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Prevalence of cardiometabolic risk factors in three populations from Venezuela: the VEMSOLS STUDY 2006-2010

Running title: prevalence of cardiometabolic risk factors in Venezuela

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Abstract

Introduction: no previous studies had reported the prevalence of cardiometabolic diseases various regions of Venezuela. **Objective**: to determine the prevalence of cardiometabolic risk factors in 3 populations of Venezuela. **Methods**: the VEMSOLS study is a sub-national, cross-sectional, population based, with bi-stage random sampling study, evaluating 751 subjects aged 20 or older from 3 selected municipalities of Venezuela. Anthropometric and biochemical measurements were obtained. ANOVA was used to continous variables and Chi-square to proportions, a $p<0.05$ was significant. **Results**: 69% were females and 81.4% from urban areas. Low HDL-c was the most prevalent disorder (63.8% [–CI- 95% 60.1-67.4]), being more common in women than in men (74.1% [69.9 -77.9] and 40.4% [33.7-43.4], respectively, $p < 0.05$); followed by abdominal obesity (47.4% [43.8 -51.1]) and hypertriglyceridemia (45.2% [41.5 - 49.0]). One third (30.0% [26.7-33.4]) had hypertension, 11.8% (9.5 -14.5) diabetes, 23.1% (20.2-26.3) obesity, and 20.1% (17.2-23.4) elevated LDL-cholesterol. Metabolic syndrome was present in 29.9% (26.5-33.5) of the sample. Rural population from the Andeans mountains (Páramo) presented a lower prevalence of obesity and low HDL-c ($p < 0.05$) comparing with urban samples. Lara's population, which had the highest Body Mass Index of the 3 municipalities, had a higher prevalence of abdominal obesity, atherogenic dyslipidemia and elevated LDL-c than the other two populations ($p < 0.05$). **Conclusion:** A high prevalence of cardiometabolic abnormalities in 3 populations of Venezuela was observed with a lower prevalence of alterations in the rural area. **MÉD.UIS. 2018;31(1):15-22.**

Keywords: Venezuela. Obesity. Hypertension. Diabetes Mellitus.

Prevalencia de factores de riesgo cardiometabólico en 3 poblaciones de Venezuela: estudio VEMSOLS 2006-2010

Resumen

Introducción: ningún estudio ha reportado la prevalencia de factores de riesgo cardiometabólico en varias regiones de Venezuela. **Objetivo**: determinar la prevalencia de factores de riesgo cardiometabólico en 3 poblaciones de Venezuela. **Materiales y Métodos**: el estudio VEMSOLS es un estudio sub-nacional, transversal, poblacional, de muestreo aleatorio bi-etápico, evaluando 751 sujetos de 20 o más años de edad de 3 municipios de Venezuela. Mediciones antropométricas y bioquímicas fueron obtenidas. *Analysis of Variance* se utilizó para variables continuas y Chi-cuadrado para proporciones, significancia fue $p<0,05$. **Resultados**: 69% fueron mujeres y 81,4% del área urbana. Colesterol HDL bajo fue la alteración más prevalente (63,8% [Intervalo de Confianza –IC- 95%: 60,1-67,4]), siendo más común en mujeres que en hombres (74,1% [69,9 -77,9] y 40,4% [33,7-43,4], respectivamente, $p< 0,05$); seguidos por obesidad abdominal (47,4% [43,8 -51,1]) e hipertrigliceridemia (45,2% [41,5 – 49,0]). Un tercio (30,0% [26,7-33,4]) tenía hipertensión, 11,8% (9,5 -14,5) diabetes, 23,1% (20,2 – 26,3) obesidad y 20,1% (17,2-23,4) colesterol LDL elevado. El síndrome metabólico estuvo presente en 29,9% (26,5-33,5) de la muestra.

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La población rural de los Andes (Páramo) presentó una baja prevalencia de obesidad y colesterol HDL bajo comparado con las muestras urbanas ($p < 0,05$). La población de Lara, quien tenía el índice de masa corporal más elevado de las 3 municipalidades, mostró una alta prevalencia de obesidad abdominal, dislipidemia aterogénica y colesterol LDL elevado en comparación con las otras dos poblaciones ($p< 0.05$). **Conclusión**: se observó una elevada prevalencia de anormalidades cardiometabólicas en 3 poblaciones de Venezuela con una menor prevalencia de alteraciones en el área rural. **MÉD.UIS. 2018;31(1):15-22.**

Palabras clave: Obesidad. Hipertensión. Diabetes Mellitus.

