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Consequences of the Metabolic Syndrome (MetS) among African Americans, Hispanics and Whites

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Abstract

Background: *Metabolic syndrome (MetS) is a combination of risk indicators that appear to promote the development of chronic diseases. It is also described as a group of risk factors that increase the chance of having heart disease, diabetes and stroke.*

Purpose: *The purpose of this study was to compare the consequences of MetS among adult Whites, African Americans and Hispanics aged 40 years or more.*

Methods: *The proposed study used data abstracted from the National Health and Nutrition Examination Survey (NHANES) 2015-2016. The following variables were utilized: sociodemographic data (age, gender, marital status, educational level and household income); the criteria for MetS diagnosis (levels of blood pressure, fasting plasma blood glucose, blood triglyceride, HDL-cholesterol, and waist circumference); and the consequences of MetS (coronary heart disease, heart attack, stroke, breast cancer, prostate cancer, diabetes and prediabetes, overweight and obesity). The data were analyzed using SUDAAN software (RTI international, INC., Research Triangle Park, North Carolina). The relationship of MetS and its individual components to the consequences of MetS was compared among the three ethnic groups using chi-square and t-tests. The level of significance was 5%.*

Results: *The findings demonstrated that participants who were diagnosed with MetS criteria are more likely to have higher risk of the following consequences: Diabetes and prediabetes, overweight and obesity. The findings show that of all the ethnic groups evaluated, those who had high blood glucose levels were significantly more likely to be diagnosed at risk of diabetes and obesity.*

Conclusions: *Diabetes/Prediabeteswere found (considering the sentence-has a high association with high waist among Whites, African Americans and Hispanics. There is an assassination between high waist circumference levels and overweight/obese among all ethnic groups.*

Keywords: Metabolic Syndrome (MetS); Diabetes; Prediabetes;Prostate cancer

Introduction

Chronic diseases are the largest cause of death in the world. The leading chronic diseases—cardiovascular disease, cancer, chronic respiratory disease, and diabetes—caused 57 million deaths worldwide [1]. Furthermore, despite a growing number of epidemiological evidences, such as the economic impact, the global response to the problem remains ineffective. The chronic disease problem is not limited to the developing regions put; it affects the entire world [1].

According to U.S. Department of Health and Human Services approximately 45 % of the American population is diagnosed with at least one chronic disease [2]. It was further stated by Waters and Graf, that one or more of five chronic diseases cause two-thirds of all deaths: heart disease, cancer, stroke, chronic obstructive pulmonary disease, and diabetes [3]. There is growing evidence that the presence of one

chronic condition has a negative impact on the risk of developing others, particularly as people age Researchers stated that health care costs for chronic diseases such as heart disease, cancer, diabetes, and Alzheimer's disease totaled $1.1 trillion in 2016 and expected to double by 2020. The total economic impact of this was $3.7 trillion including lost economic productivity. This was equivalent to nearly 20% of the U.S. gross domestic product.

Metabolic syndrome (MetS) is a combination of risk indicators that appear to promote the development of chronic diseases [4]. MetS is known as a consistent long-term predictor of adverse health outcomes [5]. According to the National Heart Lung and Blood Institute, MetS is described as a group of risk factors that increase the chance of having cardiovascular conditions and other health problems such as diabetes and stroke. Five conditions are involved in the diagnosis of MetS: elevated waist circumference, elevated triglycerides, low High-density lipoprotein (HDL-C) cholesterol, elevated blood pressure and elevated fasting glucose. For a diagnosis of MetS, patients must present with at least three of these conditions [6] [7].

A study by Moore et al. analyzed data from the National Health and Nutrition Examination Survey (NHANES) from 1988 through 2012 [8]. They found that MetS prevalence increased from 1988 to 2012 for every sociodemographic group. The report further stated that by 2012 more than a third of US adults met the definition and criteria for MetS. During the entire study period, the largest increase in the prevalence of MetS was observed among African- American men (55%), then White women (44%), and African-American women (41%). The smallest increase was observed among Hispanic women (2%). MetS prevalence increased among White men by 31% and increased among Hispanic men by 12.5% [8].

There are many risk factors that contribute to or influence the onset of MetS. Research by Kaur found that genetics, diet, level of physical activity, smoking, family history of diabetes, and level of education all influenced the prevalence of MetS. Also, it was reported that people who are diagnosed with MetS are twice as likely to develop cardiovascular disease (CVD), and about five times the risk for type 2 diabetes mellitus (T2DM) when compared with those without the syndrome [9].

