

Artículo de revista:

Castro, Paula A.; Spijker, Jeroen & Recaño Valverde, Joaquín (2024). "Adult Obesity in Colombia from the Sociodemographic and Public Health Perspective: A Scoping Review." *Revista Gerencia y Políticas de Salud*, 23. <https://doi.org/10.11144/Javeriana.rgps23.aocs>



Adult Obesity in Colombia from the Sociodemographic and Public Health Perspective: A Scoping Review*

Obesidad en adultos en Colombia desde la perspectiva sociodemográfica y de salud pública: una revisión sistemática exploratoria

Obesidade em adultos na Colômbia sob a perspectiva sociodemográfica e de saúde pública: uma revisão sistemática exploratória

Received: 03 de october de 2023. Accepted: 15 de April de 2024.

DOI: <https://doi.org/10.11144/Javeriana.rgps23.aocs>

Paula Andrea Castro^a

Centre d'Estudis Demogràfics- CERCA y Universitat Autònoma de Barcelona, España
ORCID: <https://orcid.org/0000-0003-1333-7983>

Jeroen Spijker

Centre d'Estudis Demogràfics- CERCA, España
ORCID: <https://orcid.org/0000-0002-3957-9553>

Joaquín Recaño Valverde

Centre d'Estudis Demogràfics- CERCA y Universitat Autònoma de Barcelona, España
ORCID: <https://orcid.org/0000-0002-7105-5768>

Cómo citar: Castro, P. A., Spijker, J. y Recaño Valverde, J. (2024). Adult Obesity in Colombia from the Sociodemographic and Public Health Perspective: A Scoping Review. *Revista Gerencia y Políticas de Salud*, 23. <https://doi.org/10.11144/Javeriana.rgps23.aocs>

^a Autora de correspondencia. Correo electrónico: pcastro@ced.uab.es



Abstract

Introduction: In Colombia, the prevalence of adult obesity continues to increase. However, there is no evidence from reviews compiling the related literature from a sociodemographic and public health perspective. Objective: A scoping review of studies was undertaken to identify and describe the sociodemographic and public health dimensions of adult obesity in Colombia. Methodology: Articles were searched using the electronic databases PubMed, Scielo, and Lilacs, focusing on papers published between 2000 and 2021. The following criteria for inclusion were adopted: studies on obesity in adults over 18 years of age in Colombia; transversal, longitudinal, and quasi-cohort studies; and ecological and/or panel-type research carried out in Colombia. Results: Twenty-one studies were included in the scoping review. These were classified into five categories: designs and methods; the prevalence of obesity; sociodemographic variables such as educational levels and occupation; practices of public health interest; associated pathologies and health variables. According to the Newcastle-Ottawa scale, 76.2 % (n=16) of the studies were high quality and 23.8 % (n=5) of average quality. Conclusions: This scoping review highlights determinants such as socioeconomic status; education; environment; and public health diseases associated with the onset of obesity. Notably, no longitudinal, quasi-, or synthetic cohort studies were found. This research gap signals an opportunity for future investigations to explore this uncharted dimension of analysing obesity in Colombia, characterised by unique ethnic, cultural, and socioeconomic particularities. This distinct context sets it apart from other Latin American countries, offering valuable insights for further exploration.

Keywords: Adult, Obesity, Demography, Colombia, Socioeconomic Level, Review.

Resumen

Introducción: En Colombia, la prevalencia de la obesidad en adultos sigue en aumento. Sin embargo, no existe evidencia de revisiones que recopilen la literatura relacionada desde una perspectiva sociodemográfica y de salud pública. Objetivo: Se realizó una revisión sistemática exploratoria de distintos estudios con el fin de identificar y describir las dimensiones sociodemográficas y de salud pública de la obesidad en adultos en el país. Metodología: Se buscaron artículos en las bases de datos electrónicas PubMed, Scielo y Lilacs, publicados entre 2000 y 2021. Se adoptaron los siguientes criterios de inclusión: estudios sobre obesidad en adultos mayores de 18 años en Colombia; estudios transversales, longitudinales y cuasi-cohorte, y estudios ecológicos o tipo panel realizados en Colombia. Resultados: Se incluyeron veintiún (21) estudios en la revisión. Se clasificaron en cinco categorías: diseños y métodos; prevalencia de la obesidad; variables sociodemográficas como niveles educativos y ocupación; prácticas de interés en salud pública, y patologías y variables de salud asociadas. Según la escala de Newcastle-Ottawa, el 76,2 % (n=16) de los estudios fueron de alta calidad y el 23,8 % (n=5) de calidad media. Conclusiones: Esta revisión sistemática exploratoria destaca determinantes como el estatus socioeconómico, la educación, el entorno y las enfermedades de salud pública asociadas con la aparición de la obesidad. Es notable que no se encontraron estudios longitudinales, cuasi-cohorte o cohortes sintéticas. Esta brecha de investigación señala una oportunidad para futuras investigaciones que exploren esta dimensión del análisis de la obesidad en Colombia, caracterizada por particularidades étnicas, culturales y socioeconómicas únicas. La particularidad del contexto podría diferenciarlas de otros países latinoamericanos, y ofrecer valiosos conocimientos para futuras exploraciones.

Palabras clave: Adulto, Obesidad, Demografía, Colombia, Nivel Socioeconómico, Revisión.

Resumo

Introdução: Na Colômbia, a prevalência da obesidade em adultos continua aumentando. No entanto, não existe evidência de revisões que compilam a literatura relacionada sob uma perspectiva sociodemográfica e de saúde pública. Objetivo: Realizou-se uma revisão sistemática exploratória de diferentes estudos com o objetivo de identificar e descrever as dimensões sociodemográficas e de saúde pública da obesidade em adultos no país. Metodologia: Foram buscados artigos nas bases de dados eletrônicas PubMed, Scielo e Lilacs, publicados entre 2000 e 2021. Foram adotados os seguintes critérios de inclusão: estudos sobre obesidade em adultos maiores de 18 anos na Colômbia; estudos transversais, longitudinais e quasi-coortes, e estudos ecológicos ou de painel realizados na Colômbia. Resultados: Foram incluídos vinte e um (21) estudos na revisão. Eles foram classificados em cinco categorias: desenhos e métodos; prevalência da obesidade; variáveis sociodemográficas como níveis educacionais e ocupação; práticas de interesse em saúde pública; e patologias e variáveis de saúde associadas. De acordo com a escala de Newcastle-Ottawa, 76,2% (n=16) dos estudos eram de alta qualidade e 23,8% (n=5) de qualidade média. Conclusões: Esta revisão sistemática exploratória destaca determinantes como o status socioeconômico, a educação, o ambiente e as doenças de saúde pública associadas ao surgimento da obesidade. É notável que não foram encontrados estudos longitudinais, quasi-coortes ou coortes sintéticas. Esta lacuna de pesquisa sinaliza uma oportunidade para futuras pesquisas que



explorem esta dimensão da análise da obesidade na Colômbia, caracterizada por particularidades étnicas, culturais e socioeconômicas únicas. A particularidade do contexto poderia diferenciá-las de outros países latino-americanos e oferecer conhecimentos valiosos para futuras explorações.

Palavras-chave: Adulto, Obesidade, Demografia, Colômbia, Nível Socioeconômico, Revisão.

Introduction

According to the World Obesity Atlas, the adult obese rate was 15 % in 2020, with a higher prevalence among women than men (17 % vs. 13 %). By 2030, this rate is expected to increase to 18 % (1). Specific biological and social determinants influence the onset of this pathology. In biological terms, for example, these factors include excessive energy consumption relative to energy expenditure (2), physical inactivity, genetic effects, and gene-environment interactions. Among the social aspects, environment, socioeconomic situation, residential segregation, access to health services, transport, and social support all play a role in this malnutrition by excess (3). Obesity is also associated with metabolic conditions, including insulin resistance (4) and the onset of arterial hypertension (5).

