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Body mass index and cardiorespiratory fitness among public school teachers from Barranquilla, Colombia

Índice de masa corporal y capacidad cardiorrespiratoria en docentes de colegios públicos de Barranquilla, Colombia

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Abstract

Introduction: Cardiorespiratory fitness (CRF) is an excellent health status indicator, since reduced CRF values may constitute an early marker of alterations in the cardiovascular system.
Objective: To determine the relationship between body mass index (BMI) and CRF in teachers working in State schools of Barranquilla, Colombia.
Materials and methods: A descriptive, cross-sectional and correlational study was conducted from October 2015 to May 2016 in 363 teachers working in State schools of Barranquilla. Participants' sociodemographic data were collected, their BMI was calculated and their CRF was measured using the Rockport walking test (also known as 1-mile walking test).
Results: Participants' mean age was 48.1±9.4 years, 72.1% were women, and 65.55% had a BMI >25 kg/m^2. On the other hand, CRF mean was 26.4 mL/kg/min and was inversely correlated with BMI (p<0.05).
Conclusion: Bearing in mind the high prevalence of overweight and obesity and the low levels of CRF found in the present study it is necessary to implement health prevention programs based on physical activity and nutritional counseling aimed at encouraging public school teachers to adopt healthy lifestyles.
Keywords: Lung Volume Measurements; Oxygen Consumption; Body Mass Index; Heart Rate; School Teachers (MeSH).

Resumen

Introducción. La capacidad cardiorrespiratoria (CCR) es un excelente indicador para medir la salud, pues su disminución puede ser un marcador temprano de alteraciones en el sistema cardiovascular.
Objetivo. Determinar la relación entre el índice de masa corporal (IMC) y la CCR en docentes de colegios públicos de Barranquilla, Colombia.
Materiales y métodos. Estudio descriptivo con diseño transversal y correlacional realizado entre octubre de 2015 y mayo de 2016 en una muestra de 363 docentes de colegios públicos de Barranquilla. Se recolectaron los datos sociodemográficos de los participantes, y se utilizó el test de Rockport o test de la milla para medir su IMC y CCR.
Resultados. La media de edad fue 48.1±9.4 años, el 72.1% de los participantes fueron mujeres y el 65.55% de la población tuvo un IMC>25 kg/m^2. Por otra parte, la CCR obtuvo una media de 26.4 mL/kg/min y mostró una correlación inversa con el IMC (p<0.05).
Conclusión. Teniendo en cuenta la alta prevalencia de sobrepeso y obesidad y la baja CCR observadas en la población estudiada, es necesario implementar programas de promoción y prevención de la salud que estén mediados por la actividad física y el componente nutricional, y que ayuden a la adquisición de estilos de vida saludables.
Palabras clave: Mediciones del volumen pulmonar; Consumo de oxígeno; Índice de masa corporal; Frecuencia cardíaca; Docentes (DeCS).

Introduction

The incidence of cardiovascular disease increases every day and currently accounts for nearly 60% of deaths worldwide.[1] This situation may be aggravated by risk factors such as overweight and sedentary lifestyles.[2]

Overweight and obesity rates in Latin American countries are on the rise and have become a public health problem since the treatment of related comorbidities represents a high economic burden.[3,4] One of the most frequently used measure to assess body composition is body mass index (BMI), which associates weight with height; overweight is defined as a BMI of 25.0-29.9 kg/m², while obesity is defined as a BMI >30.0 kg/m².[5,6]

The 2010 *Encuesta Nacional de la Situación Nutricional en Colombia* (National Survey of the Nutritional Situation in Colombia) (ENSIN)[7] reported that the number of overweight adults increased from 45.9% to 51.2% between 2005 and 2010. The same survey showed that in the Atlantic region of Colombia, and especially in Barranquilla, there is a growing trend in overweight and obesity rates: 54.5% of adults between 18 and 64 years of age suffer from one of those conditions.[7] These data reveal a public health problem and are evidence of the need to address it.

