A Comparison of Metabolic Syndrome (MetS) Risk Factors in Filipino Women and Filipino American Women: A Pilot Study

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Objective: Cardiovascular disease (CVD) is a significant cause of morbidity and mortality in women of Filipino ethnicity. The objective of our work was to determine if metabolic syndrome (MetS), a modifiable CVD risk factor, differs in women as a function of country of residency and to determine if, CVD prevention strategies need to differ for these groups of Filipino women.

Design: Data were collected in community-based health screenings for this cross-sectional study.

Participants: Participants were recruited at places of worship in southeast United States ($n=60$) and Central Visayas, Philippines ($n=56$).

Main Outcome Measures: Prevalence of MetS and its component factors as defined by the International Diabetes Federation criteria.

Results: The prevalence of MetS in Filipino women (FW) and Filipino American women (FAW) groups was similar (52% vs 55%, $P=.08$) although the prevalence of elevated waist circumference was greater for FAW (78% vs 59%, $P=.03$). Conversely, the percentage of FW women with risk -associated high-density lipoprotein (HDL) levels was higher than the FAW group (84% vs 42%, $P<.001$). Other MetS component factors (blood pressure, glucose and triglycerides) did not significantly differ between groups.

Conclusion: Similar high rates of MetS were observed in Filipino women regardless of the country of residency although the FAW tended to have higher rates of central obesity while the FW tended to have higher rates of risk-associated HDL levels. Further research should examine the cause of these differences in order to develop better cardiovascular screening and intervention strategies. (*Ethn Dis*. 2012;22[4]:404–409)

Key Words: Metabolic Syndrome, Filipino, Women, Waist Circumference

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Introduction

Metabolic syndrome (MetS) is a cluster of risk factors that, when occurring together, increase the risk for coronary artery disease, stroke and type 2 diabetes.[1] For a person to be defined as suffering from MetS, they must have central obesity measured by waist circumference in combination with any two of the four following treated or untreated risk factors: triglycerides (TGL) $\geq$ 150 mg/dL (1.7 mmol/L); reduced high density lipoprotein cholesterol (HDL-C) $<$ 50 mg/dL (1.29 mmol/L); elevated blood pressure (BP) systolic $\geq$ 130 or diastolic $\geq$ 85 mm Hg; elevated fasting plasma glucose (FPG) $\geq$ 100 mg/dL (5.6 mmol/L); or previously diagnosed type 2 diabetes (International Diabetes Federation (IDF). For women of Asian ethnicity, the waist circumference cut-off point is $\geq$ 31.5 inches (80 cm). [2] Individuals who develop MetS are five times more likely to develop type 2 diabetes, three times more likely to develop cardiovascular (CVD), and twice as likely to die from heart attacks compared to those without MetS risk factors.[1]

Cardiovascular disease is the leading cause of death among Filipinos living both in the Philippines[3] and in the United States. It is also the number one cause of death among foreign-born and Filipino women.[3–5] Given the association of MetS with CVD, MetS could be a significant contributor to CVD rates in Filipino women. However, studies examining the prevalence of MetS among women of Filipino ethnicity have been scarce.[6–8] These studies have demonstrated that MetS is common in Filipinas residing in the Philippines and in Filipino American women.[7–9] Yet, to the best of our knowledge no studies have compared the rates of MetS in Filipinos as a function of country of residency. The fact that disease risk changes with acculturation is well-established for CVD.[10] By studying differences in MetS risk factors between Filipinos in their home country and the United States, it is possible to identify modifiable risk factors that can be ameliorated. Thus, the aim of this study was to determine if the risk of MetS differs between women of Filipino ethnicity who reside in the United States or in the Philippines. Secondly, the prevalence of the component risk factors was also compared to determine if country of residency affected the presence of these factors. To better identify those at risk for MetS, the authors deemed it necessary to use the IDF criteria that would best fit this Asian population.

