

# Sedentary lifestyle level in nine cities of Colombia: cluster analysis

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## Summary

**Objective:** To set the level of sedentary lifestyle in the population between 18 and 60 years of age in nine cities of Colombia.

**Materials and methods:** Descriptive correlational study with multivariate analysis. The sample was collected with 4,383 people between 18 and 60 years of age in the cities of Manizales, Pereira, Montería, Armenia, Sincelejo, Medellín, Bogotá, Neiva and Tunja. Sample selection technique: Probabilistic and K systematic. The sedentary lifestyle test by Perez-Rojas was applied. Variables analyzed: genre, age, marital status, schooling, BMI and physical activity.

**Results:** From the total sample, 53.4% were men with an average age of  $35.5 \pm 12.9$ , 57.2% with High School and/or university studies and their average BMI was  $24.5 \text{ Kg/m}^2 \pm 3.9 \text{ Kg/m}^2$ . The dendrogram showed two groups: active and sedentary. From the active group, 73% lived in Popayán, Bogotá, Medellín, Sincelejo and Armenia, they were between 18 and 24 years of age, men were predominant with normal BMI who exercised between 30 and 60 minutes three times per week. The sedentary groups was 27% of the population from the cities of Pereira, Neiva and Manizales, 35 years and older, predominantly women, single who did not practice any physical activity and were overweight.

**Conclusions:** A sedentary lifestyle is a widespread problem in the nine cities studied. Two groups were established and in the sedentary group female over 35, overweight and not being physically active stand.

## Key words:

Motion. Adult.  
Body mass index.  
Sedentary lifestyle.

## El nivel de sedentarismo en nueve ciudades colombianas: análisis de clúster

### Resumen

**Objetivo:** Establecer el nivel de Sedentarismo en la población, de 18 y 60 años de edad, de nueve ciudades de Colombia.

**Materiales y métodos:** Estudio descriptivo – correlacional con análisis multivariado. Muestra 4.383 personas de 18 a 60 años de las ciudades de Manizales, Pereira, Montería, Armenia, Sincelejo, Medellín, Bogotá, Neiva y Tunja. Técnica de Selección de la Muestra: Probabilística, K sistemática. Se aplicó el test de sedentarismo de Perez-Rojas. Variables analizadas: Género, edad, estado civil, escolaridad, IMC y Actividad Física.

**Resultados:** El 53,4% fueron hombres, con una media de edad de  $35,5 \pm 12,9$  años, estudios secundarios y/o universitarios en un 57,2% y un IMC cuya media fue de  $24,5 \text{ Kg/m}^2 \pm 3,9 \text{ Kg/m}^2$ . El dendograma mostró 2 grupos, activos y sedentarios; El grupo de activos residían en un 73% en Popayán, Bogotá, Medellín, Sincelejo y Armenia, entre los 18 y 24 años de edad, predominan los hombres, con IMC normal, realizaban ejercicio, con tiempo de práctica entre 30 y 60 minutos y tres veces a la semana. Los sedentarios eran el 27%, de las ciudades de Pereira, Neiva y Manizales. mayores de 35 años, predominantemente mujeres, solteras, no practican ningún nivel de actividad física, y presentan sobrepeso.

**Conclusiones:** El sedentarismo es un problema generalizado en las nueve ciudades estudiadas, se establecieron dos clases, en la clase sedentaria se destaca ser mujer, mayor de 35 años, tener sobrepeso y no realizar actividad física.

## Palabras clave:

Movimiento. Adulto.  
Índice de masa corporal.  
Estilo de vida sedentario.

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## Introduction

Physical inactivity is considered to be the time spent sitting down, which today also constitutes a worldwide concern and public health issue, with physical inactivity being the fourth highest mortality risk factor in the world<sup>1,2</sup>. Physical inactivity implies a minimum energy expenditure<sup>3</sup>, and some of the activities considered to have low energy expenditure are sitting, lying, and leaning back watching television<sup>4</sup>. Different authors recommend limiting the consecutive time spent doing these activities, and establish that after 30 minutes of sitting, we should stand and perform some movements that may include stretching or taking a few paces, even if this is just walking around, with the aim of interrupting the amount of time spent being sedentary as much as possible<sup>4-6</sup>.