Cardiorespiratory fitness (CRF) is an important indicator for assessing health status, as it is part of the four conditional motor capacities (strength, endurance, speed, flexibility).[8] It allows measuring endurance during activities in which the resynthesis of adenosine triphosphate is achieved mainly through aerobic metabolism.[9] Its physiological marker is the maximum rate of oxygen consumption (VO_2max), which refers to the body's ability to transport and use oxygen during exercise.[10] This is an indicator that is inversely related to cardiovascular disease morbidity and mortality,[8] and it expresses the degree or level of physical fitness of an individual; therefore, a decrease in VO_2max may be an early marker of altered cardiovascular physiology.[11]

VO_2max, which is equivalent to the maximum oxygen carrying capacity from the environment to the mitochondria,[12] is the most important parameter for quantifying the physical fitness of an individual.[13] Physical fitness can be estimated using direct and indirect methods that have different levels of accuracy and that may include surveys such as the International Physical Activity Questionnaire (IPAQ). In view of the above, functional capacity should be monitored through field tests, which are an affordable alternative[8] and have been validated in different studies.[14,15]

Teachers represent a large part of the Colombian workforce, and even though this population is subject to a series of factors that deteriorate their health status,[13] the promotion of healthy practices in their workplaces is still not satisfactory.[16] In this regard, Romero-Pérez *et al.*[17] state that there are negative relationships between workers' productivity and their level of sedentariness; moreover, Gómez *et al.*[5] argue that the presence of uncontrolled psychosocial risks in the workplace can increase the rate of cardiovascular disease. In Bogotá, García-Castro & Muñoz-Sánchez[16] have stressed the importance of understanding the relationship between the teaching practice and health and safety in the workplace given the strong impact it has on the development of society.

Due to the psychosocial factors that can trigger them, and because they not only have an impact on the personal, family and social environment but also on the working environment, cardiovascular diseases are considered as an occupational hazard for teachers.[18] This is a really concerning situation that has not been addressed adequately by any study carried out in Barranquilla. With this in mind, the aim of the present study was to determine the relationship between BMI and CRF in public school teachers in the city of Barranquilla, Colombia.

Materials and methods

A quantitative, descriptive, correlational, cross-sectional study was carried out after being approved by the Research Ethics Committee of the Physical Therapy Program of the Universidad Simón Bolívar by means of Minutes No. 0014 of 2015. For its elaboration, the dispositions of Resolution 8430 of 1993 of the Ministry of Health of Colombia[19] and the principles contained in the Declaration of Helsinki were considered.[20]

The universe consisted of 6 464 active teachers from public schools in Barranquilla aged between 18 and 65 years. The final simple size (n=363) was determined using the StatCalc application available in the Epi Info™ software, with a 95% confidence level and a 5% margin of error. Once the sample size was determined, population-based descriptive studies were conducted.

Sampling was done in 2 stages. First, 165 schools were divided/classified by location; then, the schools were randomly selected based on their location and the teachers were proportionally distributed (Table 1). The sample included teachers who had no physical limitations at the time of testing, no history of cardiovascular risk, were not on any type of medical treatment and reported not being under medical supervision.

Table 1. Distribution of the sample participating in the study according to location.

Location	Total number of schools	Percentage of schools	Number of teachers
Southeast	43	26%	95
Metropolitan	36	22%	79
Southwest	58	35%	128
North Historic Center	21	13%	46
Riomar	7	4%	15
Total	165	100%	363

Source: Own elaboration.

Before starting the study, permission was requested from the Education Department of the District of Barranquilla and a pilot test with 15 teachers was carried out, which allowed adjusting the instruments and training the evaluators according to the requirements of the instrument to be applied. Once the teachers agreed to participate, they were asked to sign an informed consent and then to fill out the questionnaires to obtain anthropometric measurements for weight and height based on the protocols proposed by the STEPS Instrument.[21]

Finally, the Rockport 1 mile walk test was applied to assess cardiorespiratory fitness.

Height was measured with a Kramer measuring device, while weight was established using a Tanita BC-585F FitScan Body Composition Monitor®. A protocol was implemented to evaluate CRF, in which the participants warmed up and then walked a mile (1 609m) as fast as possible. Aerobic capacity was estimated based on the variables age, sex, elapsed time at the end of the mile and heart rate at the end of the test, using the equation proposed by Kline *et al.* in 1987 and described by the American College of Sports Medicine in 2005: VO_2máx (mL/kg/min) = 132.85 - (0.076 x body weight) - (0.387 x age) + (6.31 x sex) - (3.264 x time) - (0.1565 x HR).[22]

The data were processed and analyzed with the statistical program SPSS version 21.0 and a univariate analysis was performed to obtain absolute and relative frequencies and central tendency and dispersion measures. Subsequently, a bivariate analysis was performed to determine the normality of the variables, which were parametric; the t-Student test was used to find mean differences for independent samples by means of correlations with the Pearson coefficient. Statistically significant differences were established based on a $p<0.05$ value.

