

## REVIEW ARTICLE

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# Prevalence of metabolic syndrome among university students: A systematic review

*Prevalencia de síndrome metabólico en estudiantes universitarios, una revisión sistemática*

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[| Abstract |](#)

**Introduction:** Metabolic syndrome (MS) is defined as a set of conditions including high blood pressure, dyslipidemia, glucose intolerance and visceral obesity. In recent years, an increase of obesity in university students has been observed, although the accurate prevalence of MS is unknown.

**Objective:** To determine the prevalence of MS in university students between January 2000 and January 2016.

**Materials and methods:** A systematic review of studies published in the PubMed, LILACS, ScienceDirect, UpToDate, Imbiomed, SciELO and Google Scholar databases was performed. To ensure the highest number of papers, different combinations of words related to MS were used in Spanish, English, and Portuguese.

**Results:** A total of 16 studies met the inclusion criteria. Students from different health, social and human sciences careers from America, Asia and Europe participated in said studies. The prevalence of MS ranged from 0 to 19.2% according to NCEP-ATP III.

**Conclusions:** The prevalence of MS varies widely across studies. It is important to expand MS research, as this would allow designing specific interventions for high-risk groups in the university context.

**Keywords:** Prevalence; Metabolic Syndrome X; Students; Universities; Review (MeSH).

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## Introduction

Today, metabolic syndrome (MS) is one of the biggest public health concerns worldwide. (1) The International Diabetes Federation states that the frequency of this syndrome is high in the global context,

[| Resumen |](#)

**Introducción.** El síndrome metabólico (SM) se define por la coexistencia de hipertensión arterial, dislipidemia, intolerancia a la glucosa y obesidad visceral. En años recientes, se ha observado incremento de la obesidad en universitarios, pero no se tiene precisión sobre la prevalencia de SM.

**Objetivo.** Determinar la prevalencia de SM en estudiantes universitarios entre enero de 2000 y enero de 2016.

**Materiales y métodos.** Revisión sistemática de estudios publicados en PubMed, LILACS, ScienceDirect, UpToDate, Imbiomed, SciELO y Google Scholar. La búsqueda usó diferentes combinaciones de palabras relacionadas con SM en español, inglés y portugués.

**Resultados.** 16 estudios reunieron los criterios de inclusión e incluyeron la participación de estudiantes de distintas carreras de ciencias de la salud, sociales y humanas, además eran provenientes de América, Asia y Europa. La prevalencia de SM observada estuvo entre 0% y 19.2% según los criterios NCEP-ATP III.

**Conclusiones.** La prevalencia de SM varía ampliamente en los diferentes estudios. Es importante extender la investigación del SM, esto permitiría el diseño de intervenciones para grupos de alto riesgo desde el contexto universitario.

**Palabras clave:** Prevalencia; Síndrome X metabólico; Estudiantes; Universidades; Revisión sistemática (DeCS).

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and is also parallel and congruent with the high frequency of type 2 diabetes and cardiovascular disease in the general population. (1,2)

MS is also known as plurimetabolic syndrome, insulin resistance syndrome, or metabolic X syndrome and is defined as the presence or coexistence of high blood pressure, dyslipidemia, insulin resistance, glucose

intolerance and visceral obesity. (3) This set of risk factors significantly increases the likelihood of long-term cardiovascular disease. (4)

In the past years, university students have shown higher obesity figures. (4,5) Young adults starting college are at a transition age, which is critical to the consolidation of health-related behaviors or habits. (6) For example, first-year college students experience faster weight gain than the average adult at another stage of life. (7) This relates to lifestyle choices, including poorly balanced diet, lack of physical activity or regular exercise, tobacco use, and excessive consumption of alcoholic beverages. (8) It has been fully established that these factors, together with obesity, contribute to increased risks of suffering from MS, regardless of age and educational or vocational level. (9)

Early detection of MS in young adults in the university context may guide the design of preventive programs or specific interventions to reduce the onset of the syndrome and associated medical and psychosocial complications that often become chronic. (10)

It is important to know the prevalence of MS in university students in order to take measures from a public health perspective and design strategies for early identification. This design is done using different screening techniques of possible cases in the academic context, and aims to reduce or minimize the problems associated with MS and the subsequent deterioration in the quality of life once current students are part of the country's productive system. (11,12)

To date, there is no systematic review summarizing the observed prevalence of MS in university students in different contexts. Systematic reviews in other age groups showed striking values