Methods

This cross-sectional, prospective pilot study of 60 Filipino American women (FAW) residing in the southeastern United States and 56 Filipino women (FW) residing in Central Philippines (Cebu City) was conducted using identical protocols at each site. FAW participants were enrolled in the study if they were Filipino by ancestry, were aged 18 years or older, and if they had resided in the United States for greater than five years. FW participants were enrolled according to the same criteria for ancestry and age, and if they had lived in the Philippines for most of their lives. Data from self-reported smokers were collected but not included in this study to maintain data consistency and reduce bias.

The University of North Florida institutional review board approved the research protocol and informed consent form prior to the study's implementation. The study deemed it necessary to be inclusive of Filipino women because they are an underserved and understudied minority. To enroll participants, recruitment flyers were posted in places of worship and local clinics frequented by FAW in Jacksonville, Florida and FW in Cebu City, Philippines. Study visits were scheduled to ensure that participants were fasting for the blood tests. Informed consent was obtained. The study's purpose, potential risks and benefits, were explained and questions and concerns regarding the study were answered in English unless the potential participant was not proficient in the language. Participants completed demographic and clinical information surveys followed by interviews to verify and clarify responses.

In order to increase reliability and decrease bias and measurement error all study equipment were calibrated for quality control and accuracy. Participants were seated for at least 10 minutes before blood pressure was measured two times within a 10-min interval using a standard sphygmomanometer and an appropriate-sized blood pressure cuff on the non-dominant arm. Then, participant's weight was obtained to the nearest 0.5 cm using a Tanita weighing scale. Height was measured using a tension tape while the participant stood, without shoes, with heels against the wall, as tall as possible, and with the head in the Frankfort plane. Waist circumference was measured using the NHANES waist measurement protocol.[11–12] Blood, obtained from a finger stick, was used to determine participant's lipid profile and blood glucose level. The Cardio Check P.A. Lipid Analyzer was used to measure total cholesterol, low-density lipoprotein (LDL), HDL and TGL, and serum glucose levels. Participants were notified for all body measurements and laboratory results. Additionally, appropriate heart disease education was provided to all enrolled participants. The presence of MetS was assessed using the IDF criteria as described above.

Statistical Analysis

A confidential, password-secured database was used for data entry, management, and analysis. Inconsistencies were checked, and the data descriptions were verified by the principal investigator and the statistician. Data were analyzed using the Statistical Package for the Social Sciences (SPSS, version 19, Armonk, NY: IBM) and GraphPad® Prism 5 software (San Diego, Calif: GraphPad Statmate). Demographic factors were coded as dichotomous variables, and frequency distributions of these variables were checked for inconsistencies. Dichotomous demographic factors were analyzed using chi-square tests for independence with Yates continuity correction. Continuous MetS component variables, reported as means ± standard deviations were analyzed as a function of age group and country of residency using a two-way between groups Multivariate Analyses of Variance (MANOVA) with Tukey's post hoc tests. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity, with no serious violations noted. Analysis by Fisher's exact chi-square statistics was used to determine differences between groups in the prevalence of MetS and its individual component factors. Additionally, odds ratios with 95% CI were calculated for metabolic syndrome and its component factors. Statistical significance was set at $P<.05$.

RESULTS

Demographic Characteristics

The demographic characteristics for both groups are presented in Table 1. Major findings for the demographic characteristics are that the FAW group significantly differed from the FW group in age distribution and access to health insurance. In regards to age, both groups had a similar percentage of those aged 41–60 years (48%–51%) although the FW group had a higher percentage of younger women (37%) and a lower percentage of women aged 61–80 years (12%), ($P=.019$). With respect to health insurance, 85% of the FAW group had access to health insurance compared to 30% of FW group, $P=.000$.

Behavioral and family history characteristics are crucial factors contributing to the development of CVD and are presented in Table 1. Chi square tests of independence indicated a significant difference in the percentage of those in the FAW group who reported exercise compared to the FW group (73% vs 46%, $P=.034$, respectively). A higher percentage of the FW group (39%) reported a parent and/or sibling who died at <55 years of age from CVD compared to the FAW group (13%), $P=.002$. All other demographic and behavioral variables did not vary between the two groups. In this regard, there were no significant associations between the country of residency and the level of education ($P=.066$), marital status, ($P=.19$), occupation ($P=.16$), watching one's diet, ($P=.055$) and reported family history of CVD, ($P=.554$).