Results

The mean age of the participants was 48.1±9.41 years. It should be noted that 82.3% of the participants were adults, mostly women, who lived in low-middle-income households (socioeconomic stratum 3, for detailed information of socioeconomic classification in Colombia, see Table 2), with bachelor's degrees and with more than 13 years of service in teaching (Table 3).

Table 2. Socioeconomic strata in Colombia according to the National Administrative Department of Statistics.

Stratum	Description
1	Low-low. Beneficiaries of home utility subsidies.
2	Low. Beneficiaries of home utility subsidies.
3	Middle-low. Beneficiaries of home utility subsidies.
4	Middle. They are not beneficiaries of subsidies, nor do they pay surcharges; they pay exactly the amount that the company defines as the cost for providing home utilities.
5	Middle-high. They pay surcharges (contribution) on the value of home utilities.
6	High. They pay surcharges (contribution) on the value of home utilities.

Source: Elaboration based on the data by National Administrative Department of Statistics.[23]

Table 3. Socio-demographic characteristics of the participants.

Variables		Sample n=363		Male n=101		Female n=262	
		Frequency	%	Frequency	%	Frequency	%
Age	Youth	13	3.5	4	3.9	9	3.4
	Adulthood	299	82.3	90	89.1	209	79.7
	Old age	51	14	7	6.9	44	16.7
Socioeconomic stratum	1	20	5.5	5	5	15	5.7
	2	119	32.8	43	42.6	76	29
	3	166	45.7	40	39.6	126	48.1
	4	44	12.1	9	8.9	35	13.4
	5	8	2.2	4	4	4	1.5
	6	6	1.7	0	0	6	2.3
Educational attainment	High school	2	0.6	0	0	2	0.8
	Associate degree	12	3.3	1	1	11	4.2
	Bachelor's degree	155	42.7	53	52.5	102	38.9
	Postgraduate diploma	145	39.9	31	30.7	114	43.5
	Master's degree	46	12.7	15	14.9	31	11.8
	Doctoral degree	3	0.8	1	1	2	08
Tenure	<1 year	23	6.3	10	9.9	13	5
	1-12 years	128	35.3	39	38.6	89	34
	13-24 years	147	40.5	37	36.6	110	42
	26-36 years	34	9.4	11	10.9	23	8.8
	37-48 years	31	8.5	4	4	27	10.3

Source: Own elaboration.

The mean BMI was 27.02±4.49 kg/m^2 and it was higher in men; on the other hand, the mean CRF was 26.41 mL/kg/min^{-1}, with better values in men (30.5 mL/kg/min^{-1}) than in women (24.84 mL/kg/min^{-1}). The average time used by both men and women to perform the Rockport test was approximately 18.8 minutes (Table 4); mean weight, height and diastolic blood pressure were better in women. There was also a high prevalence of overweight and obesity among the sample, which was higher in men as well (Table 5).

Table 4. Descriptive statistics of the body mass index and cardiorespiratory capacity assessment.

Variables		n=363			Male (n=101)	Female (n=262)
		x̄±σ	Min.	Max.	x̄±σ	x̄±σ
Body mass index assessment	Age	48.1+9.4	23	65	47+8.8	48.55+9.6
	Weight (kg)	73.4+14	39.7	128	81.6+12.8	70.3+13.1
	Height (cm)	1.64+0.0	1.5	1.9	1.70+0.1	1.6+0.1
	Body mass index (kg/m^2)	27.0+4.4	16.3	41.8	27.5+4.1	26.8+4.63
Cardiorespiratory fitness assessment	Ending heart rate (beat/m)	110+15	73	165	110.4+15	111.0+15.8
	Time (min)	18.8+2.2	13.4	25.3	18.11+2.3	19.18+2.10
	Cardiorespiratory fitness (mL/kg/min^{-1})	26.4+6.9	16.21	49.83	30.50+8.4	24.84+5.55

x̄: mean; σ: standard deviation; Min: minimum; Max: maximum.
Source: Own elaboration.

