women and men. (Table 3)

A logistic regression with abdominal obesity as a dichotomous dependent variable, considering the simultaneous influence of the explanatory variables (sex, age, stratum, educational level and family income) was carried out to establish the social and economic determinants. We found that the educational level, family income, age, sex and some occupational categories continue to be statistically significant for increased risk of abdominal obesity. Accordingly, women, the elderly, those living in families with incomes below $1400.000 ($777) and those who have lower educational level have increased risk for abdominal obesity. In relation to occupation, the greatest risk of abdominal obesity was in employers, formal employees (income earners) and retirees.

Table 3. Correlation between socio-economics factors and abdominal obesity.

Variables/Categories		Male			Female			Total		
		OR Adjusted age	Confidence Interval of 95%		OR Adjusted age	Confidence Interval of 95%		OR Adjusted age and sex	Confidence Interval of 95%	
			Linf	Lsup		Linf	Lsup		Linf	Lsup
Age	18-30	1.0			1.0			1.0		
	31-44	3.4	2.6	4.6	2.8	2.3	3.5	3.0	2.6	3.6
	45-69	5.9	4.6	7.7	6.3	5.3	7.6	6.2	5.3	7.2
Socio-economic stratum	High	1.0			1.0			1.0		
	Low	0.7	0.5	0.9	3.0	2.3	3.9	1.8	1.4	2.2
	Medium	0.8	0.5	1.1	2.3	1.7	3.0	1.6	1.3	2.0
Educational level	High	1.0			1.0			1.0		
	Low	0.9	0.7	1.2	3.0	2.4	3.7	1.9	1.7	2.3
	Médium	0.8	0.6	1.0	2.1	1.7	2.5	1.5	1.3	1.7
Occupation	Student	1.0			1.0			1.0		
	Informal worker	2.1	1.2	3.6	1.7	1.1	2.4	1.7	1.2	2.3
	Formal worker	3.1	1.7	5.4	3.1	2.0	4.7	2.8	2.0	3.9
	Employer	5.8	2.5	13.4	1.1	0.4	2.6	2.6	1.4	4.6
	Unempoyed	1.3	0.7	2.4	1.8	1.1	2.9	1.4	0.9	2.0
	Home worker	2.4	1.2	4.8	3.4	2.4	5.0	4.2	3.1	5.8
	Retired	3.9	2.0	7.5	3.0	1.8	4.9	3.3	2.2	4.9
	Disabled / Others	1.5	0.8	3.1	2.0	1.1	3.8	1.5	0.9	2.3
Family Income	> 1400000 (USD 777)	1.0			1.0			1.0		
	≤ 1400000	0.9	0.6	1.2	2.3	1.8	2.9	1.6	1.3	1.9

When the variables are considered simultaneously, the variable stratum ceases to be statistically significant. (Table 4)

DISCUSSION AND CONCLUSIONS

The overall prevalence of abdominal obesity is 45%. We found higher prevalences in women than in men (55% *vs* 27%), and in the age group between 45 and 64 years. The prevalence of women classified at very high risk of metabolic complications category is also greater than in men (31% *vs* 11%).

The most significant finding of this study is that the social structure has a strong effect on the distribution of abdominal obesity. It was found that having a low educational level, living in houses built with precarious materials and/or in under-equipped neighborhoods and having a low family income (not able to ensure food security) increase the probability of abdominal obesity.

The prevalences of total abdominal obesity, in men as in women, almost tripled those of obesity (measured as BMI>30) in the same age group in Medellín which are 11% in women, and 19% in men respectively[26]. This means that a significant percentage of the population does not have obesity, but can be at risk for metabolic problems, with very serious consequences in terms of morbidity and mortality.

Table 4. Correlation between socio-economic factors and abdominal obesity. Results of logistical regression.

Variables		CI. 95% / EXP(B)		
	Sig.	Exp(B)	Inferior	Superior
Schooling	**0,002**			
Low	0.000	1.560	1.219	1.996
Medium	0.008	1.324	1.077	1.627
Socioeconomic stratum	**0.758**			
Low	0.899	0.977	0.688	1.388
Medium	0.810	1.040	0.755	1.432
Income (<=1'400.000/mo.) (USD 777)	**0.025**	**1.325**	**1,035**	**1.696**
Occupation	**0.000**			
Informal (no income)	0.020	1.545	1.070	2.233
Formal (income)	0.000	2.385	1.599	3.558
Employer	0.007	2.585	1.300	5.143
Unemployed	0.867	0.962	0.610	1.516
Home worker	0.000	2.205	1.503	3.235
Retired	0.000	2.484	1.570	3.931
Disabled/Other activities	0.356	1.294	0.749	2.238

Some of the findings of this investigation are similar to those of studies performed in several Brazilian cities, where, in general, there was a higher prevalence of abdominal obesity in women, and among those older than 40 years old[27–31]. The Brazilian studies also agree with our findings of a relationship between lower educational level and higher probability of abdominal obesity in women (28-32). However, not all of the studies found a relationship between the same variable and low income[27,30].