Weight and height were measured to determine BMI. Although height did not differ between groups (FAW 60.7 ± 0.30 cm and FW 59.9 ± 0.41 cm, $P=.09$), both mean weight and BMI were higher in the FAW vs the FW group, $P=.040$ and $P=.012$, respectively. Mean weight values were 139.24 ± 30.11 lbs (FAW) and 128.09 ± 27.96 Ibs (FW). BMI also differed between the groups ($P=.013$) with mean values of 23.54 ± 4.71 for the FAW vs 21.34 ± 4.42 for the FW.

Mean Values of the Individual MetS Components

The mean values ± standard deviations of the individual MetS component

Table 1. Demographic and cardiovascular characteristics between Filipino American and Filipino women

Characteristic	FAW (*n*=60) (%)	FW (*n*=56) (%)	X^2	*P*
Age			7.96	.019[a]
18–40	18%	37%		
41–60	52%	48%		
61–80	30%	15%		
Marital status			4.76	.190
Single	13%	27%		
Married	67%	62%		
Divorced	13%	9%		
Widow	7%	2%		
Occupation			10.49	.163
Business	12%	9%		
Health	43%	25%		
Sales & Service	15%	16%		
Other	30%	50%		
Education			10.35	.066
<High school	10%	18%		
High school	15%	13%		
Some College	15%	25%		
>4 Yr. Degree	60%	44%		
Insurance	85%	30%	36.01	.000[a]
Body mass index	34%	23%	2.49	.114
Exercise	73%	46%	4.48	.034[a]
Diet awareness	60%	33%	3.66	.055
Family history	32%	39%	0.35	.554
Parent/sibling died < 55 y o from CVD	13%	39%	10.05	.002[a]

Note: Statistical differences were determined by chi-square analysis.
[a] $P<.05$.
FAW= Filipino American women; FW= Filipino women.

factors as a function of country of residency and age category are presented in Table 2. Significant differences between groups were apparent for waist circumference and HDL-C. The FAW group exhibited a greater mean waist circumference (37.63 ± 5.26) than the FW group (35.29 ±4.91), $P<.05$ when all ages were considered together. When data were analyzed as a function of age category, the FAW 61–80 year old group had a higher waist circumference (38.22 ± 4.26) compared to the FW 61–80 year old group (32.79 ± 5.26), $P<.01$. With regard to HDL-C levels, the FW group exhibited a lower mean HDL level (37.90 ±13.10) compared to the FAW group (53.10± 15.21), $P<.001$). When each age group was compared independently, lower mean HDL values were observed for all age categories of the FW group ($P<.05$).

Prevalence of Individual MetS Components in both FAW and FW

The prevalence of individual MetS risk components, expressed as percent of group, is presented in Table 3. Seventy-eight percent of the FAW group exhibited elevated central obesity compared to 59% of the FW group, $P<.05$. The odds ratio was 2.59 (95% CI: 1.12–5.90) for the risk of elevated central obesity for the FAW group compared to the FW group. The FAW group had a lower percent (42%) with abnormal HDL cholesterol, defined by IDF as ≤ 50mg/dL, compared to the FW group (84%), $P<.001$. The FW group was more likely to have reduced HDL compared to the FAW group (OR= 0.09,95% CI: 0.03–0.23). In

Table 2. Mean values of individual component factors of metabolic syndrome in Filipino ethnicity as a function of country of residency and age, as defined by the International Diabetes Federation criteria