Table 5. Overweight and obesity indicators.

Variable	Total	%	Male n (%)	Female n (%)
Obesity	88	24.2%	63 (24%)	25 (24.8%)
Overweight	150	41.3%	104 (39.7%)	46 (45.5%)
Normal weight	121	33.3%	91 (34.7%)	30 (29.7%)
Underweight	4	1.1%	4 (1.5%)	0 (0.0%)

Source: Own elaboration.

When applying the t-Student test, significant differences were found between men and women ($p<0.05$) in variables such as weight, height and CRF (Table 6). On the other hand, after applying Pearson's correlation coefficient, a negative correlation (-0.181) was found between BMI and CRF, which indicated that teachers with normal BMI tend to have better VO$_2$max; the strength of the correlation was almost zero (Table 7).

Table 6. Comparison of sex and anthropometric and physiological variables.

Variables	t	Significance (bilateral)	Mean difference	95% confidence interval	
Weight (kg)	-7.425	0.000 *	-11.384	-14.40	-8.36
Height (meters)	-14.287	0.000 *	-0.1053	-0.11	0.09
Body Mass Index (kg/m^2)	-1.318	0.188	-0.6933	-1.72	0.34
Heart rate at the end of the test (beat/m)	0.298	0.766	1.844	-3.07	4.17
VO$_2$máx (mL/kg/min)	-7.436	0.000 *	-5.667	-7.16	-4.16

* Significance level <0.05.
Source: Own elaboration.

Table 7. Correlation of cardiorespiratory fitness with body mass index

Variable	Pearson's Correlation	Significance (bilateral)
Body Mass Index	-0.181	0.001 *

* Significance level <0.05.
Source: Own elaboration.

Discussion

The present research sought to determine the relationship between BMI and CRF in active teachers of public schools in Barranquilla, Colombia. It found a high prevalence of overweight and obesity and low CRF in the evaluated population, as well as a significant and negative correlation between BMI and CRF.

72.20% of the population studied were women. This aspect coincides with the study conducted by García-Castro & Muñóz-Sánchez[16] in teachers from public schools in the city of Bogotá, Colombia, which suggests that the predominant presence of women in teaching activities may be explained by the fact that this is a profession with deep emotional ties.

According to their educational attainment, rank and socioeconomic stratum, most of the sample was classified in the middle-income level. In this regard, Álvarez-Castaño et al.[24] suggest that the probability of suffering from obesity is greater for those living in the low- or medium- class households and in families with incomes below COP 1 400 000 (about USD 400). These aspects may explain the socioeconomic gradient of overweight and obesity and the decrease in CRF, as there is an inverse relationship between these variables.[6] The relationship between socioeconomic level and the probability of developing these diseases is more evident in women since it has been found that overweight and obesity rates in this population decrease as the economic level increases.[4]

The prevalences of overweight and obesity found in the present study are similar to those reported in the 2010 ENSIN[7] and other research conducted in Latin America. For example, Bencomo et al.[25] reported a prevalence of overweight of 44% and obesity of 23% in university teachers, while Romero-Pérez et al.[17] reported a prevalence of overweight of 40.1% and obesity of 12% in women, data that is comparable to what was obtained here for the same population (39.7% and 24%, respectively).

The presence of overweight and obesity in the participants of our study is high: 24.2% were obese and 41.3% overweight. Nationwide, these data are similar to the findings of Valencia-García et al.[26] in Risaralda, who reported that 62.5% of the sample was overweight and obese, particularly women (64.7%) compared to men (57.4%), but contrary to the study by Fernández-Rodríguez et al.,[27] in which there were no significant correlations between CRF and BMI in university students in Villavicencio, Colombia.

The percentages of normal weight and underweight teachers in this study were 33% and 1%, respectively. This agrees with the findings of Mora-García et al.[28] in Cartagena, Bolívar, where the prevalence of underweight was 3.3%, and by Mantilla-Morrón et al.[29] in Barranquilla, where the prevalence of underweight was 5.7%.