In Latin American countries such as Colombia, the prevalence of adult obesity continues to increase. In 2005, 13.7 % of adults were classified as obese (6), but by 2015, the figure had risen to 18.7 %. Notably, obesity was more prevalent among women (22.4 %) than men (14.4 %). Additionally, significant disparities in obesity rates were observed across different socioeconomic groups, with the highest prevalence found among individuals with medium (20.5 %) and low (19.4 %) wealth index, compared to those with high (18.6 %) or very low (16.8 %) wealth index, respectively. Furthermore, when considering race/ethnicity, the Afro-Colombian group had the highest prevalence at 22.9 %, significantly surpassing the figures for indigenous people (14.9 %) and others (predominantly mestizo) (18.5 %) (7). Meanwhile, a prognostic study foresees that, by around 2030, shifts from being overweight to being obese will sharply increase among adults of the lowest socioeconomic status (8).

Based on this statistical background, this scoping review seeks to answer five questions related to the literature on adult obesity in Colombia from 2000 to 2021: 1) What has been the reported prevalence in the studies conducted? 2) What study designs, methods and measures have been used? 3) What demographic and socioeconomic variables have been included in the studies? 4) What were the practices of public health interest linked to the evidence? 5) Which pathologies have been included in the studies? Addressing the above questions aims to identify and describe the sociodemographic and public health dimensions of adult obesity in Colombia. This information will highlight gaps in the literature that need to be closed to support the development of public health policies. Such policies are essential for promoting healthy lifestyles and preventing non-communicable diseases.

Methodology

This study, in the form of a scoping review, helps to identify the types of evidence available, clarify key concepts and characteristics related to an idea and to recognise and analyse knowledge gaps (9) as in the case with adult obesity in Colombia. It is important to note that some nutritional events, such as food choices and food environments, have been studied using this methodology (10,11). We followed the guidelines established in the PRISMA statement to ensure a replicable process (12).

The search, which accepted works in English and Spanish, was conducted on April 27 2021, in PubMed and on May 4 2021, in Scielo and Lilacs. It included the following search terms: “Obes* AND Colombia”; “BMI AND Colombia NOT Obes”; “IMC AND Colombia NOT Obes”; Adiposity AND Colombia NOT Obes*” and was restricted to papers published between 2000 and 2021 because we considered it an appropriate cut-off year based on the availability of nutritional status data in the country. Mendeley was the software used for managing the references, removing duplicates, and obtaining complete documents for review.

Regarding inclusion criteria, original articles were included if they described: 1. Any study of obesity in adults over 18 in Colombia; 2. Any transversal, longitudinal, cohort, quasi-cohort, ecological, or panel study of Colombia. The following criteria were used to exclude articles from the review: 1. Studies concerning children and young people under 18 years of age; 2. Clinical studies due to difficulties in generalising findings resulting from selection or rigidity in intervention strategies and case-control research because the time frame between exposure and pathology was not always easy to establish; 3. Studies about pregnant women; 4. Studies of the student population (i.e., school and university); 5. Studies conducted outside of Colombia, as the aim of this review is to understand the phenomenon of obesity based on the conditions of this country.

Concerning variables of interest, the following were included:

Nutritional status variables: Body Mass Index (BMI), obesity, abdominal obesity, waist circumference, and body adiposity index.

Health variables: Physical activity practice and associated comorbidities.

Demographic variables: Sex, age, and racial/ethnic group.

Socioeconomic variables: Occupation, educational level, and Socioeconomic Status (SES). In Colombia, SES is a variable that is not classified at the individual level but by dwelling strata, denominated as 1. Low-low; 2. Low; 3. Medium-low; 4. Medium; 5. Medium-high; and 6. High. Of these, strata 1, 2, and 3 correspond to lower levels encompassing small, lower-quality dwellings with limited or no access to municipal services such as sewerage system, running water, and electricity. In contrast, the high strata 5 and 6 contain higher quality dwellings in neighbourhoods where these services are provided, and property owners are obliged to pay taxes for them (13).

The variables of interest were used in thematised narrative form to present the results. The outcome (obesity) is shown through its prevalence in the population. For evaluating the quality of the studies, researchers independently used the Newcastle-Ottawa scale, designed for assessing cross-sectional studies. This scale employs a star system, allocating a maximum of

10 stars to evaluate bias risk of in three areas: selection (five stars), comparability (two stars), and outcome (three stars). Scores of three and below are considered low quality, four to six are deemed average, and seven and above represent high quality. The full scale is ten stars, with more indicating better quality (14).

Three independent researchers obtained information from the studies using a data extraction format. To resolve a few discrepancies, we followed the strategies proposed by PRISMA. We reviewed the inclusion and exclusion criteria and variables defined in the protocol. Meetings were held to reach a consensus with one of the senior researchers acting as the mediator.

Results

Synthesis of the Search

The search strategy initially yielded 1,766 articles. After duplicates (n=49) were eliminated, and another 1,677 were excluded by title and abstract since they did not identify or describe the demographic or socioeconomic dimensions of obesity and their links with adult public health, the list linked 40 citations for assessment by eligibility criteria. Twenty-one articles were identified for full-text review (Figures 1 and 2). In terms of the Newcastle-Ottawa scale, 76.2 % (n=16) of the studies were high quality, and 23.8 % (n=5) were average quality (Table 1). The main characteristics of the included articles are presented in Tables 2 and 3.

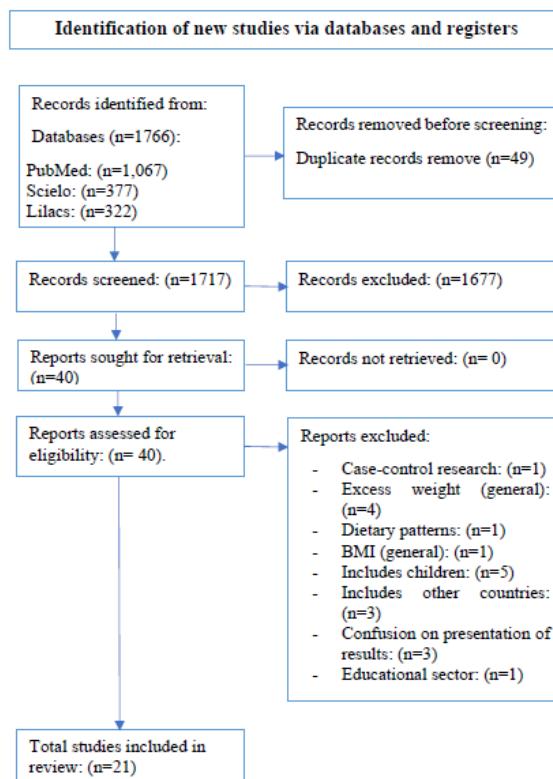


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)
Source: Authors' own elaboration.

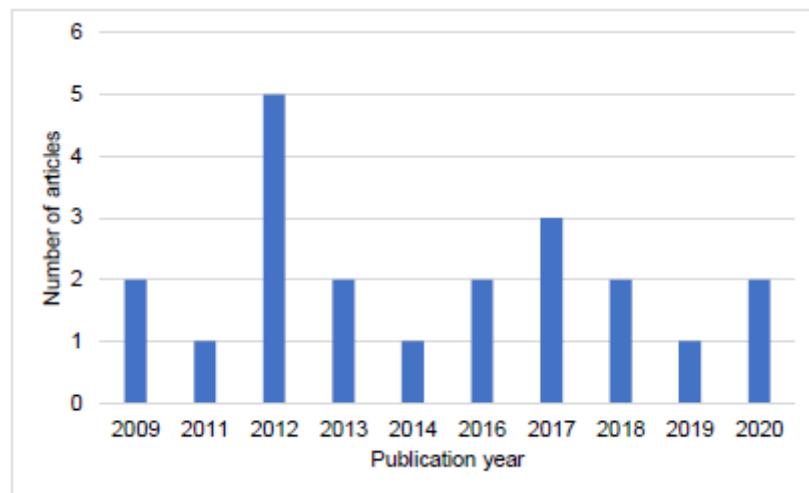


Figure 2. Number of articles by year of publication included in the scoping review

Source: Authors' own elaboration.