Age Years	Waist Inches	TGL mg/dL	HDL-C mg/dL	FBG mg/dL	Sys. BP mm Hg	Dias. BP mm Hg
FAW group						
18–40 *n*=11	35.91±3.33	124.91±72.11	56.55±11.37	100.45±14.07	112.36±13.96	74.73±14.06
41–60 *n*= 31	37.79±6.62	179.58±108.6	49.52±12.15	125.23±40.96	128.35±16.89	82.48±11.86
61–80 *n*= 18	38.22±4.26 [b]	161.78±96.49	58.44±19.06	121.44±27.75	130.39±21.29	76.56±8.66
All Ages *n*= 60	37.63±5.26 [a]	164.22±99.90	53.10 ±15.21	119.55 ±34.06	126.03 ±18.76	79.28 ±11.72
FW group						
18–40 *n*=21	33.78±5.39	117.86±88.29	38.67±15.09[a]	102.00±17.63	115.24±18.46	74.73±14.06
41–60 *n*= 29	36.98±4.19	164.03±77.18	36.55±11.72[a]	113.86±16.33	123.93±17.63	82.48±11.86
61–80 *n*= 7	32.79±5.26	123.86±45.29	41.43±19.26	111.86±22.33	142.14±24.74	76.56±8.65
All Ages *n*= 57	35.29 ± 4.91	142.09 ±92.39	37.90 ±13.10[c]	109.25 ± 18.16	122.96 ± 20.29	79.29 ± 11.75

Note: Values are expressed as means ± SDs.
Note that [a]<.05, [b]<.01 and [c]<.001 for FAW versus FW groups.
Key: waist = waist circumference; TGL = triglycerides; HDL-C= high density lipoprotein cholesterol; FBG = fasting blood glucose; Sys. BP= systolic blood pressure; Dias. BP= diastolic blood pressure.

Table 3. Prevalence of metabolic syndrome components expressed as percent per group for FAW and FW as a function of country of residency

Variable	FAW *n*=60 (%)	FW *n*=56 (%)	Odds Ratio (95% CI)	*P*
MetS	55%	52%	0.94 0.66–1.32	>.05
Waist (≥31 inches)	78%	59%	2.59 1.12–5.90	**.03**
TGL (≥150mg/dL)	48%	33%	1.82 0.86–3.90	>.05
HDL (≤50mg/dL)	42%	84%	0.09 0.03–0.23	**.0001**
Glucose (≥100mg/dL)	57%	67%	0.61 0.29–1.32	>0.05
Systolic BP (≥130 mm Hg)	30%	28%	1.1 0.48–2.4	>0.05
Diastolic BP (≥85 mm Hg)	39%	38%	1.0 0.49–2.2	>0.05

Note: International Diabetes Federation guidelines for Asian women were used to determine cut-off levels for each measure and these cut-offs are noted in parentheses. Fisher's exact test was used to determine statistical significance and expressed as *P*. Statistical significance was set at $P<.05$. All significant values have been bolded.

contrast, no differences in the prevalence of elevated systolic blood pressure, diastolic blood pressure, triglycerides and glucose were observed between groups.

Prevalence of MetS in both FAW and FW

The presence of MetS was determined using IDF guidelines as described earlier. Figure 1 and Table 3 show that the prevalence of MetS was similar in both groups for the combined ages: 52% for FW and 55% for FAW , $P=.08$ (OR= 0.94; 95% CI: 0.66–1.32) for the FW group compared to the FAW group. In the 18–40 year old category, 18% of the FAW group and 23% of the FW group met the MetS definition. In the 41–60 year old category, 67% of the FAW group and 62% of the FW group met the MetS definition. In the 61–80 year old group, 56% of the FAW group and 57% of the FW group met the MetS definition. Women in the older age category (aged 41–60 years) were more likely to develop MetS compared to those aged 18–40 years, regardless of country of residence. In the FAW group, the older women were 2.5 times more likely to develop MetS compared to their younger counterparts (OR=2.54; 95% CI: 1.42–4.53, $P<.01$). Likewise, among FW, the older women were twice as likely to develop MetS than their younger counterparts (OR=2.01, 95% CI: 1.19–3.39, $P<.01$).