In Latin America almost three quarters of the population has a sedentary lifestyle, a large part of the population of all ages is inactive, and women display a greater tendency to be sedentary, as do low-income demographics<sup>7</sup>. The proportion of the population whose health is at risk because of an inactive lifestyle is approximately 60%<sup>8</sup>.

The information obtained regarding physical inactivity in Colombia is similar to international data. There are numerous studies claiming that the prevalence of physical inactivity is 52%<sup>9</sup>. These figures have been determined using universal instruments such as the International Physical Activity Questionnaire (IPAQ). In the search for even more precise and objective data, the level of physical inactivity has been measured in different cities in the country, applying the physical inactivity test<sup>10</sup>. The aims of this work were:

- To analyse the Body Mass Index (BMI) depending on the age, gender, civil status and physical activity.
- To determine the dendrogram and the groups to be analysed in this study.
- To analyse different variables depending on the previously obtained groups in the dendrogram (active vs. sedentary participants).

## Materials and methods

### Participants

A total of 4383 people from 9 cities in Colombia (Manizales, Neiva, Tunja, Pereira, Medellín, Popayán, Bogotá, Sincelejo and Armenia) participated in this study. The bioethics committee from the Autonomous University of Manizales approved this work.

### Design

A correlating descriptive study with a multi-varied analysis, performed between 2012 and 2014, the levels of physical inactivity of the participants in the research were assessed. To gather the information an instrument designed by the researchers was used that was assessed by experts. The aim was to establish the socio-demographic variables of perception on the practice of physical exercise. This instrument was authorised by the people selected. Next the height and body weight were measured to calculate the BMI.

To define the level of physical inactivity, the physical inactivity test was applied<sup>10</sup> and once finished, the person was informed of their classification level according to the established test.

### Material

The level of physical inactivity was assessed based on the physical inactivity classification test; its objectivity, reliability and validity were proven in the general population<sup>10</sup>.

- The par-q questionnaire<sup>11</sup>: was applied to establish the cardiovascular risk, adding to the blood pressure reading using a blood pressure gauge and a LORD brand stethoscope, aspects defined as participant inclusion criteria.
- Heart rate: once the participant was established as apt to participate in the physical inactivity test, this was taken using the Fingertip Pulse Oximeter version 3.0.
- Test rhythm: an MA-30 KORG brand digital metronome was used.
- Execution timekeeping: measured with a SEIKO brand stopwatch.
- Physical Inactivity Classification Test: consisted in going up and down a 25 cm-high step at the rhythm of: 1st load 17 steps per minute for 3 minutes. After the 3 minute load was finished, the pulse rate was taken in the first 15 seconds of 1 minute of recovery. If the pulse rate remained below 120 beats/minute after one minute of recovery, the participant moved on to the second load. If the figure was higher, the test finished and a classification was given, in this case, sedentary. The second load followed the same procedure (26 steps per minute and the third load 34 steps per minute, always applying a 3-minute load and one minute of recovery)<sup>10</sup>. With this procedure, and in accordance with the participant's response, he/she was classified as severely sedentary, moderately sedentary, active or very active.
- BMI: To measure the weight, a Tanita digital scale was used and a height rod to measure the height.

For the statistical analysis, data about the heart rate was used, which enabled the final classification of the physical inactivity levels of the participants and the socio-demographic variables, BMI and physical activity that allowed for the final configuration of the clusters.

### Statistical analysis

For the statistical analysis of the data, the SPSS 20.0 was used. The Cluster or Conglomerate analysis was taken with the SPAD version 4.1 statistics package, from which the dendrogram was constructed, which consisted in a graphical representation in the shape of a tree that summarised the individual grouping process; those with similar characteristics are connected with links whose position on the diagram is determined by the degree of similarity or dissimilarity between the individuals.