Overweight and obesity are health issues that also contribute significantly to MetS through certain pathophysiological mechanisms [9]. It was stated by many researchers that chronic inflammation associated with excess adipose tissue may explain the development of obesity-related pathologies, such as T2DM and CVD [10,11]. Other studies demonstrated that management of weight and engaging in an appropriate level of physical activity might prevent the transition from impaired glucose tolerance to T2DM, and help to reduce MetS [12]. According to González et al several studies concluded that several health issues are associated with high sedentary time. For example, sedentary behavior has positive associations with an increased risk of T2DM, CVD mortality and cancer [13] [14].

Sleep disorder is a major public health issue and it is linked to the cluster of conditions associated with increased risk of obesity, insulin resistance (IR), and MetS or components of MetS, among adult and pediatric populations [15]. According to Medic et al. sleep disorders are associated with health risk problems such as increased body mass index, poor physical health, substance abuse, depression, and negative alteration in metabolic and endocrine functions [16].

There is growing evidence that lifestyle changes can help to reduce the growing rate of MetS in the population. According to Pérez-Martínez et al physical activity and consumption of the Mediterranean diet pattern can help to control or prevent the factors that contribute to MetS [17]. It was recommended that the ideal dietary pattern should have increased levels of unsaturated fat, cereals, whole grains, fruits, vegetables, nuts, fish, and low-fat dairy products, as well as moderate consumption of alcohol. Other dietary patterns such as; Dietary Approaches to Stop Hypertension (DASH), new Nordic, and vegetarian diets have been proposed as alternatives for preventing MetS [17]. The first hypothesis tested was that African Americans and Hispanics would be more likely to have higher risk of the following consequences of MetS than Whites: Heart attack, coronary heart disease, stroke, breast cancer, prostate cancers, diabetes, prediabetes, overweight and obesity. The hypothesis was supported that African Americans and Hispanics would be more likely to have higher risk of heart attack, breast cancers, diabetes, prediabetes, overweight and obesity than Whites. However, the hypothesis was not supported that African Americans and Hispanics would be more likely to have higher risk of coronary heart disease, stroke and prostate cancers than Whites.

Secondly, it was noticed that subjects who diagnosed with MetS criteria would be more likely to have higher risk of the following consequences: heart attack, coronary heart disease, stroke, breast cancer, prostate cancers, T2DM, prediabetes, overweight and obesity. Therefore, the hypothesis was supported that subjects who were diagnosed with MetS criteria would be more likely to have higher risk of stroke, diabetes, prediabetes, prostate cancer, overweight and obesity. However, the hypothesis was not supported that subjects who were diagnosed with MetS criteria would be more likely to have higher risk of Heart attack, coronary heart disease and breast cancer.

Methods

The proposed study used data abstracted from the National Health and Nutrition Examination Survey (NHANES) 2015-2016. The following variables were utilized: sociodemographic data (age, gender, marital status, educational level and household income); the criteria for MetS diagnosis (levels of blood pressure, fasting plasma blood glucose, blood triglyceride, HDL-cholesterol, and waist circumference); and the consequences of MetS (coronary heart disease, heart attack, stroke, breast cancer, prostate cancer, diabetes and prediabetes, overweight and obesity). The sample was made up of 1,562 African Americans, Hispanics and Whites aged 40 years or more, and of both genders. Subjects with incomplete waist circumference, blood pressure, fasting blood glucose, and lipid profile data, and pregnant women were excluded. The data were analyzed

using SUDAAN software (RTI international, INC., Research Triangle Park, North Carolina). SUDAAN is the recommended software for analysis of NHANES data. The relationships of MetS and its individual components were compared among the three ethnics groups using chi-square and t tests. The significance level used was 5%.

Of the data collected in NHANES 2015-2016, the following were utilized:

1. Sociodemographic data (age, gender, marital status, educational level and household income);

2. The criteria for MetS diagnosis (levels of blood pressure, fasting plasma blood glucose, blood triglyceride, HDL-cholesterol, and waist circumference,);

3. Consequences of MetS (Heart Attack, Coronary Heart Disease, Breast Cancer, Prostate Cancer, Diabetes, Prediabetes, Stroke, Overweight and Obesity).

