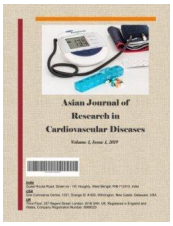

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Difference in BMI and Body Fat Measurement between Bangladeshi Men and Women Living in Hamtramck, Michigan: A Cross-Sectional Study

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background. There is evidence that points towards an increased preponderance of CVD among Bangladeshi American adults. Yet, most health data on Bangladeshi Americans were derived from New York studies or were clustered with other Asian subgroups.
Aim. To determine whether there is a difference in body mass index (BMI) and body fat measurement between Bangladeshi men and women living in Hamtramck, Michigan.
Method. A cross-sectional study design. A convenient sample of adult Bangladeshis who attended two scheduled community events in Hamtramck, Michigan.
Results. The mean age of the participants was 48.6 (SD-13.9) years of age and 59% were men. A statistically significant difference was found in the BMI between Bangladeshi men and women, with women having a higher BMI (t(40) = -2.87, p=0.006). Both men and women have high body fat measurements, but not statistically different.
Conclusion: Bangladeshi women living in Hamtramck, Michigan may be at an increased risk of developing CVD.

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Keywords: Body mass index; body fat measurement; Bangladeshi men and women; Hamtramck.

1. INTRODUCTION

It is forecasted that by 2055 Asians will replace Latin Americans as the new immigrants [1]. In 2019, there were almost 19 million Asian Americans living in the United States (U. S.), representing 5.9% of the nation's population [2]. Michigan is one of the states experiencing a 31% increase in the number of Asian immigrants over the past decade, albeit smaller in number compared to other states including California, New York, and Texas [2,3]. South Asians, including Bangladeshis, have the highest population growth rate of 224%. The Majority of Bangladeshi people live in Hamtramck, Detroit, and southern Macomb County in Michigan [4]. However, there is limited health data on Bangladeshis living in the U. S.

Most health data on Bangladeshi Americans have been derived from New York studies or were clustered with other Asian subgroups [5-12]. A local survey of 166 Bangladeshi Americans living in Michigan noted a decreased use of and/or referral to preventative measures for chronic illnesses among this group [13]. In addition, there is evidence pointing towards an increased preponderance of cardiovascular disease among Bangladeshi American adults [14,15].

Cardiovascular disease (CVD) is the second leading cause of death among Asian Americans and Pacific Islanders [16], of which obesity and physical inactivity are two major risk factors [17]. There is evidence that shows overweight and obesity are prevalent among Bangladeshi Americans, particularly women [18,19], younger age groups, those with higher education, and higher socio-economic status [18]. In addition, Bangladeshi women in New York have the lowest rate of physical activity compared to other racial/ethnic groups [20]. Results have also shown discrepancies in risks between Bangladeshi men and women. Therefore, we aimed to determine whether there is a difference in body mass index (BMI) and body fat measurement between Bangladeshi men and women living in Hamtramck Michigan.

2. METHODS

2.1 Design

This was a cross-sectional study design.

2.2 Participants

A convenient sample of adult Bangladeshi men and women who attended community events in Hamtramck, Michigan.

2.3 Data Collection

Data were collected from two planned community events: first in October 2019 conducted inside a mosque and the second one in August 2020 via drive-thru because of the coronavirus (COVD-19) pandemic. In order to follow Centers for Disease Control and Prevention guidelines on physical distancing and no indoor gatherings allowed, the second event had to be drive thru rather than inside a mosque.

2.4 Measures

2.4.1 Body Mass Index (BMI)

Height and weight were used to calculate BMI. The Asian specific BMI-cut off [21] was utilized to determine attendees' weight category. Table 1 compares the BMI-cut off used for Asian Americans and World Health Organization BMI [22].

2.4.2 Body fat measurement

Body fat measurement was obtained using two different methods. At the first community event, body fat measurement was calculated using both waist circumference and a skinfold caliper; whereas the BZ-2009 Body Fat Monitor (accelerometer) was used in the drive-thru event.

2.5 Data Analysis

Descriptive statistics was used to analyze the demographic data. Independent t-test was used to determine the differences in BMI and body fat measurements between Bangladeshi men and women.

3. RESULTS

3.1 Socio-clinical Characteristics

Sixty-five community members attended the two community events in Hamtramck. Data from 51 attendees were included in the analysis. We did not include those with missing information on

BMI or body fat measurement. The mean age was 48.6 (SD-13.9) years of age, 59% were men, 65% were married and the majority were born outside the U.S. Forty-three percent were working and 43% reported having health insurance. The average years of residency in the U.S. was 10 years. Twenty-seven percent reported having a history of high blood pressure, 33% with diabetes mellitus and 18% had heart disease. The mean SBP was 132mmHg (SD – 19; range: 102-185) and DBP – 81mmHg (SD – 11; range: 49-106). Table 2 presents the full socio-demographic and clinical characteristics of the attendees.