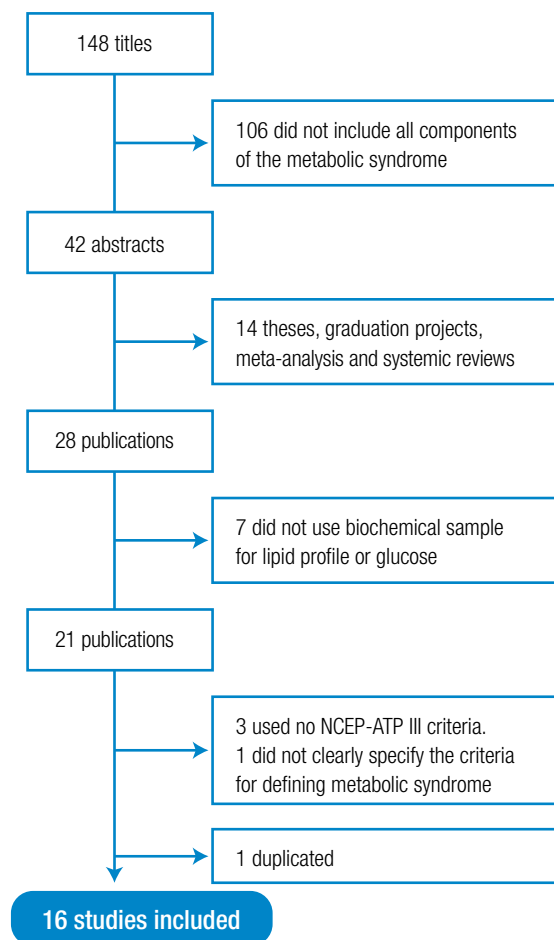
and a systematic review including obese adolescents revealed a mean prevalence of 31.2% ranging from 2.1% to 58.3%. (13) A similar review, including adults aged between 18 and 65 years, apparently healthy, from Latin American countries, found an adjusted prevalence of 24.9%, with a range between 18.8% and 43.3%. (14)

The objective of this systematic review was to establish the prevalence of MS in the university population as reported in studies published between January 2000 and January 2016.

## Materials and methods

A systematic review of studies published in the PubMed, LILACS, ScienceDirect, UpToDate, Imbiomed, SciELO and Google Scholar databases between January 2000 and January 2016 was carried out to review the prevalence of MS in university students.

“Metabolic syndrome”, “Cardiovascular risk factors”, “University students” and “Students” were included as keywords. In order to ensure the largest number of publications, different word combinations were used in Spanish, English and Portuguese. This process was complemented by a manual review of the references of articles initially identified in the database search. Studies that evaluated the presence of MS according to the criteria of the National Cholesterol Education Program and the Adult Treatment Panel III (NCEP-ATP III) were included. (15) Figure 1 presents the flowchart of the selection of the reviewed studies.



**Figure 1.** Flowchart of research inclusion.  
Source: Own elaboration.

NCEP-ATP III defines MS as the coexistence of at least three of the following factors: increased abdominal perimeter ( $\geq 102$  cm in men and  $\geq 88$  cm in women), hypertriglyceridemia ( $\geq 150$  mg/dl), decreased HDL ( $< 40$  mg/dl in men and  $< 50$  mg/dl in women), fasting hyperglycemia ( $\geq 110$  mg/dl) and altered blood pressure (systolic blood pressure  $\geq 130$  mm Hg or diastolic blood pressure  $\geq 85$  mm Hg). (15,16) Narrative reviews, graduation projects, theses and studies carried out in the university context in which professors or administrators were mixed and the prevalence in the student group that could not be discriminated were excluded.

First, the titles were reviewed, then the abstracts and finally the full version of the articles that met all the inclusion criteria. A descriptive analysis of the publications was carried out and the country in which the study was conducted, year of publication, sample size, major/program, academic level of the population studied, and observed prevalence of MS in percentages were specified. For a more accurate observed prevalence, 95% confidence intervals were found for each of the frequencies reported in the articles.

The quality of the studies was evaluated using the questionnaire for observational analytical studies proposed by du Prel *et al.* (17). This instrument consists of 12 points that collect the most important aspects of the design and non-experimental observational studies analysis, as proposed by the instrument *Strengthening the Reporting of Observational Studies in Epidemiology*. (18)

## Results

148 titles were identified, of which 120 were discarded since 106 did not include all the components of the MS and 14 were theses, graduation projects, meta-analyses or systemic reviews. Of the 28 pre-selected abstracts, 7 investigations that did not use biochemical tests to define MS were eliminated, as well as 3 that used criteria other than NCEP-ATP III, finally 1 study that did not clearly specify the criteria used to define MS, and 1 duplicated were also excluded. 16 studies met all the criteria for this review. (19-34) Regarding the quality of study reports, all met at least 11 of the 13 criteria assessed (10 met 13, 5 met 12, and 1 met 11). The articles with the lowest scores usually had smaller samples.

In general, studies conducted in different parts of the world, most of them from Latin America or Brazil, were included. In terms of the major or program to which the students were enrolled, the largest selection was made randomly from all programs (10 studies). The age of the participants ranged approximately between 17 and 26 years, and both men and women participated. The prevalence range of MS ranged from 0% to 19.2%. Table 1 summarizes the information on the findings of the studies in chronological order.

## Discussion

This study shows a high variation in the prevalence of MS in university students, which is between 0% and 19.2% according to the NCEP-ATP III criteria. In this sense, 10 studies found a prevalence of MS of  $< 5.0\%$ , 3 between 5.1% and 15%, and 3 of  $> 15\%$ , and this is somehow different from what has been reported in other systematic reviews in children, adolescents and adults.