A possible explanation on the association between abdominal obesity and low income not found in other studies could be due to the fact that in our study, instead of defining several income categories, we defined a cut-off point needed to buy the basic food basket. Also, this investigation used a system of stratification of the population according to the household and neighborhood conditions that is not used in other countries.

Another study in Colombia, within the frame of the IDEA project (International Day for Evaluation of Abdominal Obesity)[32], evaluated both male and female with ages between 18 and 80, who attended medical consultation at 105 healthcare centers in two half days. That study also found a higher prevalence of abdominal obesity in women than in men, but with lower proportions (45% & 25% respectively). They also found a higher probability of abdominal obesity in women with low educational level, while the association was the opposite for men. In another study in Cali, Colombia, among a male population with ages between 18 and 65 who worked at a manufacturing industry, the prevalence of abdominal obesity was similar to the one we found (28%) and they found an association between abdominal obesity and workplace absenteeism[33].

The social conditions of Medellin are mirrored in some findings of this study: the city has a 0.52 Gini index[34] demonstrating inequality and also high levels of poverty, violence and residential segregation. These structural determinants are expressed by intermediary factors as conditions of housing, endowment of neighborhoods, access to education and family income[35–40].

The combination of social inequality and poverty has resulted in the enchaining of low level of education, unemployment and low incomes. Studies carried out in

Medellín have shown that higher education has been a vehicle to overcome poverty in a segment of the population. In turn, it is one of the most decisive factors in ensuring job procurement in the formal economy, which is also stable and has better remuneration[41]. Similarly, it has also been established that people with higher education levels tend to have better health-related habits; and, among women, have greater achievements in the care of the children's health[42]. But, access to higher education is of the social benefits most unequally distributed in Medellín. Only 30% of young people between 18 and 24 years have access to higher education[41]; among the poorest population, over 18 years only 10% has some level of higher education.

Residential segregation merits special mention: it is in poor areas where the levels of violence (expressed as homicides) are highest[43]. Although there are no specific studies in the case of Medellín on this subject, researches carried out in other countries demonstrate that in neighborhoods with higher levels of insecurity, people tended to engage in less physical activity. Thus a disadvantageous economic situation is aggravated by the constraints for practicing physical activity, even if there is available equipment to do so.

Based on the results, we consider indispensable the strengthening of municipal policy of access to higher education. It is also necessary to increase availability of healthy foods in the poor neighborhoods, so geographical constraints and the cost of transportation does not exacerbate nutritional status problems of these families. In the field of research, it is important to deepen the knowledge about the availability and use of recreational and physical activity facilities by the inhabitants of the areas with higher levels of violence, in order to establish the association between these two factors.

Weaknesses and strengths of the study

Among the weaknesses of the study is that it was a cross-cutting research with a single measurement of the phenomenon. Another limitation was the use of the classification established by DANE (Government entity responsible for measurements on employment and unemployment in Colombia) to the variable occupation; this decision was taken because the study "Food and nutritional profile of Medellín 2010" was a research requiring comparability with governmental parameters. DANE Classification Board in the category "self-employed worker" encompasses to independent professionals with high incomes, with people working in the informal economy. In the category formal employment are those who work for a company, independent of income that accrued, i.e. from managers to those who perform manual work. In this way the category occupation does not mirror the type of activity carried out –in the field of authority, or physical or emotional– waste or income.

This research has several strengths: is the first time that is carried out in the city of Medellín and was representative of their *comunas* and small towns (rural). It shows the way in which the social structure determines the distribution of health, in this case the abdominal obesity problems. This contribution is even more valuable because Colombia is a country with high inequality and this is a primarily urban phenomenon. Research provides information for policy makers know accurately the magnitude of the problem, its main affected and some of their social and economic determinants.

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COMPETING INTERESTS

The authors state that there are no conflicts of interest in preparing the manuscript.