Table 1. Assessment of Quality of the Studies Following the Newcastle-Ottawa-Scale Based on Three Categories: Selection, Comparability, and Outcome

Author, Year (Reference number)	Selection			Comparability			Outcome			Total (out of 10 stars)
	Representativeness of the sample (1 star)	Sample size (1 star)	Non- respondents (1 star)	Ascertainment of exposure (2 stars)	Controls for the most important factor (1 star)	Controls for any additional factor (1 star)	Assessment of the outcome (2 stars)	Statistical test (1 star)		
Vecino et al., 2018 (15)	*	*	*	**	-	-	**	-	-	7
Olszowy et al., 2012 (16)	*	*	-	**	-	*	**	-	-	7
Caro et.al., 2017 (17)	*	-	-	**	-	-	**	*	*	6
Gómez et al., 2016 (18)	*	*	-	**	-	-	**	*	*	7
Ramírez et al., 2019 (19)	*	*	-	**	-	-	**	*	*	7
Ruiz et al., 2012 (20)	*	*	-	**	-	-	**	*	*	7
Cuello et al., 2017 (21)	*	-	-	**	-	-	**	*	*	6
Gilbert et al., 2009 (22)	*	*	*	**	-	*	**	*	*	9
Alvarez et al., 2013 (23)	*	*	-	**	-	-	**	*	*	7
Kasper et al., 2013 (24)	*	*	-	**	-	*	**	*	*	8
Parra et al., 2009 (25)	*	*	-	**	*	-	**	*	*	8
Ruiz et al., 2018 (26)	*	*	-	*	-	-	**	*	*	6
Escobar et al., 2017 (27)	*	*	-	**	-	-	**	*	*	7
Alvarez et al., 2012 (28)	*	*	*	**	*	-	**	-	-	8
Navarro et al., 2012 (29)	*	*	*	**	-	-	**	*	*	7
Flórez et al., 2012 (30)	*	-	-	**	-	*	**	*	*	7
Agredo et al., 2014 (31)	*	*	-	*	-	-	**	-	-	5
García et al., 2016 (32)	*	*	-	**	-	*	**	*	*	8
Bastidas et al., 2011 (33)	*	*	-	*	-	-	**	-	-	5
Bender et al., 2012 (34)	*	*	-	**	-	*	**	-	-	7
Flórez et al., 2020 (35)	*	*	-	**	*	*	**	*	*	9

Source: Authors' own elaboration.

Table 2. Main Characteristics of the Articles

Variable	Main characteristic	Number of studies
Geographical area	Colombia (national level)	7
	Cali	3
	Antioquia, Bolívar, Nariño	1
	Medellín	4
	Bogotá	3
	Cartagena de Indias	1
	Soledad	1
	Manizales	1
Study type	Cross-sectional studies	20
	Cohort study	1
Nutritional status	Body mass index	17
	Obesity	21
	Abdominal obesity	11
	Adiposity	1
Health	Insulin resistance	1
	Metabolic disorders: hypertension, diabetes, chronic obstructive pulmonary disease, coronary heart disease and/or heart failure	7
	Breast cancer	1
	Rheumatoid arthritis	1
Demographic	Sex	21
	Age	21
	Ethnic group	2
Socioeconomic	SES	9
	Wealth index	2
	Occupation	4
	Educational level	9
	Civil status	4
	Ownership and use of means of transport	2
Practices of public interest	Smoking and alcohol consumption	2
	Physical activity	1
	Other: food security, place of residence, region, level of urbanisation, number of family members	2

Source: Authors' own elaboration.

Table 3. Relevant Characteristics of Studies on Obesity in Adults in Colombia

Reference No.	Region	Sample size	Age range (years)	Sex	Prevalence of obesity / adiposity	Socioeconomic information	Associated comorbidities
Vecino et al., 2018 (15).	Colombia.	7,140 adults.	18-64 years.	Male, female.	<ul style="list-style-type: none"> High SES: 15.36 % Low SES: 16.79 % 	<ul style="list-style-type: none"> Educational level. Civil status. Residential area. 	-
Olszowy et al., 2012 (16).	Colombia: Cali.	<ul style="list-style-type: none"> 1988-1989: 1,572 adult women. 2007-2008: 580 adult women. 	18-44 years.	Female.	<ul style="list-style-type: none"> Prevalence of obesity: <ul style="list-style-type: none"> Low SES 1988-1989: 7.9 % Low SES 2007-2008: 17.0 % Medium SES 1988-1989: 4.5 % Medium SES 2007-2008: 8.2 % High SES 1988-1989: 1.1 % High SES 2007-2008: 5.2 % Abdominal obesity: <ul style="list-style-type: none"> Low SES 1988-1989: 15.4 % Low SES 2007-2008: 33.0 % Medium SES 1988-1989: 9.0 % Medium SES 2007-2008: 17.2 % High SES 1988-1989: 9.2 % High SES 2007-2008: 11.8 % 	<ul style="list-style-type: none"> Educational level. Occupation. 	-
Caro et al., 2017 (17).	Colombia: Antioquia, Bolívar, Narino (Mestizo) and Jardín (Emberá).	<ul style="list-style-type: none"> 471 Mestizo. 159 Emberá. 	<ul style="list-style-type: none"> Mestizo: 30±21 years. Emberá: 46±28.75 years. 	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: <ul style="list-style-type: none"> Mestizo: 10.0% (M: 13.0 %, F: 8.6 %) Emberá: 7.9 % (M:13.3 %, F:7.0 %) Abdominal obesity: <ul style="list-style-type: none"> Mestizo: 48.6 % (M: 43.4 %, F: 51.2 %) Emberá: 42 % (M:50.0 %, F: 49.3 %) 	-	Insulin resistance.
Gómez et al., 2016 (18).	Colombia: Medellín.	200 adults.	35.1±9.1 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: 7 % Prevalence of obesity in shift workers: 7.90 % 	<ul style="list-style-type: none"> Civil status. Occupation. Educational level. 	<ul style="list-style-type: none"> Smoking habit. Drinking habit. Regular exercise.
Ramírez et al., 2019 (19).	Colombia.	20,507 adults.	70±7.6 years.	Male, female.	Prevalence of obesity: 25.1 %	SES.	<ul style="list-style-type: none"> Arterial hypertension. Diabetes. COPD (chronic obstructive pulmonary disease). Coronary heart disease. Heart failure. Cancer. Hearing problems. Vision problems. Moderate dependence.
Ruiz et al., 2012 (20).	Colombia.	3,795 adults.	18-30 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: M: 19.3 %, F: 18.6 % Abdominal obesity: M: 24.6 %, F: 44.6 % 	<ul style="list-style-type: none"> Educational level. Occupation. 	<ul style="list-style-type: none"> Dyslipidaemia. Arterial hypertension.
Cuello et al., 2017 (21).	Colombia: Medellín.	849 women.	26-91 years.	Female.	<ul style="list-style-type: none"> Prevalence of obesity: 28.15 % Prevalence of obesity related with menopausal condition: <ul style="list-style-type: none"> Premenopausal: 26.7 % Postmenopausal: 31.1 % 	-	In obese patients a higher BMI is positively associated with hormone receptor negative tumours.
Gilbert et al., 2009 (22).	Colombia: Bogotá.	671 women.	21-55 years.	Female.	<ul style="list-style-type: none"> Prevalence of obesity: 11.6 % Prevalence of abdominal obesity: 16.5 % Being born in Bogotá and cohabiting with male partner are positively associated with being overweight. Prevalence of obesity is 68 % higher among women with four or five household assets. 	SES.	-
Alvarez et al., 2013 (23).	Colombia: Medellín.	2,719 households 5,556 adults.	18-69 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: M: 11.4 %, F:19.1 % Prevalence of obesity is greater among women of lower SES: 21.6 % vs. 18.6 % and 8.4 % Presence of obesity is greater among women with income less than 1,400,000 pesos: 21.4% vs. 12.8 % 	SES.	Metabolic risk is greater among shorter men and women.