Table 1. Comparison Between Asian American BMI Cut-Off and WHO BMI

Asian American BMI Cut-off [21]	Category	World Health Organization BMI Cut-off [22]	Category
<18.5 kg/m^2	Below Healthy Range	<18.5 kg/m^2	Underweight
18.5-22.9 kg/m^2	Within Healthy Range	18.5 – 24.9 kg/m^2	Normal
23-26.9 kg/m^2	Above Healthy Range	25-29.9 kg/m^2	Overweight/ pre-obesity
≥27 kg/m^2	Further Above Healthy Range	30 – 34.9 kg/m^2	Obesity Class I
		35 – 39.9 kg/m^2	Obesity Class II
		>40 kg/m^2	Obesity Class III

Table 2. Socio-Demographic and Clinical Characteristics

Characteristics	Frequency
Overall Mean Age (n=42)	Mean= 48.6 years (SD=13.9; range 19-69)
- Mean Age Female (n=10)	Mean = 44.6 (SD= 13.9)
- Mean Age Male (n=30)	Mean = 51.0 (SD= 13.4)
Sex	% (n)
- Male	59 (30)
- Female	24 (12)
- Missing	17 (9)
Number of Years living in the U.S. (n=35)	Mean = 10.1 years
Marital Status	% (n)
- Single	4 (2)
- Married	65 (33)
- Divorce	4 (2)
- Widow/er	2 (1)
- Did not disclose	25 (13)
Highest Level of Education	% (n)
- Elementary education	20 (10)
- High school education	8 (4)
- College	22 (11)
- Completed college	17 (9)
- Higher education	4 (2)
- Refused to answer/missing	29 (15)
Currently working	% (n)
- Yes	43 (22)
- No	33 (17)
- Missing	24 (12)
Do you have health insurance?	% (n)
- Yes	43 (22)
- No	31 (16)
- Missing	26 (13)

History of Hypertension	% (n)
- Yes	27 (14)
- No	51 (26)
- Did not respond	22 (11)
History of Diabetes	% (n)
- Yes	33 (17)
- No	45 (23)
- Missing	22 (11)
History of Heart Disease	% (n)
- Yes	18 (9)
- No	61 (31)
- Missing	21 (11)
Blood Pressure (BP)	Mean (SD, range) (n)
- Systolic BP	131.8 mmHg (SD= 18.6, range: 102-185) (n=45)
- Diastolic BP	80.9 mmHg (SD=11.8, range: 49-106) (n=45)
Body Mass Index (BMI)	Mean = 28.2 kg/m^2 (SD=5.8; range- 16-52.3) (n=51)
Overall BMI categories[1]	% (n)
- Below Healthy Range (<18.5)	2 (1)
- Within Heathy Range (18.5- 22.9)	12 (6)
- Above Healthy Range (23-26.9)	31 (16)
- Further Above Healthy Range (≥27)	55 (28)
Body Fat Measurement	Mean = 30.1% (SD=7.9; range 10-46) (n=45)
Overall Body Fat Measurement Categories[2]	% (n)
- Thin (10%)	0
- Standard (10-20%)	1 (2%)
- Hide Corpulent (20-25%)	14% (7)
- Corpulent (>25%	82% (37)

[1] (Hsu et al); [2] Based on BZ-2009 accelerator

3.2 Gender Differences in BMI

The overall BMI was – 28.2 kg/m^2 (SD-5.8; range – 16-52), indicating a BMI *further above the healthy* range based on the Asian American BMI cut-off. The mean BMI for men was 26.4 kg/m^2 (SD- 4.4), which is *above the healthy* range, whereas the mean BMI for women was – 31.9 kg/m^2 (SD=7.9), indicating *further above the healthy* range. Eighty-six percent of the cohort were in the *above healthy* and *further above healthy* ranges; however, 83% of women had a BMI of *further above the healthy* range. There was a statistically significant difference in the BMI between Bangladeshi men and women, with women having a higher BMI (p=0.006). Table 3 presents the comparison in the BMI category between men and women.

3.3 Gender Differences in Body Fat Measurement

The mean body fat measurement was 30.1% (SD- 7.9; range 10-46), which is categorized as *hide corpulent* (normal value=10%-30%). The mean body fat measurement for men was 30.1% (SD= 8.0), whereas the mean body fat measurement for women was 31.5% (SD=7). Table 3 presents the comparison in body fat measurements between men and women. There was no significant difference in the body fat measurement between men and women. Table 4 depicts the differences between Bangladeshi men and women in BMI and body fat measurements.