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BIBLIOGRAFÍA

1. Bogers RP, Bemelmans WJ, Hoogenveen RT, Boshuizen HC, Woodward M, Knekt P, et al. Association of overweight with increased risk of coronary heart disease partly independent of blood pressure and cholesterol levels: a meta-analysis of 21 cohort studies including more than 300000 persons. Arch Intern Med. 2007; 167(16): 1720–8.
2. World Health Organization. Obesity: preventing and managing the global epidemic. WHO Technical Report Series. 2000; 894.
3. Zhang C, Rexrode KM, van Dam RM, Li TY, Hu FB. Abdominal Obesity and the Risk of All-Cause, Cardiovascular, and Cancer Mortality Sixteen Years of Follow-Up in US Women. Circulation. 2008;117(13):1658-67.
4. Casanueva FF, Moreno B, Rodriguez-Azeredo R, Massien C, Conthe P, Formiguera X, et al. Relationship of abdominal obesity with cardiovascular disease, diabetes and hyperlipidaemia in Spain. Clin Endocrinol. 2010; 73(1): 35-40.
5. Organización Mundial de la Salud. Obesidad y Sobrepeso. Nota descriptiva 311 [portal en Internet]. Geneve: 2011 Mar [cited 2011 Dic 5] Available from: http://www.who.int/mediacentre/factsheets/fs311/es/index.html
6. Pouliot MC, Despres JP, Lemieux S, Moorjani S, Bouchard C, Tremblay A, et al. Waist circumference and abdominal sagittal diameter: best simple anthropometric indices of abdominal visceral adipose tissue accumulation and related cardiovascular risk in men and women. Am J Cardiol. 1994; 73(7): 460–8.
7. Klein S, Allison DB, Heymsfield SB, Kelley DE, Leibel RL, Nonas C, et al. Waist Circumference and Cardiometabolic Risk: a Consensus Statement from Shaping America's Health: Association for Weight Management and Obesity Prevention; NAASO, the Obesity Society; the American Society for Nutrition; and the American Diabetes Association. Obesity (Silver Spring). 2007; 15(5): 1061-7.
8. Ascaso JF. La cintura hipertrigliceridémica. Clin Invest Arterioscl. 2005; 17: 286-96.
9. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. Circulation. 2009; 120(16): 1640-5.
10. World Health Organization. Diet, Nutrition, and the Prevention of Chronic Diseases. Joint WHO/FAO Expert Consultation. WHO Technical Report Series. 2003; 916.
11. Law C, Power C, Graham H, Merrick D. Obesity and Health Inequalities. Obes Rev. 2007; 8(Suppl 1): 19-22.
12. Cadavid M, Zapata M, Aguirre D, Álvarez M. Intelligence quotient of school-aged children enrolled in public schools located in the northeast and northwest areas of Medellin based on the level of household food security and socioeconomic conditions. Rev Chil Nutr. 2011; 38(4): 392-403.
13. Jiménez Z. El análisis de las necesidades relacionadas con la seguridad alimentaria y nutricional de la población de un territorio determinado, desde la perspectiva de los determinantes sociales. Módulo 2 Diplomado; Gestión municipal en seguridad alimentaria y nutricional. Observatorio de Seguridad alimentaria y nutricional Universidad Nacional de Colombia; 2006.
14. Hermann S, Rohrmann S, Linseisen J, May AM, Kunst A, Besson H, et al. The association of education with body mass index and waist circumference in the EPIC-PANACEA study. BMC Public Health. 2011; 11: 169.
15. Vernay M, Malon A, Oleko A, Salanave B, Candice R, Szego E, et al. Association of socioeconomic status with overall overweight and central obesity in men and women: the French Nutrition and Health Survey 2006. BMC Public Health. 2009; 9: 215.
16. Boissonnet C, Schargrodsky H, Pellegrini F, Macchia A, Marcet Champagne B, Wilson E, et al. Educational inequalities in obesity, abdominal obesity, and metabolic syndrome in seven Latin American cities: the CARMELA Study. Eur J Prev Cardiol. 2011; 18(4): 550-6.
17. Pandey RM, Gupta R, Misra A, Misra P, Singh V, Agrawal A, et al. Determinants of urban–rural differences in cardiovascular risk factors in middle-aged women in India: A cross-sectional study. Int J Cardiol. 2013; 163(2): 157-62.
18. Yoo S, Cho HJ, Khang YH. General and abdominal obesity in South Korea, 1998–2007: gender and socioeconomic differences. Prev Med. 2010; 51(6): 460-5.
19. Ministerio de la Protección Social, Instituto Nacional de Salud, Instituto Colombiano de bienestar familiar. Encuesta Nacional de la situación Nutricional en Colombia (ENSIN) 2010.
20. Figueroa, D. Obesidad y pobreza: marco conceptual para su análisis en Latinoamérica. Saúde Soc. 2009; 18(1): 103-17.
21. World Health Organization –WHO– (1997). Obesity: Preventing and Managing the Global Epidemic: Report of the WHO Consultation of Obesity. Geneva: World Health Organization.
22. Departamento Administrativo Nacional de Estadistica. Gran encuesta integrada de hogares. [cited 2014 May 15] Available from: https://www.dane.gov.co/files/noticias/presentacion_lacea_medellin.pdf
23. Alzate MC. La estratificación socioeconómica para el cobro de los servicios públicos domiciliarios en Colombia ¿Solidaridad o focalización?. [Internet]. Bogotá D.C.: CEPAL, Naciones Unidas; 2006 [Cited 2014 May 17]. Available from: https://www.dane.gov.co/files/geoestadistica/Estratificacion_Solidaridad_CEPAL.pdf
24. Alonzo H. Mancero X. Escalas de equivalencia en los países de América Latina. [Internet]. Santiago de Chile: CEPAL, Naciones Unidas; 2011 [Cited 2013 June 21]. Available from: http://www.eclac.org/cgi-bin/getProd.asp?xml=/publicaciones/xml/4/43554/P43554.xml&xsl=/deype/tpl/p9f.xsl&base=/ddpe/tpl/top-bottomudit.xslt
25. Kleinbaum D, Kupper L, Muller K, Nizam A. Applied regression analysis and other multivariable methods. Third edition. NY: Duxbury Press; 1998.
26. Álvarez LS, Goez JD, Carreño C. Factores sociales y económicos asociados a la obesidad: los efectos de la inequidad y de la pobreza. Rev Gerenc Polit Salud. 2012; 11(23): 98-110.
27. 27. Porto C, Da Silva A, Kruze I, Batista M, Cabral Poliana, De Souza L, et al. Prevalência e fatores associados à obesidade abdominal em indivíduos na faixa etária de 25 a 59 anos do Estado de Pernambuco, Brasil. Cad Saúde Pública. 2011; 29(2): 313-24.
28. Anselmo M, Nácul L, Soares J, Petrucci D, Menezes A, Macedo S. Níveis de intervenção para obesidade abdominal: prevalência e fatores associados. Cad Saúde Pública. 2006; 22(6): 1207-15.
29. Ferreira T, Vinicius M, Santos D, Firpo G, Peres M. Fatores associados à obesidade central em adultos de Florianópolis, Santa Catarina: estudo de base populacional. Rev Bras Epidemiol. 2011; 14(2): 296-309.
30. Da Silva R, Lessa B, Petrucci D, Soares J, Anselmo M. Distribuição de obesidade geral e abdominal em adultos de uma cidade no Sul do Brasil. Cad Saúde Pública. 2012; 28(3): 438-48.