Table 3. Relevant Characteristics of Studies on Obesity in Adults in Colombia (cont.)

Kasper et al., 2013 (24).	Colombia.	112,220 adults.	18-64 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity in 2005: M: 9.0 %, F: 17 % Prevalence of obesity in 2010: M: 11.5 % F: 20 % 	<ul style="list-style-type: none"> Civil status. Food security. Wealth index quintile. Place of residence. 	-
Parra et al., 2009 (25).	Colombia.	49,079 adults.	18-64 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: M: 10.13 %, F: 16.89 % Abdominal obesity: M: 37.91 %, F: 50.98 % Risk of obesity because of owning a car: M: (POR 1.8, 1.5-2.2, <0.00) Risk of obesity because of owning a motorbike: M: (POR 1.4, 1.2-1.7, <0.00) Risk of obesity because of owning other motor vehicle: M: (POR 1.7, 1.4-1.9, <0.00) 	<ul style="list-style-type: none"> SES. Level of urbanisation. Number of family members. Household car. Household motorbike. Other household motor vehicles. 	
Ruiz et al., 2018 (26).	Colombia: Cartagena de Indias.	675 adults.	44.1 ± 17.4 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: 18.5 % Prevalence of abdominal obesity: 66.8 % 	SES.	<ul style="list-style-type: none"> Hypertension. Hyperglycaemia. Hypercholesterolaemia. Hypertriglyceridaemia. Low HDL cholesterol.
Escobar et al., 2017 (27).	Colombia.	11,621 adults.	18-64 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: 16 % Adults from 40 to 64 years show greater probability of presenting obesity by comparison with those from 18 to 39 years (OR 1.80, 1.63-199). Women show greater probability of presenting obesity by comparison with men (OR 1.24, 1.22-1.37). The population without higher education shows greater probability of suffering obesity (OR 1.19, 1.03-1.38) by comparison with the population with technical or technological education. The population not living in conditions of overcrowding presents greater probability of obesity (OR 1.25, 1.03-1.42). Enjoying food security means greater probability of presenting obesity (OR 1.01, 0.99-1.21). 	Educational level Wealth quintile.	-
Alvarez et al., 2012 (28).	Colombia: Medellín.	2,719 households 5,555 adults.	18-69 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: 16.2 % M: 11.1 %, F: 19.1 %. Obesity increases with age: <ul style="list-style-type: none"> 18-30 years: 7.4 %. 31-44 years: 16.7 %. 45-69 years: 22.9 %. Obesity by SES: <ul style="list-style-type: none"> Low: 17.3 %. Medium: 16.4 %. High: 9.2 %. Obesity by educational level: <ul style="list-style-type: none"> Primary and no education: 26.4 %. Secondary: 15.0 %. University: 9.1 %. 	<ul style="list-style-type: none"> Occupation Educational level. Income. SES. 	-
Navarro et al., 2012 (29).	Colombia: Atlántico-Soledad.	790 adults.	20-64 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: 24.6 % (M: 20.6 %, F: 26.8 %) Prevalence of abdominal obesity: 45.2 %. Prevalence of self-perceived obesity: 53.2 %. 	<ul style="list-style-type: none"> Educational level. Civil status. Occupation 	<ul style="list-style-type: none"> Arterial hypertension. Diabetes.

Table 3. Relevant Characteristics of Studies on Obesity in Adults in Colombia

Flórez et al., 2012 (30).	Colombia.	7,900 adults.	18-64 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: M: 9.7 %, F: 15.4 %. Prevalence of abdominal obesity abdominal: M: 26.7 %, F: 15.6 %. Risk of obesity in terms of time spent travelling by motorbike per week: 10-149 minutes: M: POR 2.39 (1.43-3.99), F: POR 1.14 (0.84-1.56). 150 minutes or more: M: POR 1.93 (1.22-3.08), F: POR 0.91 (0.66-1.28). 	<ul style="list-style-type: none"> SES. Educational level. Time spent on motorbike per week. 	-
Agredo et al., 2014 (31).	Colombia: Cali.	185 men.	18-65 years.	Male.	<ul style="list-style-type: none"> Prevalence of abdominal obesity: 28.7 %. Greater frequency of incapacity for work in patients with abdominal obesity: 42 %. Longer period of incapacity for work in patients with abdominal obesity: 21.7 ± 9.2 and 16.3 ± 10.5 hours. 	<ul style="list-style-type: none"> Ethnicity. Civil status. Educational level. 	-
García et al., 2016 (32).	Colombia: Bogotá.	413 men.	30.6 ± 11.8 years.	Males.	Prevalence of visceral obesity: 34.6 %.	-	Individuals with higher values of visceral adiposity are associated with higher levels of LDL cholesterol, glucose, and a higher lipid-metabolic index (0.73±0.13) by comparison with individuals with lower values of visceral adiposity (0.68±0.13).
Bastidas et al., 2011 (33).	Colombia: Manizales.	206 clinical records.	37-97 years (average: 65.7 years).	Male, female.	<ul style="list-style-type: none"> Prevalence of abdominal obesity: 82.9 %. 	-	<ul style="list-style-type: none"> Prehypertension in obese patients: 67.9 %. Stage 1 hypertension in obese patients: 28.6 %. Stage 2 hypertension in obese patients: 14.3 %.
Bender et al., 2012 (34)*.	Colombia: Cali.	<ul style="list-style-type: none"> 1968-1989: 1,533 women. 2007-2008: 577 women. 	18-44 years.	Female.	<ul style="list-style-type: none"> Adiposity average: (0.68 ≤ r ≤ 0.82, p<0.001), associated with weight and all socioeconomic levels in both periods. 	SES.	-
Flórez et al., 2020 (35)**.	Colombia: Bogotá.	269 patients.	Average: 53.38 years.	Male, female.	<ul style="list-style-type: none"> Prevalence of obesity: 19.3 % M: 8.1 % F: 22.5 %. 	-	<ul style="list-style-type: none"> Disease activity score (erythrocyte sedimentation rate): all obese patients ended up with higher scores. Reduction or disappearance of symptoms: better possibility for patients who joined the study with obesity by comparison with those who joined as overweight.

Study design: *Factor analysis, **Cohort

Source: Authors' own elaboration.

What has been the reported prevalence in the studies conducted?

Prevalence of obesity was reported in 16 studies, presenting values ranging from 7.0 % to 28.2 % (Table 3) (15-30). Prevalence of abdominal obesity appeared in eleven studies, ranging from 9.0% to 82.9% (16,17,20,22,25,26,29-33). Moreover, one study included an analysis of average adiposity ($0.68 \leq r \leq 0.82$, $p < 0.001$) (34). Although two studies covered the race/ethnicity variable, only one offered a race/ethnic analysis of obesity in Colombia. This study showed lower levels of abdominal obesity in the Emberá population (an indigenous ethnic group) of Jardín-Antioquia than those of mixed race living in the provinces of Antioquia, Bolívar and Nariño, with prevalences of 42.6% and 48.7%, respectively (n=159 individuals) (17).

What study designs, methods, and measures have been used?