4. Descriptions of how these data were collected follow.

Results andDiscussion

	Number	Percent
Gender		
Male	711	48.8
Female	746	51.2
Total	**1457**	**100**
Age Group		
40-40 years	355	24.4
50-59 years	376	25.8
60-69 years	405	27.8
70-79 years	214	14.7
80 years or more	107	7.3
Total	**1457**	**100**
Race/ Ethnicity		
Mexican American	223	15.3
Other Hispanic	225	15.4
Non-Hispanic White	538	36.9
Non-Hispanic Blacks	298	20.5
Other Race- Including Multi-Racial	173	11.9
Total	**1457**	**100**
Marital status		
Married	842	57.8
Widowed	145	10.0
Divorced	200	13.7
Separated	56	3.8
Never married	134	9.2
Living with partner	79	5.4
Not reported	1	.1
Total	**1457**	**100**

Table 1. Socio-demographic Characteristics

Table 1 shows data on the socio-demographic characteristics of the subjects. The majority of the subjects (78.0%) were aged between 40 and 69 years. The percentage of females was higher than males. In terms of race/ethnicity, Non-Hispanic White had the highest percentage (approximately 37%), followed by Non-Hispanic Blacks, other Hispanics and Mexican Americans.

	Number	Percent
Educational Level		
Less than 9th grade	187	12.8
9-11th grade (Includes 12th grade with no diploma)	174	11.9
High school graduate/ GED or equivalent	318	21.8
Some college or AA grade	414	28.4
College graduate or above	364	25.0
Total	**1457**	**100**
Annual Household Income		
Under $20,000	294	20.2
$20.000- 34,999	251	17.2
$35.000-54,999	243	16.7
$55.000-74,999	171	11.7
$20.000 or more	29	2.0
$75.000-99,999	130	8.9
$100.000 or more	239	16.4
Not reported	100	6.8
Total	**1457**	**97.3**

Table 2. Socio-economic Characteristics

Table 2 shows the educational level and annual household income frequencies. In terms of educational level, the majority of the subjects (75.2%) had educational levels between high school graduate/GED, and college graduate or above. Annual household incomes were highly variable, the most common annual household incomes being under $20,000, $20.000- 34,999, $35.000-54,999 and $100,000 or more.

	Have MetS Number (Percent)	Do Not Have MetS Number (Percent)
African Americans	101 (33.9)	197 (66.1)
Hispanics	206 (46.0)	242 (54.0)
Whites	101 (33.9)	321 (59.7)

Table 3. MetS Status by Ethnicity

Table 3 shows MetS status by ethnicity. The prevalence of MetS was highest in Hispanics, followed by Whites, and African Americans.

	Have MetS Number (Percent)	Do Not Have MetS Number (Percent)
African Americans		
Diabetes		
Yes	36 (35.6%)	35 (17.8%)
No	57 (56.4%)	153 (77.7%)
Borderline	8 (7.9%)	9 (4.6%)

Total	**101 (100.0%)**	**197 (100.0%)**
Prediabetes		
Yes	10 (17.5%)	24 (15.7%)
No	47 (82.5%)	129 (84.3%)
Total	**57 (100.0%)**	**153 (100.0%)**
	(15.7%)	
Hispanics		
Diabetes		
Yes	66 (32.0%)	46 (19.0%)
No	132 (64.1%)	190 (78.5%)
Borderline	8 (3.9%)	6 (2.5%)
Total	**206 (100.0%)**	**242 (100.0%)**
Prediabetes		
Yes	35 (26.5%)	20 (10.6%)
No	97 (73.5%)	169 (89.4%)
Total	**132 (100.0%)**	**189 (100.0%)**
Whites		
Diabetes		
Yes	55 (25.5%)	31 (9.7%)
No	155 (71.8)	282 (87.9%)
Borderline	6 (2.8%)	8 (2.5%)
Total	**216 (100.0%)**	**321 (100.0%)**
Prediabetes		
Yes	28 (18.1%)	36 (12.8%)
No	127 (81.9%)	245 (87.2%)
Total	**155 (100.0%)**	**281 (100.0%)**

Table 4. Doctor or Other Health Professional Diagnoses of Diabetes and Prediabetes by MetS and Ethnicity

Table 4 shows that among the subjects with MetS, the highest prevalence of diabetes diagnosed by doctors or other health professionals was in African Americans (35.6%), followed by Hispanics (32.0%), and Whites (25.5%). A similar pattern was seen for diagnoses of borderline diabetes. For diagnoses of prediabetes, the highest prevalence was among Hispanics (26.5%), followed by Whites (18.1%), and African Americans (17.5%). In all ethnic groups, the prevalence of both conditions was lower in the subjects who did not have MetS.