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Introduction

Non-communicable diseases (NCDs) are the leading cause of global death, representing 68% (38 million) of the world's 56 million deaths in 2012[1]. Cardiovascular disease comprised the major cause of NCD deaths responsible for 17.5 million deaths (46% of NCD deaths)[1]. In Venezuela, the crude mortality rate of diabetes, coronary and cerebrovascular disease, increased from 33 255 deaths (33.7%) in 1995 to 55 454 deaths (35.9%) in 2011[2]. Classic factors as high cholesterol, smoking, hypertension, high body mass index (BMI), and family history of coronary heart disease, accounted for 76% of cases of myocardial infarction in this country[3].

Only two mayor well designed studies had previously reported the prevalence of cardiometabolic risk factors in Venezuela. The Cardiovascular Risk Factor Multiple Evaluation in Latin America (CARMELA) study that included 11 550 subjects from seven Latin American cities, reported that Barquisimeto city (Venezuela) occupied the second place of prevalence of metabolic syndrome (25.8%), 3rd place in hypertension (24.7%), 3rd place in obesity (25.1%); with a lower prevalence of diabetes (6.0%, 5th place), hypercholesterolemia (5.7% 7th place), and cigarette smoke (21.8%, 7th place)[4]. The study of Cardiac Coronary Disease Risk Factors from Zulia state evaluated 3 108 subjects reporting a high prevalence of metabolic syndrome (32.2%), atherogenic dyslipidemia (24.1%), low concentration of high density lipoproteins cholesterol (HDL-c) (65%), abdominal obesity (43%), and elevated blood pressure (38%)[5].

Despite this reports, no previous studies had reported the prevalence in more than one region of Venezuela, this creates a knowledge gap necessary to stablish proper public politicies in Venezuela, prompting the design of the Venezuelan Metabolic Syndrome, Obesity and Lifestyle Study (VEMSOLS). This paper presents the results of VEMSOLS, specifically, the prevalence of cardiometabolic risk factors composed by increased weight, higher blood pressure, dysglycemia, and metabolic syndrome, of three populations, including two urban and one rural area from two regions of Venezuela.

Methods

1. Design and Subjects

An observational, cross-sectional study was designed to determine the prevalence of cardiometabolic risk factors in a sub-national sample of Venezuela. The sample size was calculated to detect a hypercholesterolemia prevalence (the lowest prevalent condition reported in Venezuela) of 5.7%[4] with a standard deviation of 1,55%, which allows to calculate a 95% confidence interval (95% CI). The minimal estimated number of subjects to be evaluated was 830. Overall, 1320 subjects were evaluated in five cities from three regions in Venezuela. In this paper, we analyzed and compared in detail three populations from two regions: Palavecino Municipality in Lara State (urban n=339) from the Western region which is an important urban, industrial, commercial and transportation center of the country located at 622 metres above sea level; Ejido Municipality (Mérida city) in Merida State (urban n= 272) located at 1600 metres above sea level; and Rangel Municipality (Páramo area) in Merida State (rural n= 140), these last two from Andeans region. The rural population, defined as those with territory not included within an urban area with less than 50 000 habitants, is located in the Páramo Mountains at 3000 meter over the sea level, predominantly dedicated to agriculture. During the years 2006 to 2010, a total of 750 subjects aged 20 or older that had lived in their houses at least six months were selected by bi-stage random sampling multistage stratified random sampling. Each

region was stratified by municipalities and one was randomly selected. Map and census of each location were required to delimit the streets or blocks, and to select the households to visit in each municipality. After selecting the sector to be surveyed at each location, the visits to households started from number one onwards skipping every two houses. Pregnant women and participants with inability to stand up and/or have verbal communication were excluded.

2. Clinical and biochemical data

All subjects were evaluated in their home or in a nearby health center by a trained health team according to a standard protocol. This health team was composed of volunteer's medical students from basic and postgraduate[6], and the principal investigators of the study, who provided a two-days training to the collaborators. Each home was visited twice. In the first visit, the participants received information about the study and the written informed consent was obtained. Demographic and clinical information was obtained using a standardized questionnaire. Blood pressure was measured twice in the right arm supported to the heart level, in sitting position, after five minutes of rest, with a calibrated aneroid sphygmomanometer or mercury sphygmomanometer in the rural sample. Weight was measured with the fewest clothes possible, without shoes, using a calibrated scale. Height was measured using a metric tape on the wall. Body mass index (BMI; weight [kg]/height[m]^2) was calculated. Waist circumference was measured at the iliac crest, in a horizontal plane with the floor at the end of expiration.