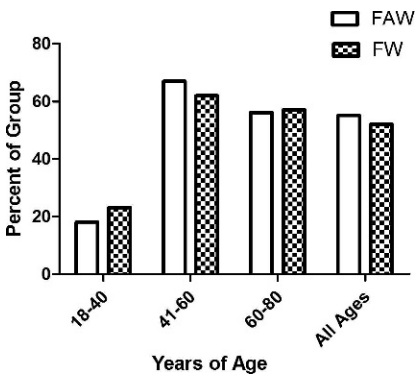

Fig 1. Prevalence of Metabolic Syndrome (MetS) in Women of Filipino Ethnicity as a Function of Country of Residency (USA or Philippines) using the International Diabetes Federation guidelines. The percent of each group with MetS was similar regardless of country of residency (*P*=.08)

DISCUSSION

The use of the IDF criteria for MetS, which uses waist circumference values tailored for different populations, plus two other CVD risk factors is an effective and economically low-cost screening method to identify those at-risk for MetS and thus at higher risk for CVD and diabetes. Critical to the success of the use of this set of criteria is that body size as a function of race is taken into account. Several studies have indicated that in Asians, a low BMI does not equate to a low risk for CVD. [6,8,13] Our study suggests that determining MetS, which can be performed in community-based health screenings, similar to those used in our study, may be a better method for determining CVD and diabetes risk than BMI. Germane to this argument is the fact that only 23% of the FW group and 34% of the FAW had elevated BMI compared to 52% (FW) and 55% (FAW) of these groups presenting with MetS. In support of this premise, Asian Americans were reported to have higher rates of MetS in spite of lower BMI values and lower prevalence of overweight/obesity than non-Hispanic Whites; MetS was prevalent even in those with normal BMI's. Moreover, MetS was more prevalent in Filipino regardless of their BMI category.[13]

Major findings of our study were that the prevalence of MetS was high (52%–50%) in Filipino women regardless of country of residency and that MetS prevalence was lower among women aged 18–40 years than in the other age categories for both groups. Although there was a higher percentage of 18–40 year olds in the FW group, this age category had lower MetS prevalence; yet the combined total number of participants from both FW and FAW groups had statistically similar prevalence of MetS, possibly because of limited numbers of participants in this pilot study. When analyzing a Philippines National Nutrition and Health Survey, Morales et al[7] showed that MetS prevalence for the total population in the Philippines was about 13%–19% regardless of the criteria used (NCEP/ATP III, IDF and AHA/NHLBI). In accordance with our findings, Morales et al[7] demonstrated that MetS prevalence in Filipino women increased. However, their reported MetS prevalence was lower than our values even when they used Asian specific waist guideline and the IDF criteria. In the Morales et al[7] study, MetS prevalence rates were 5%–11%,

23%, 37%, and 29% for those aged 20–39 years, 40–49 years, 50–59 years, and ≥60 years, respectively. The higher rates of MetS observed in our study compared to those of the Morales study may have resulted from sampling because the Morales study used a national survey with random sampling, while our study did not. Our findings support those of Grandinetti et al[14] who reported an overall prevalence of MetS as 33% in rural Hawaiians, including Filipinos who had the highest adjusted odds for MetS (OR=4.2; 95% CI=2.4–7.3). Given the high rates (28% of adult Filipinos) of MetS especially in women, Tanchoco et al[15] recommended that health programs focus on minimizing this morbid risk factor in the Philippines. Our work suggests that such a focus should also include Filipino American women. Moreover, our results underscore the importance of targeted health programs to reduce MetS and other CVD risk factors because according to Tan[16] the rapidly growing, aging and urbanized population in Asia-Pacific with increased chronic diseases threaten to overwhelm the health care system of countries like the Philippines. Indeed already half of the world's CVD burden is associated with Asia-Pacific.[16]

Another significant finding of our study was that central obesity was prevalent in both groups but tended to be more prevalent in the FAW group. Significantly more women (78% vs 59%) in the FAW group presented with central obesity as measured by the waist circumference. Additionally, the mean waist circumference was 10% higher for the FAW group when all age categories were analyzed together but this value was only higher for the oldest FAW group when data were analyzed as a function of age. Thus, our study demonstrates that MetS should be of great concern in women of Filipino ethnicity no matter where they reside. Women of Filipino ethnicity have a tendency to develop central obesity in both countries; although our study findings suggest that FAW may have a greater tendency to develop this condition, a premise that needs to be more thoroughly investigated with a larger study. Several studies have shown central obesity to be problematic in Filipinos including those residing in the United States. Indeed, Araneta et al[6] reported that Filipino American women had significantly higher waist circumferences, with no significant difference in BMI when compared to non-Filipino women. Additionally, Filipino American women were more likely to be obese compared to other Asian groups, such as Chinese and other Asians.[10] Increased waist circumference is a significant predictor of increased high sensitivity C-reactive protein (hs-CRP) levels, an important pro-inflammatory biomarker for CVD.[17–18] In the latest American Heart Association (AHA) Call to Action, Science Advisory for Asian Americans,[18] it is noted that elevated hs-CRP is an emerging risk factor in Asians but there is a need to examine hs-CRP as a function of various Asian subgroups. Given the prevalence of central obesity in Filipinos and its relationship to hs-CRP, screening for elevated hs-CRP in those of Filipino ethnicity may be warranted. Our results indicate that central obesity is a problem in Filipinas and thus weight loss programs that lead to reduction in central obesity should be targeted to those of Filipino ethnicity no matter where they reside.