The normality test for quantitative values was established via the Shapiro-Wilk' test and the homoscedasticity via the Levene test. The agglomerative hierarchical method was used, meaning that each individual constitutes a small group, does not change group in the entire grouping process, until there is only one group which contains all the observations. The analysis metric was the Euclidean distance of the

squared standardised variables table, and the conglomeration criteria used was the Ward system or the minimum variance criteria, whose objective is to minimise the variance between each cluster. The level of statistical significance was established at  $p < 0.05$ .

## Results

Regarding age, this oscillated between 18-60 years with an average of  $35.5 \pm 12.9$  years, the BMI with a range of 14.2-48.4 Kg/m<sup>2</sup> with an average of  $24.5 \pm 3.9$  Kg/m<sup>2</sup>. Table 1 displays the general description of the participants in terms of socio-demographic variables such as gender, civil status, level of education and physical activity undertaken.

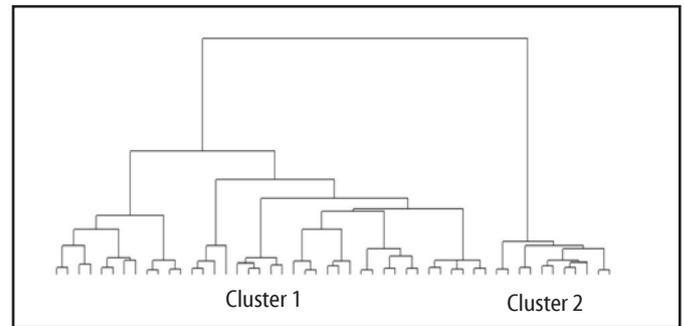
The first approach for detecting the number of groupings or clusters is to perform a classification dendrogram. Once this has been performed, there are 2 clearly defined groups (cluster 1 and cluster 2), which are both homogeneous between individuals and heterogeneous between themselves (Figure 1).

Once the number of groups has been chosen the partition is obtained as well as the indicators of the homogeneity of the classes obtained. The partition of the classification tree in 2 classes has provided groups composed of 73% (n=3,194), and 27% (n=1,189) individuals respectively. Table 2 displays the inertia of each of the clusters and their distances to the centre of gravity of the sample. The most homogeneous and the smallest is class 2 (inertia 0.2741), class 1 is the most heterogeneous (1.1498) and includes the most individuals.

Figure 2 and Table 3 display the coordinates of the classes on the factorial axes and their test-values. The classes may be interpreted as well as the position of the individuals on the first factorial plane.

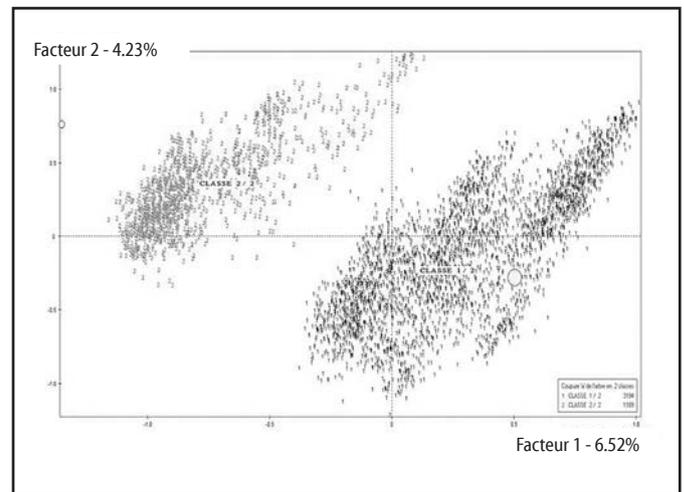
Class 1 is formed of 73% (n=3,194) of the people studied, 1,577 males and 1,617 females, aged between 18 and 24 years, in the BMI classification they are considered within the normal group. There is a prevalence of practising exercise, the time spent doing so is between

Figure 1. Dendrogram of the cluster analysis.



The dendrogram shows the heterogeneity of all the individuals in the sample. Cluster 1 shows the majority of individuals (72.9%) and it is the class with the greatest inertia (1,232). Cluster 2 is the most homogeneous group and has less individuals, its inertia is just 0.2301.

Figure 2. Factorial plan of the classes.