In the second visit, blood samples were drawn after 12 hours of overnight fasting. Samples were centrifuged during 15 minutes at 3000 rpm within 30-40 minutes after collection, and transported with dry ice to the central laboratory where were properly stored at -40°C until analysis. Questionnaire information from absents participants in the first visit was collected. Glucose plasma concentration[7], total cholesterol[8], triglycerides[9], lipoprotein of low density of cholesterol (LDL-c), and HDL-c[10], were determinate by standard enzymatic colorimetric methods.

3. Categorization of variables

Individuals were classified according to the BMI as normal weight (BMI < 25 kg/m^2), overweight (BMI ≥ 25 kg/m^2 and < 30 kg/m^2), or obese (IMC ≥ 30 kg/m^2)[11]. Abdominal obesity was defined according to the cut-off proposed to Latin-America (waist circumference ≥ 94 cm in men or ≥ 90 cm in women)[12]. Hypertension was defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg, or antihypertensive medications use[13]. Dyslipidemia was defined according to the NCEP/ATPIII[14] definition, and was categorized in 6 types: Hypercholesterolemia (≥ 240 mg/dL of total cholesterol); low HDL-c (< 40 mg/dL HDL-c in men and < 50 mg/dL HDL-c in women); hypertriglyceridemia (≥ 150 mg/dL of triglycerides); mixed dyslipidemia (≥ 150 mg/dL of triglycerides plus ≥ 240 mg/dL of total cholesterol); high LDL-c (≥ 160 mg/dL of LDL-c), and atherogenic dyslipidemia (≥ 150 mg/dL triglycerides plus low HDL-c). Glucose alterations where classified as prediabetes if fasting glucose was between 100 mg/dL and 125 mg/dL (impaired fasting glucose), and diabetes if fasting plasma glucose was ≥ 126 mg/dL.[15] Participants receiving anti-diabetic medications also were considered as diabetic. Metabolic syndrome was defined as in the NCEP/ATPIII[14] to compare the results with studies previously published. These criteria include the presence of 3 or more of the following abnormalities: waist circumference > 102 cm in men or > 88 cm in women; triglycerides ≥ 150 mg/dL; HDL-c level < 40 mg/dL in men or < 50 mg/dL in women; blood pressure ≥ 130/85 mmHg; and fasting blood glucose ≥ 110 mg/dL.

4. Statistical Analysis

All calculations were performed using the SPSS 20 software (IBM corp. Released 2011. Armonk, NY: USA). Data for continuous variables are presented as mean ± standard error of the mean. Differences between mean values were assessed by analysis of variance (ANOVA), with Bonferroni adjustment for multiple comparisons. Proportion of subjects with obesity, hypertension, dyslipidemia, prediabetes, diabetes, and metabolic syndrome, were presented as prevalence rates and 95% confidence intervals (95% CI). Chi square test was applied to compare different frequencies by gender and between the three regions. A p-value of < 0.05 was considered to be statistically significant.

Results

Subjects Characteristics

Overall, 751 subjects, 69% females and 81.4% from urban areas were assessed (See Table 1). Almost half

of participants had family history of diabetes and one third had family history of obesity and hypertension. Six percent reported have diabetes and around three percent had previous cardiovascular disease. Lower values of waist circumference, blood pressure, glucose, and triglycerides; and a higher concentration of HDL-c were found in women. Participants living in rural areas had lower values of BMI and waist circumference, but higher concentrations of glucose and HDL-c.

Table 1. Demographic and clinics characteristics and cardiometabolic risk factors in the subjects by locality and gender.