In relation to sex, the frequency of overweight and obesity was higher in men than in women (70% and 63.7%, respectively). Overweight was the most common variable in both sexes (39.7% in men and 45.5% in women), which coincides with Fortich & Gutiérrez[4] and Rodríguez-Rodríguez et al.,[30] but differs from Navarro-Lechuga & Vargas-Moranth,[31] who reported that the prevalence of obesity was higher in women (26.80%) than in men (20.50%).

The present study is related to others that show that a better CRF is associated with a lower risk of disease and death[10,13] since there is a statistically significant relationship between the presence of overweight and obesity —which bring with them a series of associated comorbidities— and the likelihood of suffering from cardiovascular diseases.

The estimated average CRF was 26.41 mL/kg/min (standard deviation 6.9) with a minimum value of 16.21 mL/kg/min and a maximum value of 49.83 mL/kg/min, being higher in men with an average of 30.5 mL/kg/min. This coincides with the study by Ho et al.,[32] which described an average of 26.8 mL/kg/min in men, but differs from the averages reported by Meseguer-Zafra et al.[33] in men (37.1 ml/kg/min) and women (31.1 ml/kg/min), and by Aranguiz et al.[2] (37.4 ml/kg/min and 30.4 ml/kg/min, respectively). Moreover, the average cardiorespiratory fitness in men found in the present study is much lower than that described by Sechi & García[8] (42-49 ml/kg/min), although VO_2max was evaluated using different equations in their study.

In our study, the average CRF in women was similar to that described by Zapata-Lamana,[34] who reported worse levels of cardiorespiratory fitness and higher BMI values. These data may be related to the measurement of the waist circumference and the percentage of total and localized fat mass, variables that were not considered in the present research; however, they are endogenous variables from a physiological point of view.

A statistically significant and negative relationship between BMI and CRF was found during the investigation. This is similar to what was reported by Shazia et al.,[11] who reported that overweight girls had decreased cardiorespiratory fitness compared to young women with normal weight. It also differs from Aranguiz et al.,[2] who found a negative linear relationship like that of the present study where the strength of this correlation is zero.

Teachers in Barranquilla public schools currently have a low CRF that is associated with increased BMI and risk of cardiovascular disease. This situation is also influenced by family and personal medical history, which were found in 59.2% and 40.5%, respectively. In this sense, the results highlight the importance of creating public policies that allow the implementation of cardiovascular disease prevention and occupational health programs that include the practice of physical activity, thus raising awareness among the population about the undoubted benefits that these practices have for their health.

The authors acknowledge that the main limitation of this study was the access to teachers due to their multiple routine activities.

Conclusion

Given the high prevalence of overweight and obesity and the low CRF found among teachers in public schools from Barranquilla, there is a clear need to implement health promotion and prevention programs that include physical activity and the nutritional component to support the acquisition of healthy lifestyles.

Explanatory note: This article derives from the final work presented to obtain the Master's degree in Physical Activity and Health of the Universidad Simón Bolívar entitled *Índice de masa corporal y capacidad*

cardiorespiratoria en docentes activos del sector oficial del distrito de Barranquilla (Body mass index and cardiorespiratory fitness in active public school teachers of the district of Barranquilla.)[35]

Conflicts of interest

None stated by the authors.