The plan shows all the individuals divided in two large groups. Class 1 can be called the class or group of the active participants (non sedentary), whilst class 2 is the sedentary group.

Table 1. General characteristics of the participating sample in this study.

Variables	Category	Frequency	Percentage
Gender	Male	2,043	46.6
	Female	2,340	53.4
Civil status	Single	1,032	23.5
	Married	1,058	24.1
	Separated	346	7.9
	Divorced	437	10.0
	Widowed	1,104	25.2
	Free partnership	406	9.3
Level of education	No studies	54	1.2
	Primary	1,180	26.9
	Secondary	1,408	32.1
	University	1,117	25.5
	Others	624	14.2
Physical activity	None	1,191	27.2
	Physical activity	1,059	24.2
	Sport	603	13.8
	Exercise	1,530	34.9

Table 2. Breakdown of the inertia.

Inertia	Inertia	Strength	Distances
Inter-classes	0.2780		
Intra-classes			
Class 1	1.1498	3,194	0.1035
Class 2	0.2741	1,189	0.7467

The level of statistical significance was established at  $p < 0.05$

Table 3. Coordinates and test-values about the factorial axes.

Classes	Test values		Coordinates	
	Axis 1	Axis 2	Axis 1	Axis 2
Clase 1	54.3	-30.7	0.29	-0.13
Clase 2	-54.3	30.7	-0.77	0.35

**Table 4. Description of class 1: active participants**

Variables	Categories	Percentage	Probability
Participant's city	Popayán	11.34	0.000
Participant's city	Bogotá	10.20	0.000
Participant's city	Medellín	12.07	0.000
Participant's city	Sincelejo	10.43	0.000
Participant's city	Armenia	10.15	0.001
BMI classification	Normal	52.91	0.004
Age by ranges	15-24 years	27.95	0.000
Civil status	Widowed	25.19	0.000
Weekly frequency	Once	26.26	0.000
Weekly frequency	Three times	15.20	0.000
Weekly frequency	Twice	12.75	0.000
Weekly frequency	Four times	9.83	0.000
Weekly frequency	Five times	8.76	0.000
Gender	Male	46.61	0.000
Level of physical activity	Exercise	34.91	0.000
Level of physical activity	Physical activity	24.16	0.000
Level of physical activity	Sport	13.76	0.000
Level of education	Others	14.24	0.000
Level of education	Primary studies	26.92	0.000
Level of physical inactivity	Active	31.30	0.000
Level of physical inactivity	Very active	13.39	0.000
Codified physical inactivity	Active	43.85	0.000
Time practising	Between 30 and 60 mins	29.02	0.000
Time practising	Over 60 mins	22.18	0.000
Time practising	Less than 30 mins	21.63	0.000

The level of statistical significance was established at  $p < 0.05$

30 and 60 minutes, with a frequency of three times a week. They were classified in the physical inactivity level as active participants. Cluster name: Active participants (Table 4).

Class 2 is displayed in Table 5, and was made up of 27% ( $n=1,189$ ), 725 women and 464 men, aged over 35 years, predominantly single women that do not practise any kind of physical activity, are overweight and are sedentary. Cluster name: Sedentary participants.

## Discussion

The general aim was to establish the level of physical inactivity in the population aged between 18 and 60 years, in nine Colombian cities. The results reveal a greater level of physical activity among men aged between 18 and 24, and the reduction of physical activity with age. Different studies suggest that these inequalities in sex in physical activity levels may be due to the different attitude that men and women have towards physical exercise<sup>12-14</sup>. Specifically, men consider sporting activities as congruent to the masculine role and acquire prestige through competition, whilst women are less likely to relate sporting activity with the process of being a woman, which may mean they avoid participating in any activities that may be perceived as threatening to their femininity<sup>15</sup>.