	Men			Women			Total	
	Lara (Urban) (n=107)	Páramo (Rural) (n=51)	Mérida (Urban) (n=71)	Lara (Urban) (n=232)	Páramo (Rural) (n=89)	Mérida (Urban) (n=201)	Men (n=229)	Women (n=522)
Age (years)	45,1 ± 1,38	41,1 ± 1,38	45,9 ± 1,38	46,1 [1] ± 0,88	40,4 [2] ± 1,38	46,0 [1] ± 1,38	44,5 ± 1,38	45,1 ± 1,38
Body mass index (kg/m²)	28,2[a] ± 0,53	24,9 [b] ± 1,38	26,7 [a,b] ± 1,38	27,2 [1] ± 0,34	24,9 [2] ± 1,38	26,7 [1] ± 1,38	27,0 ± 1,38	26,6 ± 1,38
Waist Circumference (cm)	99,3*[a] ± 1,38	91,3 [b] ± 1,38	92,0 * [b] ± 1,38	89,7 [1] ± 1,38	87,4 [2] ± 1,38	88,4 [2] ± 1,38	95,2 * ± 1,38	88,8 ± 1,38
Systolic blood pressure (mmHg)	124,2* ± 1,38	121,6 ± 1,38	122,5 ± 1,38	118,6 ± 1,38	116,8 ± 1,38	118,0 ± 1,38	123,1 * ± 1,38	118,0 ± 1,38
Diastolic Blood Pressure (mmHg)	78,3* ± 1,38	79,6 * ± 1,38	76,1 ± 1,38	73,9 ± 1,38	75,4 ± 1,38	73,4 ± 1,38	77,9 * ± 1,38	73,8 ± 1,38
Fasting glucose (mg/dl)	95,0 [a,b] ± 1,38	112,0 * [a] ± 1,38	84,6 [b] ± 1,38	94,9 [1] ± 1,38	90,3 [1,2] ± 1,38	82,9 [2] ± 1,38	96,4 * ± 1,38	90,0 ± 1,38
Total cholesterol (mg/dl)	206,6 ± 1,38	197.4 ± 1.38	195.7 ± 1.38	209,4 [1] ± 1,38	204,0 [1,2] ± 1,38	192,1[2] ± 1,38	201,6 ± 1,38	202,6 ± 1,38
HDL cholesterol (mg/dl)	41,1[a]* ± 1,38	50,3 [b] ± 1,38	42,4 [a] ± 1,38	44,1 [1] ± 1,38	51,4 [2] ± 1,38	44,5 [1] ± 1,38	43,6 * ± 1,38	45,5 ± 1,38
LDL cholesterol (mg/dl)	127,0 ± 1,38	112,5 ± 1,38	120,9 ± 1,38	134,9 [1] ± 1,38	123,4 [1,2] ± 1,38	118,3 [2] ± 1,38	122,0 ± 1,38	127,4 ± 1,38
Triglycerides (mg/dl)	225,0* ± 1,38	173,7 ± 1,38	157,0 ± 1,38	155,2 ± 1,38	146,3 ± 1,38	149,1 ± 1,38	194,9 * ± 1,38	151,5 ± 1,38

Values are expressed in mean ± standard error

*** Indicate differences between genders from each region and the total by t-test to independent samples.**

[a,b,c] Letters indicate differences between men in the 3 regions by one way ANOVA and Bonferroni test.

[1,2,3] Numbers indicate differences between women in the 3 regions by one way ANOVA and bonferroni test.
Source: authors.

Prevalence of Cardiometabolic Risk Factors

Low HDL-c was the most prevalent disorder, representing almost two thirds of the participants (63.8%), being more common in women than men (74.1% vs. 40.4%, respectively; p< 0.05) (See table 2). Secondly, abdominal obesity (47.4%) and hypertriglyceridemia (45.2%) affected half of the sample, this last, was more prevalent in men than women (52.8% vs. 41.9%, respectively; p< 0.05) (Table 2). 30% of population had hypertension, 11.8% diabetes, 23.1% obesity, and 20.1% elevated LDL-c. When different variables were pooled, 58.5% of the subjects have an increased BMI (>25 kg/m²), 62.3% have raised blood pressure (pre-hypertension plus hypertension) and 24.6% presented glucose alterations (prediabetes plus diabetes). Metabolic syndrome, that compelling three or more alterations, was prevalent in 29.9% of the subjects.

Those subjects from rural area reported 50% less prevalence of obesity and low HDL-c than those from urban areas (p< 0.05). Only prediabetes was higher in the rural sample compared with the Ejido Municipality. Lara´s subjects (urban), had the higher BMI and a higher prevalence of abdominal obesity, atherogenic dyslipidemia, and elevated LDL-c, than the other two populations (p < 0.05).

Table 2. Prevalence of cardiometabolic risk factors by locality and gender.