	Chi-square Statistic	Probability Level[1]
African Americans		
Diabetes	11.7418	0.0006
Prediabetes	0.0230	0.8794
Hispanics		
Diabetes	7.9113	0.0050
Prediabetes	6.7513	0.0095
Whites		
Diabetes	12.5361	0.0004
Prediabetes	0.8488	0.3571

1A probability level below 0.05 indicates a significant relationship between the two variables

Table 5. Relationships of Doctor or Other Health Professional Diagnoses of Diabetes and Prediabetes to MetSby Ethnicity

Table 5 shows that in all ethnic groups who have Mets are significantly more likely to be diabetic, while Hispanics with Mets are more at risk to be diagnosed with prediabetic. In African Americans and Whites, there was no significant relationship between MetS and prediabetes.

	Have MetS Number (Percent)	Do Not Have MetS Number (Percent)
African Americans		
Coronary Heart Disease		
Yes	7	6
	(7.1%)	(3.0%)
No	92	191
	(92.9%)	(97.0%)
Total	99	197
	(100.0%)	**(100.0%)**
Heart Attack		
Yes	6	6
	(5.9%)	(5.9%)
No	95	95
	(94.33%)	(94.33%)
Total	101	101
	(100.0%)	**(100.0%)**
Stroke		
Yes	6	11
	(5.9%)	(5.6%)
No	95	186
	(94.1%)	(94.4%)
Total	101	197
	(100.0%)	**(100.0%)**
Hispanics		
Coronary Heart Disease		
Yes	13	11
	(6.3%)	(4.6%)
No	193	228
	(93.7%)	(95.4%)
Total	206	239
	(100.0%)	**(100.0%)**

Heart Attack		
Yes	16	11
	(7.8%)	(4.6%)
No	190	230
	(92.2%)	(95.4%)
Total	206	241
	(100.0%)	**(100.0%)**
Stroke		
Yes	7	10
	(3.4%)	(4.1%)
No	198	232
	(96.6%)	(95.9%)
Total	205	242
	(100.0%)	**(100.0%)**
Whites		
Coronary Heart Disease		
Yes	17	29
	(7.9%)	(9.1%)
No	197	289
	(92.1%)	(90.9%)
Total	214	318
	(100.0%)	**(100.0%)**
Heart Attack		
Yes	14	25
	(6.5%)	(7.8%)
No	202	296
	(93.5%)	(92.2%)
Total	216	321
	(100.0%)	**(100.0%)**
Stroke		
Yes	16	12
	(7.4%)	(3.7%)
No	200	309
	(92.6%)	(96.3%)
Total	216	321
	(100.0%)	**(100.0%)**

Table 6. Doctor or Other Health Professional Diagnoses of Coronary Heart Disease, Heart Attack, and Stroke by MetS and Ethnicity

Table 6 shows that among the subjects with MetS, the highest prevalence of coronary heart disease diagnosed by doctors or other health professionals was in Whites (7.9%), followed by African Americans (7.1%), and Hispanics (6.3%). For diagnoses of heart attack, the highest prevalence was among Hispanic (7.8 %), followed by White (6.5%) and African American (5.9%). For diagnoses of stroke, the highest prevalence was among Whites (7.4%), followed by African Americans (5.9%) and Hispanics (3.4%). In all ethnic groups, the prevalence of all conditions was lower in the subjects who did not have MetS.

	Chi-square Statistic	Probability Level[1]
African Americans		
Coronary Heart Disease	1.9186	0.1663
Heart Attack	0.0811	0.7758
Stroke	0.0350	0.8516
Hispanics		
Coronary Heart Disease	0.4900	0.4841
Heart Attack	2.5462	0.1108
Stroke	0.1932	0.6604
Whites		
Coronary Heart Disease	0.2777	0.5983
Heart Attack	0.1277	0.7209
Stroke	2.2893	0.1305

1A probability level below 0.05 indicates a significant relationship between the two variables

Table 7. Relationships of Doctor or Other Health Professional Diagnoses of Coronary Heart Disease, Heart Attack, and Stroke to MetSby Ethnicity

Table 7 shows no significant relationships of MetS to coronary heart disease, heart attack and stroke in all ethnic groups.