Friend *et al.* (35) made a systematic review with 85 published studies in children and adolescents between 2003 and 2010 and found an average prevalence of MS of 3.3%. Other systematic reviews of findings in adult populations show a substantially higher prevalence. For example, Oguoma *et al.* (36), in 32 published studies between 2002 and 2013 worldwide, with a total sample of 10 854 subjects, found that the average prevalence is 27.9% according to NCEP-ATP III. De Carvalho-Vidigal *et al.* (37) reviewed 10 articles in Brazilian

subjects, published until May 2013, with a total participation of 8 505 people, and found an average prevalence of MS of 28.9% according to the same criteria.

**Table 1.** Prevalence of metabolic syndrome in university students (NCEP-ATP III).

Authors, year	Country	n	Sampling	Prevalence % (CI95%)
Huang <i>et al.</i> (19), 2004	USA	163	Random	0.6 (0.0-1.7)
Palomo <i>et al.</i> (20), 2006	Chile	783	Random	1.0 (0.3-1.7)
Oviedo <i>et al.</i> (21), 2008	Venezuela	120	Non-random*	3.3 (0.1-6.5)
Nillakupt & Viravathana (22), 2010	Thailand	96	Non-random*	1.0 (0.0-3.1)
Fernandes & Lofgren (23), 2011	Jamaica	189	Random	3.7 (1.0-6.4)
Dalleck & Kjelland (24), 2012	USA	207	Non-random	6.8 (3.3-10.3)
de Freitas <i>et al.</i> (25), 2012	Brazil	702	Random	1.7 (0.7-2.6)
Martínez <i>et al.</i> (26), 2012	Chile	385	Random	4.9 (2.7-7.1)
Topè & Rogers (27), 2013	USA	376	Random	16.0 (12.2-19.8)
Maldonado-Villalón <i>et al.</i> (28), 2013	Mexico	141	Random*	7.8 (3.4-12.2)
Arnold <i>et al.</i> (29), 2014	USA	109	Non-random†	0.0
Zea-Robles <i>et al.</i> (30), 2014	Colombia	193	Random	16.6 (11.3-21.9)
Vilarouca-da Silva <i>et al.</i> (31), 2014	Brazil	550	Random	3.5 (2.0-5.0)
de Carvalho <i>et al.</i> (32), 2015	Brazil	968	Random	19.2 (16.7-21.7)
Alarcón <i>et al.</i> (33), 2015	Colombia	177	Random	9.6 (5.2-14.0)
Mee-Kyung <i>et al.</i> (34), 2015	Korea	151	Random	4.0 (0.9-7.1)

Source: Own elaboration.

\* Medical students only.

† African-American students only.

Certainly, the differences in the prevalence percentages and variables associated with MS observed between the studies reviewed in this research and previous systematic reviews may be explained by the variety of demographic and cultural characteristics of the participants. (38) Likewise, social and economic inequalities should be considered, not only those that occur between countries, but also those that are found in different regions of the same country. The prevalence of obesity and, consequently, of MS tends to be higher in developed or high-income countries. (4)

It is relevant to know the prevalence of MS in university youth, both for education and public health. This information about the frequency in university institutions is fundamental to encourage, based on the best evidence, the promotion of healthy lifestyles that include non-pharmacological measures such as diet and exercise at this stage of life. (39) Moreover, these measures may need to be implemented at elementary and secondary education levels (40-42) due to the increasing prevalence of obesity in the early years of life, which is the main component of MS. (43-45)

From a public health perspective, this prevalence is relevant for promoting metabolic disorders, and control and reducing associated long-term morbidity and mortality. (46) It is important to promote preventive actions based on a healthy lifestyle that include a balanced

diet—for example, the Mediterranean diet, which has demonstrated to be helpful to reduce and prevent metabolic disorders—and habits such as regular physical activity. (47) These actions can be included in the curricular and extracurricular components of vocational training programs as ways to promote self-care. (48,49) Similarly, it is necessary to work for the promulgation of public policies more aligned with a healthy lifestyle from the early stages of life. (50-52)

The strength of this systematic review is that it summarizes the research done in the university population of the last years to date, which were not included in any systematic review. The search also included articles in Spanish and Portuguese that are not usually considered in English-language publications. However, there are some limitations, including that the participating populations showed high heterogeneity in their characteristics and in the quality of the studies, which greatly limits the generalization of any conclusion.

## Conclusion

Prevalence of MS in university students is high when compared to that observed in children and adolescents; therefore, further research with more representative or stratified samples is needed to know the frequencies in different sectors or subgroups of university populations, which will allow the design of specific interventions for high-risk groups in the university context.

## Conflicts of interest

A preliminary analysis of this work was presented at the IV Congreso de Salud Integral, Universidad del Magdalena, held in Santa Marta on October 28 and 29, 2016 and appears in the form of a summary in the report of said event.

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WILLIAM SMELLIE, M.D. (1754)  
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