Twenty articles (95.2 %) used a cross-sectional methodology, and one applied a cohort analysis (35). Most reports included BMI (n=20) (15-33,35), one article focused on the adiposity average (24,27), two studies calculated the level of food security (19,30), and two included the wealth quintile index (19,30).

What demographic and SES variables have been included in the studies?

Regarding demographic variables, four studies only included women (16,21,22,34), and two focused on men (31,32). The articles, focusing on both women and men, were conducted in the country's three main cities: Bogotá, Medellín and Cali. The fifteen remaining studies included men and women (15,17-20,23-30,33,35). All twenty-one studies considered age and covered the population over 18 years in all cases. As noted above, two studies included the race/ethnicity variable (17,31).

In addition, the review found several studies that related a range of socioeconomic aspects to obesity. The identified issues focus on SES, occupation, and means of transport. Firstly, regarding SES-related matters, one study calculated the relationship between general adiposity and SES using factor analysis in a group of women in Cali. Findings showed that the adiposity factor increased in all SES categories, especially in the middle range (34). In the same city, another study analysed trends of SES, height, and obesity of women and found that the low SES showed higher obesity rates than those of medium and high SES (16). An additional study established the social and economic factors of obesity in Medellín and found that obesity is more prevalent in low SES, low educational levels, and people whose income is below 1,400,000 pesos (COP) (23). In addition to low academic levels, being female meant a greater probability of suffering from obesity (27).

The above results are consistent with a study that established a clear association of obesity with other variables. Gender, age, educational level, occupation, family income, and SES were related to the risk of obesity, which is higher in women than in men. Obesity increases with age, it is higher in lower educational levels, it increases in people doing any work (domestic

work, in formal and informal employers and employees), and those belonging to middle and low SES groups (28).

Likewise, another study estimated the effects of a tax on sugary drinks on obesity and found that after its implementation, obesity in the lowest SES could be reduced by between 1.1 to 2.4 percentage points (15). In turn, another paper which examined the correlation between overweight, obesity and the perception of fitness among women in Bogotá identified that the number of household goods and the number of births are factors associated with obesity (22).

Our scoping review also identified a significant correlation with the wealth index. This index approximates the relative economic status of households using a measurement that aggregates several economic indicators grouped and classified into quintiles (36). One study showed that belonging to a higher wealth quintile, being female, food insecurity, living in urban areas, and the Pacific region were positively associated with obesity (24). When the index was applied on the national scale, it was also found that higher levels of wealth were associated with the appearance of obesity. However, after calculating social inequalities using the Lorenz curve, it was observed that obesity occurs at every income level and is not limited to any specific economic condition (27).

Secondly, the review identified that workers in different occupational environments exhibited diverse behaviours related to becoming obese. For health professionals, there was no significant association between shift work and obesity, indicating the need for more studies. Conversely, in a company in the metal-mechanical sector, it was found that those with more significant abdominal obesity presented more medical disorders (31).

Finally, studies have shown that owning cars or motorbikes increases the risk of obesity in men (25). The literature even suggests that the more time spent riding a motorbike, the greater the risk of obesity (30).

What were the practices of public health interest linked to the evidence?

One study found that a history of alcohol consumption was related to excess malnutrition. The habit of smoking tobacco is also associated with the development of obesity in overweight individuals, especially in occasional and heavy smokers, the latter being people who smoke more than 40 packets per year (26), according to the authors.

Which pathologies have been included in the studies?

Several studies inquired into associated pathologies and health variables related to obesity. The central themes evidenced were insulin resistance, dependence in older adults, and associated pathologies.

One study showed that the Emberá exhibit lower levels of central obesity and better function of pancreatic β cells than the mixed-race population (17). Concerning dependence in older adults, obesity has a detrimental effect on everyday activities, creates dependency and is also associated with pathologies such as diabetes, chronic obstructive pulmonary disease, coronary heart disease, heart failure, cancer, hearing and vision problems, and arterial hypertension (19).

Other obesity-related diseases are breast cancer, rheumatoid arthritis, and hypertension. In the first case, a study showed that in overweight premenopausal patients, there was a positive association with tumours typical of breast cancer (21). In the second case, after evaluating a programme for patients with rheumatoid arthritis, it was found that obese adults might have fewer possibilities for improvement in their condition than overweight patients (35). Finally, in hypertension, one study showed that prehypertension and stages one and two of arterial hypertension are associated with obesity (33).

On the other hand, abdominal obesity is related to the appearance of diseases such as diabetes, arterial hypertension, and dyslipidaemia (20). One study found that a higher value of visceral adiposity was associated with more elevated LDL cholesterol, glucose levels, and a high lipid-metabolic index by comparison with individuals presenting with less visceral adiposity (32).

Discussion

In general, this scoping review highlights several important points. In terms of demographics and socioeconomic status, obesity in Colombia is more prevalent among women and those of low SES (as defined according to the household economic resources in Colombia). However, it has also recently been identified in medium and high socioeconomic levels. Likewise, it is more prevalent in lower educational levels and low-income households. Furthermore, owning or using a motorbike or car as a means of transport increases the risk of obesity.

Regarding health, the results suggest that the consumption of alcohol and tobacco are risk factors for obesity. Moreover, obesity is associated with pathologies like diabetes, arterial hypertension, dyslipidaemia, hearing and eyesight problems, breast cancer, and rheumatoid arthritis.

Regarding the prevalence of obesity at the local level, some studies reported higher levels in certain cities compared to the national average, such as in Medellín with 28.2 % (21) and Soledad with 24.6 % (29). However, this local obesity prevalence is still lower when compared to those registered in other Latin American countries, such as Argentina and Mexico, which have values of 33.9 % (37) and 36.1 % (38), respectively. Nevertheless, despite the geographic variations,

studies in several countries have established that adult populations in social vulnerability are at a greater risk of obesity (39,40).

Despite the scoping review reporting two articles about race/ethnicity, only one analysed the abdominal obesity between Emberá indigenous from Jardín Antioquia and the mixed-race population from Antioquia, Bolívar and Nariño. This finding underscores the significance of understanding obesity within ethnic populations, given that Afro-Colombian and indigenous communities constitute a substantial portion of Colombia's population, accounting for approximately 13 % (41). These groups exhibit distinct dietary patterns (42,43), and their geographic locations often overlap with regions affected by armed conflicts (44). Moreover, many have experienced forced displacement, a primary driver of food insecurity (45,46). Therefore, future studies should incorporate a race/ethnicity-based analysis, offering valuable insights for policymakers. This approach is analogous to developing dietary guidelines for pregnant and breastfeeding mothers, infants, children under two years of age, and the general population, with adaptations tailored to Colombia's diverse food cultures (47,48).

Social vulnerability included variables from the socioeconomic component. Education is one example since -as the review also reports- studies affirm that illiterate people and/or those with primary education or less are at greater risk of obesity (49). When analysing the phenomenon by years of education, the evidence suggests that older adults with six years or less of education are at greater risk of obesity (50). The latter situation is confirmed by studies indicating that more educated individuals present a lower BMI than less educated individuals (51). Even though the causal links between education and obesity are not yet fully understood, prior studies have suggested that a) having greater access to health-related information and enhanced ability to manage such information; b) having a clearer understanding of the risks associated with lifestyle choices; and c) having better self-control and a more stable set of preferences over time may all play a role (52,53).

Low education is often associated with earning less income, and evidence shows that low income and low SES are related to higher rates of obesity and diabetes (54). Several studies indicate that the relationship between obesity and poverty in Latin America shows a rising trend in the population of lower individual-level SES. In poor individuals, obesity is linked with periods of malnutrition during infancy, which produces an adaptive response to low energy intake and, at older ages, increased consumption and hence the onset of obesity (55). As a result, it is essential to incorporate food and nutrition education into various focal points, such as schools, communities, and workplaces, while considering the diversity of food cultures and education levels.