	Lara (Urban n=339)	Páramo (Rural n= 140)	Mérida (Urban n= 272)	Total (n= 751)
Obesity (%)				
Men	26.4 (18.5-36.0)[a]	11.8 (4.9-24.6) [b]	21.1(12.7-32.7) [a,b]	21.5 (16.5-26.5)
Women	26.8 (21.3-33.1)[a]	12.4 (6.6 – 21.4) [b]	25.4(19.6-32.1) [a]	23.8 (20.2-27.7)
Total	26.7 (22.1-31.8)	12.1 (7.4 – 19.0)	24.3 (19.4 – 30.0)	23.1 (20.2-26.3)
Overweight (%)				
Men	45.3 (35.37-55.2)	31.4 (19.5 – 46.0)	40.8 (29.5 – 53.2)	40.8 (34.4-47.5)
Women	36.4 (30.2-42.9)	30.3 (21.8 – 41.1)	32.5 (28.9 – 40.6)	33.8 (29.7-38.1)
Total	39.2 (33.9-44.6)	30.7 (3.4 – 39.2)	34.6 (28.9 – 40.1)	35.4 (43.8-57.1)
Abdominal obesity (%)				
Men	62.3 (52.3-71.3) *[a]	43.1 (42.3 – 70.8)[b]	38.0 (27.0 – 50.4)[b]	50.4 (44.8-53.8)
Women	49.1 (42.5-55.7)	42.7 (46.4 – 67.6)	44.3 (37.3 – 51.4)	46.2 (41.8-50.6)
Total	53.3 (47.7-58.6)	42.9 (48.5 – 68.4)	42.7 (36.7 – 48.7)	47.5 (43.8-51.1)
Pre-diabetes (%)				
Men	19.8 (12.9-28.9) [a]	23.5 (13.3 – 37.8)[a]	7.0 (2.3 – 17.8) [b]	17.3(12.6-23.2)[a]
Women	14.0 (9.8-19.3) [a]	15.7 (9.2 – 25.3) [a]	3.7 (1.5 – 8.2) [b]	10.8(8.2-14.0)[a,b]
Total	15.8 (12.2-20.3)	18.6 (12.7 – 26.2)	4.5 (2.3 -8.4)	12.8 (10.4-15.6)
Diabetes (%)				
Men	10.4 (5.5 – 18.2)	11.8 (4.9 – 24.6)	15.8 (7.9 – 28.4)	12.1 (8.2-14.5)
Women	11.4 (7.7-16.3) [a,b]	6.7 (2.8 – 14.6)[a]	14.6 (9.8 – 21.2) [b]	11.6 (8.9-14.9)
Total	11.0 (8.2 – 15.4)	8.6 (4.7 – 14.8)	14.9 (10.6 – 20.5)	11.8 (9.5-14.5)
Pre-hypertension (%)				
Men	46.7 (37.1-56.6) [a*]	25.5(14.8 – 40.0) [b]	36.2(25.3 – 48.8) [a,b]	38.8 (32.5-45.5)[a,b]
Women	29.3 (23.6-35.7)	36.8 (26.9 – 47.9)	26.4 (20.5 – 33.1)	29.4 (25.6-35.6)
Total	34.8 (29.8-40.1)	32.6 (25.0 – 41.2)	28.9 (23.6 – 34.7)	32.3 (28.9-35.7)
Hypertension (%)				
Men	30.8 (22.5-40.6)	35.3 (22.8 – 50.0)*	34.8 (24.0 – 47.3)	33.0 (27.0-39.6)
Women	27.2 (21.6-33.4)[a,b]	19.5 (12.1 – 27.9)[a]	34.3 (27.9 – 41.4) [b]	28.5 (24.8-32.8)
Total	28.3 (23.6-33.5)	25.4 (18.5 – 33.6)	34.4 (28.8 – 40.5)	30.0 (26.7-33.4)
Hypercholesterolemia (%)				
Men	25.2 (17.6-34.7) [a]	19.6(10.9 – 39.5)[a,b]	8.9 (3.3 – 20.4) [b]	19.6 (14.6-25.7)
Women	24.6 (19.3-30.7) [a]	23.6 (15.5 – 34.0) [a]	12.6 (8.0 – 18.9) [b]	20.4 (16.9-24.3)
Total	24.8 (20.3-29.8)	22.1 (15.7 – 30.1)	11.6 (7.8 – 16.8)	20.2 (17.3-23.4)
Hypertriglyceridemia (%)				
Men	57.0 (47.1-66.4)*	52.9 (38.6 – 66.8)	44.6 (31.6 -58.4)	52.8 (45.9-59.6)*[c]
Women	45.3 (38.7-51.9)	40.4 (30.3 – 51.4)	37.7 (30.3 – 45.8)	41.9 (37.4-46.5)
Total	49.0 (43.5-54.4)	45.0 (36.6 – 53.6)	39.5 (33.0 – 46.4)	45.2 (41.5-49.0)
Low HDL-c (%)				
Men	48.6 (38.9-58.4)* [a]	20.8 (11.0 – 35.4) *[b]	41.5 (28.4 – 55.8) *[a]	40.4 (33.7-43.4)* [b]
Women	78.0 (72.0-83.0) [a]	55.1(44.2 – 65.5) [b]	79.2 (71.8 -85.2) [a]	74.1(69.9 -77.9) [b]
Total	68.7 (63.5-73.6)	43.1(34.7 – 51.8)	69.6 (62.7 – 75.6)	63.8 (60.1-67.4)
Atherogenic Dyslipidemia				
(%)	32.7 (24.1-42.5) [a]	11.8 (4.9 – 24.6) [b]	15.5 (8.6 – 28.5) [b]	22.7(17.6-28.8) [b,c]
Men	38.8 (32.5-45.4) [a]	19.1(11.8 – 29.1) [b]	21.2 (16.5-28.4) [b]	29.0 (25.1-33.1) [a]
Women	36.9 (31.7-42.3)	16.4(10.9 – 23.8)	20.2 (15.7 – 25.6)	27.0 (23.9-30.4) [b]
Total				