Importantly, our investigation determined that Filipino women who reside in the Philippines had significantly low HDL-C levels as compared to their counterparts in the United States. The FW group had significantly more women (84% vs 42%) with risk-associated HDL-C and a 30% lower mean value for this MetS component factor. Age differences between the groups did not account for the difference in HDL prevalence because there was a greater number of young Filipino women participants who were expected to have theoretically higher estrogen levels and correspondingly higher HDL levels. Results of our study corroborated those of Morales et al[7] that showed a high occurrence of low HDL in the Philippines compared to the United States. Their study also showed that isolated low HDL-C phenotype was more than 13 times greater in Filipino women when compared to Caucasians. Additionally, their results showed that 70% of Filipino women had HDL-C <45 mg/dL.[7] In support of these findings, Rutherford et al[19] reported that women from the same region in the Philippines had significantly lower HDL at all levels of BMI compared to women from the U.S. Interestingly, this same study reported that HDL-C was lower in Filipino American women as compared to Caucasian women.[19] The reasons for the low levels of HDL-C in Filipino women residing in the Philippines compared to those living in the United States are not known but determining the causes should be investigated. The Filipino American women in our study did report more exercise but had similar levels of diet awareness with their Filipino counterparts. Medication use may be higher in the FAW given their higher rates of insurance. Information of medications was collected but self-report of medication use may not be reliable in this study setting. However, the fact that the Filipino group reported higher rates of family history of CVD deaths before age 55 would indicate better treatment of CVD risk factors in the United States.

Limitations

The following limitations warrant caution in interpreting the results of our study. The use of a convenience non-probability limited sample size may have potentially biased the results. However, even this small cross-section study was able to demonstrate that prevention of central obesity and metabolic syndrome should be undertaken in

Filipino women. Moreover, the reasons for the dichotomy in HDL-C levels between the groups need to be determined and the reduced levels of HDL-C should be addressed in the Filipino women residing in the Philippines. Another limitation is that males were not enrolled in the study and thus our findings cannot be extrapolated to all Filipinos. Men were excluded from this study because of the need to limit the study size due to resource issues and the fact that men were less likely to attend screening events used in this study. The settings of the study were northeast Florida and Cebu City in Central Philippines and whether our findings are indicative of rates of metabolic syndrome in other parts of the United States and Philippines would need to be explored to be able to generalize results. For example, it is possible that Filipinos who live in the southern United States are more likely to be obese as a reflection of the higher rates of obesity in the South. Measures of serum cholesterol and glucose were drawn only with participants' self-report of fasting after information had been provided to them regarding the importance of fasting to gain accurate blood levels. Although the IDF criteria includes those successfully treated for MetS, our study design only identified those who had uncontrolled MetS components because medical records were not available and self-report is not reliable. Thus, our study may have excluded some women who had MetS. Thus, the absolute numbers of those with MetS in this group may be even higher, making MetS an even more significant problem for those of Filipino ethnicity.

CONCLUSION

The results of this study emphasize the need to develop effective and culturally tailored strategies that target the specific MetS risk factors in this ethnic population, specifically taking into consideration the ways and culture of the Filipino population. Despite differences in residency, shared genetic origins and environmental influences and acculturation are essential to consider when designing programs to reduce MetS in this Asian subgroup.

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