In the study by Gomez et al., (2016), no significant association between workers with fixed shift work hours, e.g., health professionals, and obesity was found (18). Conversely, a systematic review and meta-analysis of nurses found that the risk is higher among professionals doing shift

work than among those who do not, especially in the case of night shifts, which turned out to be statistically significant (56).

Another aspect reported as a risk factor for obesity is the ownership and use of motorbikes and cars as means of transport. The Latin American Study of Nutrition and Health (ELANS) reports that active mobility, e.g., walking or riding a bicycle, is associated with lower BMI levels (57). While some Colombian cities, like Bogotá, have reported active bike mobility among their citizens, socioenvironmental factors, such as fatal collisions and high-risk areas prone to catastrophic events, continue to limit its use. (58). The above observation suggests an additional consideration for policymakers regarding city infrastructure.

Finally, the studies relate obesity and/or abdominal obesity with the appearance or coexistence of chronic diseases, as suggested by the literature worldwide. For instance, reviews at the global level suggest connections between obesity and the metabolic complication of diabetes type 2 (59), cardiovascular disease (60), hypothyroidism, Cushing's syndrome, polycystic ovary syndrome, dyslipidaemia, arterial hypertension, coronary heart disease, heart failure, sleep apnoea, and some kinds of cancer (61).

As for country-specific examples in diverse locations worldwide, we found similarities. A cross-sectional study of workers in a region from Spain reported a greater prevalence of diabetes, arterial hypertension, dyslipidaemia, and metabolic syndrome in overweight people (62). In Brazil, a national study found that obesity increases the risk of having diabetes (prevalence ratio: 2.9) by comparison with the risk associated with being overweight (prevalence ratio: 1.8) (63). Likewise, a representative study of citizens using healthcare services in South Korea reported that central obesity and BMI are significantly associated with arterial hypertension, dyslipidaemia, and diabetes (64). Notably, health associations like the European Association for the Study of Obesity (EASO) emphasise the link between cardiovascular disease and obesity (65). While the relationship between obesity and the onset of non-communicable and cardiovascular diseases has been studied, further research is needed in Colombia, particularly considering the country's racial/ethnic, socioeconomic, and geographic diversity.

In conclusion, this scoping review has identified a clear relation in previous studies conducted in Colombia between sociodemographic determinants and obesity, including socioeconomic status, educational levels, environmental factors, and relevant public health diseases. Addressing these determinants comprehensively through integrated public policies is essential, rather than approaching them individually. Additionally, it was somewhat unexpected that the scoping review did not detect any longitudinal, quasi-cohort, or synthetic cohort studies (66) that analyse obesity trends in adults, allowing for the identification of generational changes and the progression of this chronic, non-infectious condition as individuals age, this represents a knowledge gap and a significant opportunity for future research.

Strengths and Weaknesses

The main strength of this study lies in its rigorous search methodology following the guidelines of the PRISMA statement (12). Additionally, the review involves three well-established search engines and employs uniform and reproducible data extraction methods, using a preestablished checklist to minimise errors and bias (14). These three electronic databases focus on studies related to Colombia and Latin America. Nevertheless, a significant limitation was identified. Focusing exclusively on peer-reviewed articles may have resulted in the exclusion of grey literature, which can contribute to understand the phenomenon of adult obesity in Colombia through other dimensions.

Funding

The study supported with funding from the DEMOS_2021 contract through the R&D project “Salud de las personas de edad avanzada el análisis de la comorbilidad las múltiples causas de muerte y las desigualdades de género y socioeconómicas en la salud” (COMORHEALTHSES PID2020-113934RB-I00x) financed by the Spanish Ministry of Science and Innovation (PI Jeroen Spijker).

References

1. Lobstein T, Brinsden H, Neveux M, Cavalcanti OB, Barquera S, Baur L, et al. World Obesity Atlas 2022. World Obesity Federation 2022. 2022.
2. Wright SM, Aronne LJ. Causes of obesity. *Abdom Imaging*. 2012;37(5):730-2. <https://doi.org/10.1007/s00261-012-9862-x>
3. Arroyo-Johnson C, Mincey KD. Obesity Epidemiology Worldwide. *Gastroenterol Clin North Am* [Internet]. 2016;45(4):571-9. <https://doi.org/10.1016/j.gtc.2016.07.012>
4. Zheng Y, Ley SH, Hu FB. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. *Nature Reviews Endocrinology*. 2017;14(2):88-98. Available from: <https://www.nature.com/articles/nrendo.2017.151> <https://doi.org/10.1038/nrendo.2017.151>
5. Wermelt JA, Schunkert H. Management of arterial hypertension. *Herz*. 2017;42(5):515-26. <https://doi.org/10.1007/s00059-017-4574-1>
6. Instituto Colombiano de Bienestar Familiar. Encuesta Nacional de la Situación Nutricional. 2006. Available from: https://www.icbf.gov.co/sites/default/files/libro_2005.pdf

7. Ministerio de Salud y Protección Social, Instituto Nacional de Salud, Instituto Colombiano de Bienestar Familiar. Encuesta Nacional de la Situación Nutricional 2015. 2019. Available from: <https://www.icbf.gov.co/bienestar/nutricion/encuesta-nacional-situacion-nutricional#ensin3>
8. Meisel JD, Ramirez AM, Esguerra V, Montes F, Stankov I, Sarmiento OL, et al. Using a system dynamics model to study the obesity transition by socioeconomic status in Colombia at the country, regional and department levels. *BMJ Open*. 2020 Jun 1;10(6):e036534. <https://doi.org/10.1136/bmjopen-2019-036534>
9. Munn Z, Peters MDJ, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol*. 2018;18(143). <https://doi.org/10.1186/s12874-018-0611-x>
10. Powell PK, Durham J, Lawler S. Food Choices of Young Adults in the United States of America: A Scoping Review. *Advances in Nutrition*. 2019;10(3):479-88. <https://doi.org/10.1093/advances/nmy116>
11. Turner C, Kalamatianou S, Drewnowski A, Kulkarni B, Kinra S, Kadiyala S. Food Environment Research in Low- and Middle-Income Countries: A Systematic Scoping Review. *Advances in Nutrition*. 2020; 11(2):387-97. <https://doi.org/10.1093/advances/nmz031>
12. Moher D, Liberati A, Tetzlaff J, Altman DG, Altman D, Antes G, et al. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med* 2009; 6(7): e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
13. DANE. Estratificación socioeconómica para servicios públicos domiciliarios. 2022. Available from: <https://www.dane.gov.co/index.php/servicios-al-ciudadano/servicios-informacion/estratificacion-socioeconomica#preguntas-frecuentes>
14. Ottawa Hospital Research Institute. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses 2021. Available from: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp
15. Vecino-Ortiz AI, Arroyo-Ariza D. A tax on sugar sweetened beverages in Colombia: Estimating the impact on overweight and obesity prevalence across socio economic levels. *Soc Sci Med*. 2018;209(40):111-6. <https://doi.org/10.1016/j.socscimed.2018.05.043>
16. Olszowy KM, Dufour DL, Bender RL, Bekelman TA, Reina JC. Socioeconomic status, stature, and obesity in women: 20-year trends in urban Colombia. *American Journal of Human Biology*. 2012;24(5):602-10. <https://doi.org/10.1002/ajhb.22280>
17. Caro-Gomez MA, Naranjo-González A, Parra-Marín MV, Gallego-Lopera N, Valencia DM, Rúa-Molina DC, et al. Insulin resistance and β -cell function in Colombian mestizo and Embera-Chamí populations and their relation with adiposity degree. *Endocrinología, Diabetes y Nutrición*. 2017;64(4):211-20. <https://doi.org/10.1016/j.endien.2017.05.005>
18. Gomez-Parra M, Romero-Arrieta L, Vasquez-Trespalacios EM, Palacio-Jaramillo V, Valencia-Martinez A. Association between shift work and being overweight or obese among health care workers

in a clinical setting in Medellin, Colombia. *Work*. 2016;55(3):635-42. <https://doi.org/10.3233/WOR-162438>