High LDL-c (%)				
Men	24.3 (16.7-33.7) [a]	8.3 (2.7 – 20.8) [b]	17.0 (8.5 – 30.3) [a,b]	18.8 (138-24.9) [b]
Women	26.7 (21.2-32.9) [a]	16.9 (10.0-26.6) [a,b]	13.8 (8.9 – 20.1) [b]	20.7 (17.2-24.7)
Total	26.0 (21.4-31.0)	13.9 (8.8 -21.1)	14.6 (10.2 – 20.4)	20.1 (17.2-23.4)
Metabolic Syndrome (%)				
Men	35.8 (26.9-45.8) [a]	20.8 (10.9 – 35.4) [b]	17.0 (8.5 – 30.3) [b]	27.5 (21.7-34.2)
Women	34.5 (28.5-41.0)	29.9 (20.8 – 40.8)	26.1 (19.5 – 34.0)	30.9 (26.8-35.3)
Total	34.9 (29.8-40.3)	26.7 (19.6 – 35.1)	23.8 (18.3 – 30.3)	29.9 (26.5-33.5)

Prevalence is expressed in percentage ± 95% confidence interval.
*** Indicate differences between genders from each regions and the total by Chi square.**
[a,b,c] Letters indicate differences between the 3 regions by gender by Chi square.
Source: authors.

Discussion

A high prevalence of cardiometabolic risk factors in three populations of Venezuela was found. It was characterized for the presence of the metabolic syndrome components (low HDL-c, abdominal obesity, and hypertryliceridemia) as the most frequent alterations. Subjects from urban areas had higher BMI and higher frequency of alterations than those in the rural area. The prevalence of metabolic disorders and hypertension from the rural area was reported earlier[16,17].

Worldwide, high blood pressure is estimated to cause 7.5 million deaths, about 12.8% of the total of all annual deaths by cardiovascular risk[18]. In Latin America, high blood pressure represents the main global burden disease[19]. In fact, hypertension figures double for each increase of 20/10 mmHg of blood pressure, starting as low as 115/75 mmHg[20]. In the present report, the prevalence of hypertension was very high, mainly in the urban area from Mérida (34.4%), where ranked as the third highest prevalence reported in the country when compared with previous reports from the Junquito Municipality[21], Capital District (43.4%) and Maracaibo city in Zulia state (36.9%)[22]. The prevalence reported in Venezuela is similar to the WHO Region of the Americas, with 35% for both genders[18].