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References

1. Caballero-Uribe CV, Alonso-Palacio LM. Enfermedades crónicas no transmisibles. Revista Científica Salud Uninorte. 2010;26(2):7-9.
2. Aránguiz H, Garcia V, Rojas S, Salas C, Martínez R, Mac Millan N. Estudio descriptivo, comparativo y correlacional del estado nutricional y condición cardiorrespiratoria en estudiantes universitarios de chile. Rev. chil. nutr. 2010;37(1):70-8. http://doi.org/dvbwzc.
3. García-Rodríguez JF, García-Fariñas A, Rodríguez-León GA, Gálvez-González AM. Dimensión económica del sobrepeso y la obesidad como problemas de salud pública. Salud en Tabasco. 2010;16(1):891-6.
4. Fortich R, Gutiérrez JD. Los determinantes de la obesidad en Colombia. Economía y región. 2011;5(2):155-182.
5. Gómez R, Monteiro H, Cossio-Blaños MA, Fama-Cortez D, Zanesco A. El ejercicio físico y su prescripción en pacientes con enfermedades crónicas degenerativas. Rev. Perú. med. exp. salud pública. 2010;27(3):379-386.
6. Acosta K. La obesidad y su concentración según nivel socioeconómico en Colombia. Revista de Economía del Rosario. 2013;16(2):171-200.
7. Fonseca-Centeno Z, Heredia-Vargas AP, Ocampo-Téllez R, Forero-Torres Y, Sarmiento-Dueñas OL, Álvarez-Uribe MC, et al. Encuesta Nacional de la Situación Nutricional en Colombia 2010 - ENSIN. Bogotá D.C.: Instituto Colombiano de Bienestar Familiar; 2011. Disponible en: https://bit.ly/2bwX9Od.
8. Secchi JD, García GC. Aptitud física cardiorrespiratoria y riesgo cardiometabólico en personas adultas jóvenes. Rev. Esp. de Salud Pública. 2013;87(1):35-48.
9. Niño-Hernández CA. Estimación del consumo máximo de oxigeno mediante pruebas de ejercicio maximales y submaximales. Mov. Cient. 2012;6(1):19-30. http://doi.org/dbfc.
10. Koutlianos N, Dimitros E, Metaxas T, Cansiz M, Deligianis AS, Kouidi E. Indirect estimation of VO2max in athletes by ACSM's equation: valid or not? Hippokratia. 2013;17(2):136-40.
11. Shazia SM, Badaam KM, Deore DN. Assessment of aerobic capacity in overweight young females: A cross-sectional study. Int Appl Básica Med Res. 2015;5(1):18-20. http://doi.org/c8dw.
12. Schaun GZ. The Maximal Oxygen Uptake Verification Phase: a Light at the End of the Tunnel? Sports Med Open. 2017;3(1):44. http://doi.org/gfvxf8.
13. Heyward V. Evaluación de la aptitud física y prescripción del ejercicio. 5th ed. Madrid: Médica Panamericana; 2008.
14. Coolbaugh CL, Anderson IB, Wilson MD, Hawkins DA, Amsterdan EA. Evaluation of an Exercise Field Test Using Heart Rate Monitors to Assess Cardiorespiratory Fitness and Heart Rate Recovery in an Asymptomatic Population. PLoS One. 2014;9(5):e97704. http://doi.org/f58cjm.
15. Garcés-Arteaga A, Nieto-García N, Suárez-Sánchez F, Triana-Reina HR, Ramírez-Vélez R. Influence of a Medium-Impact Exercise Program on Health-Related Quality of Life and Cardiorespiratory Fitness in Females with Subclinical Hypothyroidism: An Open-Label Pilot Study. J Thyroid Res. 2013;2013:592801. http://doi.org/gb7gmj.
16. García-Castro CM, Muñoz-Sánchez AI. Salud y trabajo de docentes de instituciones educativas Distritales de la localidad uno de Bogotá. Av. enferm. 2013;31(2):30-42.
17. Romero-Pérez I, Monterrosa-Castro A, Paternina-Caicedo A. El sobrepeso y la obesidad se asocian a mayor prevalencia de síntomas menopaúsicos y deterioro severo de la calidad de vida. Revista Científica Salud Uninorte. 2014;30(2):180-91.
18. Colombia. Ministerio de Educación Nacional. Decreto 1655 del 2015 (agosto 20): Por el cual se adiciona el Decreto 1075 de 2015, Único Reglamentario del Sector Educación para reglamentar el artículo 21 de la Ley 1562 de 2012 sobre la Seguridad y Salud en el Trabajo para los educadores afiliados al Fondo Nacional de Prestaciones Sociales del Magisterio y se dictan otras disposiciones. Bogotá D.C.: Diario Oficial 49610; agosto 20 de 2015 [cited 2019 Jul 17]. Available from: https://bit.ly/2Y2Wg75.
19. Colombia. Ministerio de Salud y Protección Social. Resolución 8430 de 1993 (octubre 4): Por la cual se establecen las normas científicas, técnicas y administrativas para la investigación en salud. Bogotá D.C.; octubre 4 de 1993 [cited 2019 Jul 17]. Available from: https://bit.ly/2nH9STI.
20. World Medical Association (WMA). WMA Declaration of Helsinki - Ethical principles for medical research involving human subjects. Fortaleza: 64th WMA General Assembly; 2013 [cited 2019 Jul 17]. Available from: https://bit.ly/2rJdF3M.
21. Organización Mundial de la Salud (OMS). Manual de vigilancia STEPS de la OMS: el método STEPwise de la OMS para la vigilancia de los factores de riesgo de las enfermedades crónica. Parte 1: Introducción y funciones. Ginebra: MS; 2006 [cited 2010 Jan 26]. Available from: https://bit.ly/30CeIAS.
22. American College Of Sport Medicine (ACSM). Manual ACSM para la valoración y prescripción del ejercicio. 2nd ed. Barcelona: Editorial Paidotribo; 2005.
23. Departamento Administrativo Nacional de Estadística DANE. Estratificación socioeconómica para servicios públicos domiciliarios. Bogotá D.C.: DANE; 2015 [cited 2015 Dec 15]. Available from: http://bit.ly/2IUai29.
24. Álvarez-Castaño LS, Goez-Rueda JD, Carreño-Aguirre C. Factores Sociales y económicos asociados a la obesidad: los efectos de la inequidad y la pobreza. Rev. Gerenc. Polit. Salud, Bogotá (Colombia). 2012;11(23):98-110.
25. Bencomo MN, Dugarte-Fernández N, Berríos-Rivas AT, Blanco MR. Factores de riesgo obesidad y sobrepeso en el personal docente universitario. Barquisimeto, estado Lara Venezuela. Sal Art Cuidad. 2011;4(2):20-31.