19. Ramírez-Vélez R, Pérez-Sousa MA, Venegas-Sanabria LC, Chavarro-Carvajal DA, Cano-Gutierrez CA, Correa-Bautista JE, et al. Gait speed moderates the adverse effect of obesity on dependency in older Colombian adult. *Exp Gerontol*. 2019;127:110732. <https://doi.org/10.1016/j.exger.2019.110732>
20. Ruiz ÁJ, Aschner PJ, Puerta MF, Alfonso-Cristancho R. Estudio IDEA (international day for evaluation of abdominal obesity): Prevalencia de obesidad abdominal y factores de riesgo asociados en atención primaria en Colombia. *Biomedica*. 2012;32(4):610-6. <https://revistabiomedica.org/index.php/biomedica/article/view/799/1669>
21. Cuello-López J, Fidalgo-Zapata A, Vásquez-Trespalacios E. Obesity and Prognostic Variables in Colombian Breast Cancer Patients: A Cross-Sectional Study. *Int J Breast Cancer*. 2017;2017: 9574874. <https://doi.org/10.1155/2017/9574874>
22. Gilbert-Diamond D, Baylin A, Mora-Plazas M, Villamor E. Correlates of obesity and body image in colombian women. *J Womens Health*. 2009;18(8):1145-51. <https://doi.org/10.1089/jwh.2008.1179>
23. Álvarez LS, Estrada A, Goez JD, Carreño C, Mancilla L. The effects of socioeconomic status and short stature on overweight, obesity and the risk of metabolic complications in adults. *Colomb Med*. 2013;44(3):146-54. Available from: <https://doi.org/10.25100/cm.v44i3.1218>
24. Kasper NM, Herrán OF, Villamor E. Obesity prevalence in Colombian adults is increasing fastest in lower socio-economic status groups and urban residents: Results from two nationally representative surveys. *Public Health Nutr*. 2013;17(11):2398-406. <https://doi.org/10.1017/S1368980013003418>
25. Parra DC, Lobelo F, Gómez LF, Rutt C, Schmid T, Brownson RC, et al. Household motor vehicle use and weight status among Colombian adults: Are we driving our way towards obesity? *Prev Med (Baltim)*. 2009;49(2-3):179-83. <https://doi.org/10.1016/j.ypmed.2009.07.010>
26. Ruíz Díaz MS, Mora García G, Gómez Camargo Doris. Asociación del consumo de alcohol y tabaco con la obesidad en adultos de Cartagena de Indias, Colombia. *Salud Uninorte*. 2018;34(1):100-11. <https://doi.org/10.14482/sun.34.1.9716>
27. Escobar Velasquez K, Ruidiaz Gomez K. Desigualdad social y obesidad en la población adulta colombiana. *Archivos de Medicina (Manizales)*. 2017;17(2):338-49. Available from: <https://doi.org/10.30554/archmed.17.2.2338.2017>
28. Álvarez Castaño LS, Goez Rueda JD, Carreño Aguirre C. Factores sociales y económicos asociados a la obesidad: los efectos de la inequidad y de la pobreza. *Revista Gerencia y Políticas de Salud*. 2012;98-110. Available from: <https://www.redalyc.org/pdf/545/54525297007.pdf>

29. Navarro Lechuga E, Vargas Morantz R. Prevalencia de obesidad en adultos del municipio de Soledad (Atlántico, Colombia), 2010. Salud Uninorte. 2012;28(1):49-64. Available from: <http://www.scielo.org.co/pdf/sun/v28n1/v28n1a06.pdf>
30. Flórez Pregonero A, Gómez LF, Parra DC, Cohen DD, Arango Paternina CM, Lobelo F. Time spent traveling in motor vehicles and its association with overweight and abdominal obesity in Colombian adults who do not own a car. Prev Med (Baltim). 2012;54(6):402-4. <https://doi.org/10.1016/j.ypmed.2012.04.002>
31. Agredo Zúñiga RA, García Ordoñez ES, Osorio C, Escudero N, López-Albán CA, Ramírez-Vélez R. Obesidad abdominal y ausentismo por causa médica en una empresa de la industria metalmecánica en Cali, Colombia. Rev Peru Med Exp Salud Publica. 2014;30(2):251-5. Available from: <https://doi.org/10.17843/rpmesp.2013.302.200>
32. García AI, Niño-Silva L, González-Ruiz K, Ramírez-Vélez R. Volumen de grasa visceral como indicador de obesidad en hombres adultos. Rev Colomb Cardiol. 2016;23(4):313-20. <https://doi.org/10.1016/j.rccar.2015.12.009>
33. Bastidas Vivas C, Elena R, Castrillón C, Jaime J, Cadena E, Marcela D, et al. Relationship between hypertension and obesity in hypertensive patients treated in ASSBASALUD ESE, Manizales (Colombia) 2010. Archivos de Medicina (Col). 2011;11(2):150-8. Available from: <https://doi.org/10.30554/archmed.11.2.822.2011>
34. Bender RL, Bekelman TA, Sandberg PA, Dufour DL, Reina JC. Shift in body fat distribution from lower body to upper body among urban Colombian women, 1988-1989 to 2007-2008. Public Health Nutr. 2020;23(8):1320-8. <https://doi.org/10.1017/S1368980019004099>
35. Flórez-Suárez JB, Mendez-Patarroyo P, Coral-Alvarado P, Quintana-López G. Association of Obesity With Lower Rates of Remission in a Colombian Cohort of Patients With Rheumatoid Arthritis. JCR: Journal of Clinical Rheumatology. 2021;27(6S):S161-S167. <https://doi.org/10.1097/RHU.00000000000001598>
36. Rutstein Oscar, Johnson Kerten. DHS Comparative Reports 6. The DHS Wealth Index. 2004. Available from: <https://dhsprogram.com/pubs/pdf/CR6/CR6.pdf>
37. ENNyS, Secretaría de Gobierno de Salud, Ministerio de Salud y Desarrollo Social Presidencia de la Nación. 2o Encuesta Nacional de Nutrición y Salud. 2019. Available from: https://cesni-biblioteca.org/wp-content/uploads/2019/10/0000001565cnt-ennys2_resumen-ejecutivo-20191.pdf
38. INEGI, Instituto Nacional de Salud Pública, Secretaría de Salud. Encuesta Nacional de Salud y Nutrición 2018 Presentación de resultados. 2018. Available from: https://ensanut.insp.mx/encuestas/ensanut2018/doctos/informes/ensanut_2018_presentacion_resultados.pdf
39. Shamah Levy T, Campos Nonato I, Cuevas Nasu L, Hernández Barrera L, Morales Ruán M del C, Rivera Dommarco J, et al. Sobre peso y obesidad en población mexicana en condición de vulnerabilidad. Resultados de la Ensanut 100k. Salud Pública Mex. 2019;61:852-65. <https://doi.org/10.21149/10585>