	Have MetS Number (Percent)	Do Not Have MetS Number (Percent)
African Americans		
Underweight	0	2
	(0.0%)	(1.0%)
Normal/Healthy Weight	1	54
	(1.0%)	(27.4%)
Overweight	25	62
	(24.8%)	(31.5%)
Obese	75	79
	(74.3%)	(40.1%)
Total	101	197
	(100.0%)	(100.0%)
Hispanics		
Underweight	0	3
	(0.0%)	(1.2%)
Normal/Healthy Weight	8	49
	(3.9%)	(20.2%)
Overweight	67	106
	(32.5%)	(43.8%)
Obese	131	84
	(63.6%)	(34.7%)
Total	206	242
	(100.0%)	(100.0%)
African Americans		
Underweight	0	4
	(0.0%)	(1.3%)
Normal/Healthy Weight	19	111
	(8.8%)	(34.8%)
Overweight	67	113
	(31.0%)	(35.4%)

Obese	130	91
	(60.2%)	(28.5%)
Total	216	319
	(100.0%)	(100.0%)

[1]BMI<18.5 kg/m^2 [2]BMI 18.5-24.9 kg/m^2

[3]BMI 25.0-29.9 kg/m^2 [4]BMI≥30.0 kg/m^2

Table 8. BMI Category by MetS and Ethnicity

Table 8 shows that among the subjects with MetS, the highest prevalence of overweight diagnosed by doctors or other health professionals was in Hispanics (32.5%), followed by Whites (31.0%), and African Americans (24.8%). For obesity, the highest prevalence was among African Americans (74.3%), followed by Hispanics (63.6%), and Whites (60.2%).

	Chi-square Statistic	Probability Level[1]
African Americans		
BMI Category	18.4785	0.0000
Hispanics		
BMI Category	15.1517	0.0000
Whites		
BMI Category	24.3118	0.0000

[1]A probability level below 0.05 indicates a significant relationship between the two variables

Table 9. Relationship of BMI Category to MetSby Ethnicity

Table 9 shows that in all ethnic groups those who have Mets are significantly more likely to be overweight or obese.

	Have MetS Number (Percent)	Do Not Have MetS Number (Percent)
African Americans		
Breast Cancer		
Yes	2	1
	(2.0%)	(0.5%)
No	99	196
	(98.0%)	(99.5%)
Total	101	197
	(100.0%)	(100.0%)
Prostate Cancer		
Yes	2	3
	(2.0%)	(1.5%)
No	99	194
	(98.0%)	(98.5%)
Total	101	197
	(100.0%)	(100.0%)
Hispanics		
Breast Cancer		
Yes	8	6
	(3.9%)	(2.5%)
No	197	236
	(96.1%)	(97.5%)
Total	205	242
	(100.0%)	(100.0%)
Prostate Cancer		
Yes	2	5
	(1.0%)	(2.1%)
No	230	237
	(99.0%)	(97.9%)
Total	205	242
	(100.0%)	(100.0%)
Whites		
Breast Cancer		
Yes	4	9
	(1.9%)	(2.8%)
No	212	312
	(98.1%)	(97.2%)
Total	216	321
	(100.0%)	(100.0%)
Prostate Cancer		
Yes	6	8
	(2.8%)	(2.5%)
No	210	313
	(97.2%)	(97.5%)
Total	216	321
	(100.0%)	(100.0%)

Table 10. Diagnoses of Breast Cancer and Prostate Cancer to MetS by Ethnicity

Table 10 shows that among the subjects with MetS, the highest prevalence of diagnosed breast cancer was in Hispanics (3.9%), followed by African Americans (2.0%), and Whites (1.9 %). For diagnoses of prostate cancer, the highest prevalence was among Whites (2.8%), followed by African Americans (2.0%) and Hispanics (1.0%). In all ethnic groups, the prevalence of both conditions was lower in the subjects who did not have MetS (Table 1-Table 10).

Conclusion

In conclusion, this study demonstrated that the first objective was to compare Heart attack, coronary heart disease, stroke, breast cancer, prostate cancers, diabetes, prediabetes, overweight and obesity in African Americans, Hispanics and Whites.

Whereas, it was found that African Americans and Hispanics would be more likely to have higher risk of heart attack, breast cancers, diabetes, prediabetes, overweight and obesity than Whites. However, African Americans and Hispanics would not be more likely to have higher risk of coronary heart disease, stroke and prostate cancers than Whites.

This study also demonstrated that the second objective was to evaluate the relationships of the individual components of MetS to Heart attack, coronary heart disease, stroke, breast cancer, prostate cancers, diabetes, prediabetes, overweight and obesity in African Americans, Hispanics and Whites.

Whereas, it was found that subjects who were diagnosed with MetS criteria would be more likely to have higher risk of stroke, diabetes,

prediabetes, overweight and obesity. However, it was found that subjects who were diagnosed with MetS criteria would not be more likely to have higher risk of Coronary Heart Disease, Heart attack, Stroke, Breast cancer and Prostate cancer.

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