The metabolic syndrome represents a cluster of abnormalities with great relevance in the understanding of physiopathology and epidemiologic prevalence of several cardiometabolic alterations[23]. The presence of metabolic syndrome as an increasingly entity predicts the risk for coronary heart disease, cardiovascular disease, type-2 diabetes, and overall mortality; compared to its individual components[24]. In this study, the prevalence of metabolic syndrome in Lara`s populations was very high (34.9%), compared with the CARMELA study (25.8%)[4] and Zulia state (31.2%)[5]; however, it`s kept below when is compared with the Junquito populations (45.4%)[21], Catia city, Vargas state (37%)[25], and Mucuhíes (town), Mérida state (38%)[26]. The prevalence of metabolic syndrome in Mérida city and Páramo area (23.8% and 26.7%; respectively) is the lowest reported in the country, only above of Sucre Municipality, in Miranda state (20%)[6].

The risk of coronary heart disease, stroke and type-2 diabetes increase steadily with increasing BMI[18], and the global prevalence of obesity is continually growing, increasing from 3.2% in 1975 to 10.8% in 2014 in men, and from 6.4% to 14.9% in women[27]. The prevalence of obesity found in the rural sample of this study is the lowest reported in Venezuela (12.1%), being the half of the observed in the urban areas (24.3% and 26.7%, Merida - Lara, respectively), and one third of the observed in Catia (35%)[25], and Valencia city, Carabobo state (39%)[28]. This low prevalence of obesity in the rural area could be explained by agrarian life style, but more studies in other rural areas of the country are necessary.

The global age-standardized diabetes prevalence increased from 4.3% in 1980 to 9.0% in 2014 in men, and from 5.0% to 7.9% in women, representing more than 422 millions of subjects with diabetes around the world[29]. Most people with diabetes live in low- and middle-income countries and these will experience the greatest increase in cases of diabetes over the next 22 years[30]. The prevalence of diabetes reported in the urban areas of the present study is the highest reported in Venezuela (14.9%, and 11.0%, in Merida City and Lara, respectively), doubling the observed in Barquisimeto in the CARMELA study (6%)[31], the Zulia state (7.8% and 7.4% to men and

women, respectively)[5] and the weighed prevalence of all the previous studies in Venezuela (7.7%)[32].

Raised total cholesterol is a major cause of disease burden, in both the developed and developing world, as a risk factor for ischemic heart disease and stroke[18]. The prevalence of hypercolesterolemia observed in our report in Lara populations (24.8%) quintupled the observed in the same population in the CARMELA study (5.7%),[4] but, is significant lower when it's compared with Valencia city, (59%)[28] and Zulia state (39.3%)[33]. In 2008, the worldwide prevalence of raised total cholesterol among adults was 39% (37% for males and 40% for females)[18], figure that duplicate the prevalence reported in this study (20.2%). Low HDL-c is highly prevalent in Venezuela. In the urban populations evaluated, the prevalence of low HDL-c was 68.7% in Lara and 69.6% in Mérida city, which correspond with the reported in Zulia state (65.3%)[5], but is lower than the one reported in the Junquito, Capital District (81.1%)[21], and Valencia city (90%)[28]. The lowest prevalence of low HDL-c reported in Venezuela is in Sucre Municipality, Miranda state (42.9%) and in the Paramo area, Mérida state (43.1%). High prevalence of low HDL-c levels has been reported in Mexico (64.7%)[34] and in other Latin populations[35-37]. It is pending to elucidate the mechanisms (exercise, diet, genetics) involved in these inter-ethnic and inter-regional differences.

Some limitations can be observed in the present study. The sample did not represent the entire population of the country, only two of the eight regions of Venezuela were included. Additionally, in the VEMSOLS, eating pattern and physical activity was not investigated. However, despite these limitations, this study is the first report of cardiometabolic risk factors in more than one region of Venezuela.

Conclusion

This is the first report of the evaluation under the same methodology of the prevalence of cardiometabolic risk factors in three populations from Venezuela that included a rural area. In general, the prevalence of these cardiometabolic alterations was high in these populations. In the rural area, people was leaner and presented the highest levels of HDL-c, however, the figures reported are similar to those obtained in other regions of the country. This elevated prevalence of cardiometabolic risk factors will carry on an increased number of preventable cardiovascular events imposing a big load on the Venezuelan public health services. Major interventions, including clinical physicians and policymakers, are required to improve population health. In 2017 was completed the Venezuelan Study of Cardio-Metabolic Health (EVESCAM, for its acronym in Spanish) which evaluated the entire country and will allow us compare will other regions not previously evaluated.

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Interest conflict

Nothing to declare.

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