40. Custodio J, Elizathe L, Murawski B, Rutsztein G. Obesity in Argentina: A remaining challenge. Public health policies and prevalence rates. *Rev Mex Trastor Aliment.* 2015; 27(6):137-42. <https://doi.org/10.1016/j.rmta.2015.10.002>
41. DANE. Autorreconocimiento étnico. 2022. Available from: <https://www.dane.gov.co/index.php/estadisticas-por-tema/enfoque-diferencial-e-interseccional/autorreconocimiento-etnico>
42. Janneth Molano-Tobar N, Org O. Cosmovisión de salud y alimentación en la cultura Guambiana Worldview of health and food in the Guambiana culture. 2018;20(1):16-25. <https://doi.org/10.22267/rus.182001.105>
43. Rivas X, Pazos S, Castillo S, Pachón H. Archivos Latinamericanos de Nutrición. Alimentos autóctonos de las comunidades indígenas y afrodescendientes de Colombia. 2010; 60(3). Available from: <https://www.alanrevista.org/ediciones/2010/3/art-1/>
44. Centro Nacional de Memoria Histórica. Regiones y conflicto armado. CNMH. 2018. Available from: <https://www.centrodememoriahistorica.gov.co/micrositios/balances-jep/descargas/balance-regiones.pdf>
45. Puentes M, Bejarano A. Prácticas de consumo alimentario de familias desplazadas por el conflicto armado, asentadas en Bosa, Bogotá - Dialnet. Diversitas: perspectivas en psicología. 2020;16(1). Available from: <https://doi.org/10.15332/22563067.5547>
46. Escobar Rodríguez WE. Seguridad Alimentaria y Nutricional de la población víctima de desplazamiento forzado en Puerto Asís-Putumayo: ¿De la negligencia institucional a la indiferencia social? 2018. Available from: <https://repositorio.unal.edu.co/handle/unal/69452>
47. ICBF. Guías Alimentarias Basadas en Alimentos para la Población Colombiana Mayor de 2 Años | Portal ICBF - Instituto Colombiano de Bienestar Familiar ICBF. 2018. Available from: <https://www.icbf.gov.co/guias-alimentarias-basadas-en-alimentos-para-la-poblacion-colombiana-mayor-de-2-anos-0>
48. ICBF. Guías Alimentarias basadas en Alimentos para mujeres gestantes, madres en período de lactancia y niños y niñas menores de 2 años para Colombia | Portal ICBF - Instituto Colombiano de Bienestar Familiar ICBF. 2018. Available from: <https://www.icbf.gov.co/guias-alimentarias-basadas-en-alimentos-para-mujeres-gestantes-madres-en-periodo-de-lactancia-y-2>
49. Mosli HH, Kutbi HA, Alhasan AH, Mosli RH. Understanding the Interrelationship between Education, Income, and Obesity among Adults in Saudi Arabia. *Obes Facts.* 2020;13(1):77-85. <https://doi.org/10.1159/000505246>
50. Hsieh TH, Lee JJ, Yu EWR, Hu HY, Lin SY, Ho CY. Association between obesity and education level among the elderly in Taipei, Taiwan between 2013 and 2015: a cross-sectional study. *Scientific Reports* 2020; 10:1. 2020 20;10(1):1-9. <https://doi.org/10.1159/000505246>

51. Böckerman P, Viinikainen J, Pulkki-Råback L, Hakulinen C, Pitkänen N, Lehtimäki T, et al. Does higher education protect against obesity? Evidence using Mendelian randomisation. *Prev Med (Baltim)*. 2017; 101:195-8. <https://doi.org/10.1016/j.ypmed.2017.06.015>
52. Liu YB, Liu L, Li YF, Chen YL. Relationship between health literacy, health-related behaviors and health status: A survey of elderly Chinese. *Int J Environ Res Public Health*. 2015;12(8). <https://doi.org/10.3390/ijerph120809714>
53. Friis K, Lasgaard M, Rowlands G, Osborne RH, Maindal HT. Health Literacy Mediates the Relationship Between Educational Attainment and Health Behavior: A Danish Population-Based Study. *J Health Commun*. 2016;21(2):54-60. <https://doi.org/10.1080/10810730.2016.1201175>
54. Volaco A, Cavalcanti AM, Filho RP, Precoma DB. Socioeconomic Status: The Missing Link Between Obesity and Diabetes Mellitus? *Curr Diabetes Rev*. 2018;14(4):321-6. <https://doi.org/10.2174/1573399813666170621123227>
55. Pedraza DF. Obesidad y pobreza: marco conceptual para su análisis en latinoamérica. *Saúde e Sociedade*. 2009;18(1):103-17. Available from: <https://doi.org/10.1590/S0104-12902009000100011>
56. Zhang Q, Chair SY, Lo SHS, Chau JPC, Schwade M, Zhao X. Association between shift work and obesity among nurses: A systematic review and meta-analysis. *Int J Nurs Stud*. 2020; 112:103757. <https://doi.org/10.1016/j.ijnurstu.2020.103757>
57. Habinger JG, Chávez JL, Matsudo SM, Kovalskys I, Gómez G, Rigotti A, et al. Active Transportation and Obesity Indicators in Adults from Latin America: ELANS Multi-Country Study. *Int J Environ Res Public Health*. 2020;17(19):6974. <https://doi.org/10.3390/ijerph17196974>
58. Carvajal GA, Sarmiento OL, Medaglia AL, Cabrales S, Rodríguez DA, Quistberg DA, et al. Bicycle safety in Bogotá: A seven-year analysis of bicyclists' collisions and fatalities. *Accid Anal Prev*. 2020; 144:105596. <https://doi.org/10.1016/j.aap.2020.105596>
59. Lingvay I, Sumithran P, Cohen R V, le Roux CW. Obesity management as a primary treatment goal for type 2 diabetes: time to reframe the conversation. *The Lancet*. 2022;399(10322):394-405. [https://doi.org/10.1016/S0140-6736\(21\)01919-X](https://doi.org/10.1016/S0140-6736(21)01919-X)
60. Ortega FB, Lavie CJ, Blair SN. Obesity and Cardiovascular Disease. *Circ Res*. 2016;118(11):1752-70. <https://doi.org/10.1161/CIRCRESAHA.115.306883>
61. Apovian CM. Obesity: definition, comorbidities, causes, and burden. *Am J Manag Care*. 2016;22(7):s176-85. Available from: <https://www.ajmc.com/view/obesity-definition-comorbidities-causes-burden>
62. Ramón-Arbués E, Martínez-Abadía B, Gracia-Tabuenca T, Yuste-Gran C, Pellicer-García B, Juárez-Vela R, et al. Prevalence of overweight/obesity and its association with diabetes, hypertension, dyslipidemia and metabolic syndrome: A cross-sectional study of a sample of workers in Aragón, Spain. *Nutr Hosp*. 2019;36(1):51-9. <https://doi.org/10.20960/nh.1980>

63. Malta DC, Bernal RTI, Iser BPM, Szwarcwald CL, Duncan BB, Schmidt MI. Factors associated with self-reported diabetes according to the 2013 National Health Survey. *Rev Saude Publica*. 2017;51:1-11. <https://doi.org/10.1590/s1518-8787.2017051000011>

64. Boo S, Yoon YJ, Oh H. Evaluating the prevalence, awareness, and control of hypertension, diabetes, and dyslipidemia in Korea using the NHIS-NSC database: A cross-sectional analysis. *Medicine*. 2018;97(51):e13713. <https://doi.org/10.1097/MD.00000000000013713>

65. Kotsis V, Jordan J, Micic D, Finer N, Leitner DR, Toplak H, et al. Obesity and cardiovascular risk: A call for action from the European Society of Hypertension Working Group of Obesity, Diabetes and the High-risk Patient and European Association for the Study of Obesity: Part A: Mechanisms of obesity induced hypertension, diabetes and dyslipidemia and practice guidelines for treatment. *J Hypertens*. 2018;36(7):1427-40. <https://doi.org/10.1097/HJH.0000000000001730>

66. Cámara AD, Spijker JJ. Super size Spain? A cross-sectional and quasi-cohort trend analysis of adult overweight and obesity in an accelerated transition country.. *J Biosoc Sci*. 2010;42(3):377-93. <https://doi.org/10.1017/S0021932009990629>

Notes

* Review article