26. Valencia-García MD, Aguilar OL, Rodríguez-Morales AJ. Caracterización de los pacientes en una consulta de hipertensión arterial de un municipio de Risaralda. Rev Med de Risaralda. 2012;18(2):122-9.

27. Fernández-Rodríguez JA, Ramos HS, Saantamaría OM, Ramos-Bermudez S. Relación entre consumo de oxígeno, porcentaje de grasa e índice de masa corporal en universitarios. Hacia promoc. Salud. 2018;23(2):79-89.

28. Mora-García G, Ruiz-Díaz MS, Gómez-Camargo DE. Asociación del consumo de alcohol y tabaco con la obesidad en adultos de Cartagena de Indias, Colombia. Revista científica Salud Uninorte.2018;34(1):100-11. http://doi.org/dc74.

29. Mantilla-Morrón M, Herazo-Beltrán Y, Urina-Triana M. Factores de riesgo cardiovascular según género en el programa "Muévete corazón" de Barranquilla, 2011. Arch Med (Manizales). 2014;14(1):21-8.

30. Rodríguez-Rodríguez B, López-Plaza AM, A, López-Sobaler, Ortega R. Prevalencia de Sobrepeso y Obesidad en Adultos españoles. Nutr. Hosp. 2011;26(2):355-63.

31. Navarro-Lechuga E, Vargas-Moranth R. Prevalencia de obesidad en adultos del municipio de Soledad (Atlántico-Colombia), 2010. Revista Científica Salud Uninorte. 2012;28(1):49-64.

32. Ho SS, Dhaliwal SS, Hills AP, Pal S. The effect of 12 weeks of aerobic, resistance or combination exercise training on cardiovascular risk factors in the overweight and obese in a randomized trial. BMC Public Health. 2012;12:704. http://doi.org/gb3h8q.

33. Meseguer-Zafra M, García-Cantó E, Rodríguez-García PL. Influencia de un programa de ejercicios en la condición física de sujetos de 26 a 47 años con algún factor de riesgo cardiovascular. EmasF, Revista digital de educación física. 2016;7(38):27-40.

34. Zapata-Lamana R. Capacidad Cardiorrespiratoria, Variables Antropométricas y de Composición Corporal en Mujeres Jóvenes Universitarias con Sobrepeso y Obesidad. Kronos. 2017;16(1).

35. Fontalbo- Navarro S. Índice de masa corporal y capacidad cardiorespiratoria en docentes activos del sector oficial del distrito de Barranquilla [tesis de maestría]. Barranquilla: Universidad Simón Bolívar; 2017 [cited 2020 Feb 7]. Available from: http://bit.ly/3bqfgQT.