**Table 5. Description of class 2: sedentary.**

Variables	Categories	Percentage	Probability
Participant's city	Pereira	10.50	0.000
	Neiva	10.52	0.000
	Manizales	14.40	0.000
BMI classification	Overweight	34.57	0.007
Age by ranges	35-39 years	9.63	0.000
	50 plus	19.32	0.009
Civil status	Single	23.55	0.000
	Married	24.14	0.000
Gender	Female	53.39	0.000
Level of physical activity	None	27.17	0.000
Level of education	Students	25.48	0.000
	University	32.12	0.006
	Secondary students		
Level of physical inactivity	Moderately sedentary	36.37	0.000
	Severely sedentary	18.94	0.000
	Codified physical inactivity	Sedentary	56.15

The level of statistical significance was established at  $p < 0.05$

An aspect that may be affected by cultural factors, and as presented by Inchley and Currie<sup>16</sup>, is that the existing norms for practising physical activity have been less restrictive for men. Despite this analysis not focusing on the state of health, there is a positive link between a high level of physical activity during youth and other important health indicators, such as the perception of health, emotional well-being and life satisfaction<sup>17-21</sup>.

Likewise both sedentary conduct and physical activity are perfectly compatible because they occur at different times of the day<sup>21</sup>.

In terms of the BMI, the results of this study are consistent with the research that establish positive connections between this and levels of physical inactivity. ( $24,5 \pm 3,9 \text{ Kg/m}^2$ , vs  $24,18 \pm 3,61 \text{ Kg/m}^2$ ;  $24,4 \pm 3,45 \text{ kg/m}^2$ )<sup>13,22</sup>. Some research studies on physical inactivity describe subjects with high levels of physical inactivity as sedentary; over 60% of adults over 17 years suffer from excess weight or obesity, the majority of which results from not just inactivity, but also from poor eating habits<sup>22-25</sup>.

In accordance with that established in the results of this study, the participants are associated to two groups: active and sedentary participants. The group of active participants corresponds with the criteria established for the practice of physical activity, it mainly consists of men aged between 18 and 24 years, with a normal BMI, mainly performing exercise, spending 30 and 60 minutes doing so and performing exercise three or more times a week.

This information is similar to that suggested by González *et al*<sup>26</sup>, who state that the factors that increase the possibility of complying with recommendations to perform physical activity in leisure time were age (18-29 years), a secondary or higher level of education, being a student, looking for work, working in home jobs or retired and not being disabled.

The participants in group 1 revealed a tendency to uphold the universally established criteria for practising physical activity, changes can be seen in the lifestyle habits of the population, including using a bicycle, walking and practising sports, among others. This conduct is displayed to a greater extent in participating males, data that is coherent

with that found by Muros *et al*<sup>27</sup>, who highlight that 79.66% of male subjects prove to be active compared to 40.43% of women who are active.

Cluster 2 was formed by 27% of people, residing in the cities of Pereira, Neiva and Manizales. They are over 35 years, predominantly female, single, do not practise any kind of sport, are overweight and are sedentary. This data is coherent with that found in other studies that reveal that a large percentage of women lack physical activity and present sedentary conduct<sup>28-30</sup>. Likewise, it is important to highlight that in Latin America almost three quarters of the population has a sedentary lifestyle, a large part of the population of all ages is inactive, and women display a greater tendency to be sedentary, as do low-income demographics<sup>31</sup>.

## Conclusions

In the Colombian context the results of this study enable the determination of sedentary behaviour in the population studied based on the study of physiological variables such as the heart rate, which objectively highlights a widespread problem, suggesting that measures should be taken in public policy in the search for behavioural changes.

There are variables that are associated with levels of physical inactivity in the population studied in each of the conglomerates; in particular being female, over 35 years, overweight and not practising physical activity.

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- **Neuro-Rehabilitación** <sup>(1)</sup>
- **Nutrición Clínica** <sup>(1)</sup>
- **Nutrición y Seguridad Alimentaria** <sup>(2)</sup>
- **Nutrición en la Actividad Física y Deporte** <sup>(1)</sup>
- **Osteopatía y Terapia Manual** <sup>(2)</sup>
- **Patología Molecular Humana** <sup>(2)</sup>
- **Psicología General Sanitaria** <sup>(1)</sup>

<sup>(1)</sup> Presencial    <sup>(2)</sup> Semipresencial