31. Ferreira H, Moura A. Prevalência e fatores associados à obesidade abdominal e ao excesso de peso em adultos maranhenses. Rev Bras Epidemiol. 2010; 13(3): 400-12.
32. Ruiz A, Aschner P, Puerta M, Alfonso R. Estudio IDEA (International Day for Evaluation of Abdominal Obesity): prevalencia de obe obesidad abdominal y factores de riesgo asociados en atención primaria en Colombia. Biomédica. 2012; 32(4): 610-6.
33. Agredo R, García E, Osorio C, Escudero N, López C, Ramírez R. Obesidad abdominal y ausentismo por causa médica en una empresa de la industria metalmecánica en Cali, Colombia. Rev Peru Med Exp Salud Publica. 2013; 30(2): 251-5.
34. Ipsos Public Affairs. Encuesta de Percepción Medellín Cómo Vamos 2010. Medellín: 2010.
35. Marmot M. The status syndrome. How social standing affects our health and longetivity. 1.a ed. New York: Times Book; 2004.
36. Navarrro V. What we mean by social determinants of health. Glob Health Promot. 2009; 16(1): 5-16.
37. Social epidemiologic alternatives: Sociopolitocal and psychosocial frameworks. En: Krieger N. Epidemiology and the people´s health. Theory and context. 1.a ed. New York: Oxford University Press, 2011. p. 163-201.
38. Krieger N. Theories for social epidemiology in the 21st century: an ecosocial perspective. Int J Epidemiol. 2001; 30(4): 668-77.
39. Muntaner C, Sridharan S, Solar O, Benach J. Agaisnt injust global distribution of power and money. The report of the WHO Commision on social determinants of health. Global inequality and the future of public health policy. J Public Health Pol. 2009; 30(2): 163-75.
40. Kawachi I. Daniels N, Robinson DE. Health disparities by race and class: Why both matter. Health Aff. 2005; 24(2): 343-52.
41. República de Colombia. Banco de la República. Educación superior: Mercado laboral urbano y retos del sistema universitario colombiano. [cited 2014 June 15] Available from: http://www.banrep.gov.co/docum/Lectura_finanzas/pdf/sgg_1.pdf
42. Dekker LH, Mora-Plazas M, Marín C, Baylin A, Villamor E. Stunting associated with poor socioeconomic and maternal nutrition status and respiratory morbidity in Colombian schoolchildren. Food Nutr Bull. 2010; 31(2): 242-50.
43. Cerdá M, Morenoff J, Hansen B, Tessari J, Duque L, Restrepo A, et al. Reducing violence by transforming neighborhoods: A natural experiment in Medellín, Colombia. Am J Epidemiol. 2012; 175(10)15: 1045-53.