4. DISCUSSION

Two significant results were obtained from this present study:1) a significant difference in BMI between men and women, with Bangladeshi women having significantly higher BMI and 2) no significant difference in body fat measurement between men and women but the mean body fat measurements for both were corpulent category. Eighty-three percent of women had a BMI category of further above the health range, which corresponds to Obesity class I under the WHO category. This finding is consistent with previous studies of Bangladeshi women [18-19,23-24]. Additionally, an analysis of the 2004, 2007, 2011, and 2014 Bangladeshi Demographic and Health Surveys (BDHS) reported an increasing prevalence in overweight and obesity among

women, with the greatest increase observed among women of reproductive age of 35-49 years [25].

Socioeconomic status (SES) and acculturation are two identified factors for the increased prevalence of overweight and obesity among migrants [26]. Several studies have reported an association between SES and the prevalence of obesity particularly among migrants coming from low-to middle-income Asian countries [27-30]. These studies show that highly affluent and more educated men and women from low to middle-income countries are more likely to be obese. People in these countries perceive being overweight or obese as a symbol of wealth, rather than a risk factor. Similarly, the more affluent families live in urban areas where high prevalence of overweight and obesity is noted. This could be because of the increased availability of private transportation which limits walking. This finding, however, is not isolated within the Asian American community, as a similar finding was seen among Latino Americans [31].

Acculturation is another factor, besides SES, explaining the obesogenic behaviors of immigrants from low-to medium-income and high-income countries [26]. Acculturation is defined as the process in which immigrants or individuals from different cultures gradually change their beliefs, values, identity, or behaviors to those of the host country [26]. A phenomenon known as *immigrant paradox* refers to the association between degrees of acculturation and problematic health outcomes. This phenomenon came from the healthy immigrant effect. The health immigrant effect infers that immigrants may be healthy when they migrated to the host country, but the longer they stay in the host country the more likely they are to encounter adaptation challenges making them vulnerable to health issues [32,33]. This was corroborated in the review of over 2000 Asian Americans from the 2013-2014 California Health Interview Survey which noted that the obesity rate among Asian Americans increased the longer they are exposed to the U.S. lifestyle, suggesting that acculturation to U. S. culture contributes to heightened obesity [34]. Although acculturation was not examined in this study, the average years of residency in the present study was 10 years with 40% living in the U.S. for 10 years and over. Obesity prevention should start with new Asian American immigrants, to decrease the risk of the immigrant paradox and use ethnic-specific cut-off points for BMI.

Table 3. BMI and Body Fat Analysis Comparison Between Men and Women

BMI			**Body Fat Analysis**		
Category	**Males (%) (n-30)**	**Females (%) (n=12)**	**Category**	**Males**	**Females**
Overall BMI	26.4 kg/m^2 (SD=4.4)	31.9 kg/m^2 (SD=7.9)	Overall BFA	30.1% (SD= 8.0)	31.5% (SD=7.0)
- Below Healthy Range (<18.5)	3% (1)	0	Thin (10%)	0	0
- Within Heathy Range (18.5-22.9)	17% (5)	0	Standard (10-20%)	4% (1)	0
- Above Healthy Range (23-26.9)	40% (12)	17% (2)	Hide Corpulent (20-25%)	18% (5)	11% (1)
- Further Above Healthy Range (≥27)	40% (12)	83% (10)	Corpulent (>25%)	78% (21)	89% (9)

Table 4. Difference in BMI and Body Fat Analysis Between Men and Women

Sex	**BMI**	**p value**	**Effect size***	**Body Fat Measurement**	**p value**
Men	26.4 kg/m^2 (SD=4.4) (n=30)	t(40) = -2.87, p=0.006	0.9	30.1% (SD= 8.0) (n=27)	t(34)= -.484, NS
Women	31.9 kg/m^2 (SD=7.9) (n=12)			31.5% (SD= 7.0) (n=9)	

**Effect size calculated using Hedge's g because of small and uneven sample size*

Body mass index cut-off points used to categorize overweight and obesity serve several purposes. It helps inform policy action (?), facilitate preventative strategies and measure the effects of intervention [35]. It is also used clinically to screen individuals at an increased risk for CVD, determine the intensity ~~of treatment~~ and monitor the effects of the treatment [35]. The commonly used BMI cut-off points are based on the WHO criteria to identify overweight (BMI ≥25-29.9 kg/m^2) or obese (BMI ≥30 kg/m^2) individuals. However, these cut-off points were based on studies of the general population without consideration of race and ethnic specificity [21]. Recent review of the literature found that Asian Americans have a higher prevalence of type 2 diabetes mellitus at a relatively lower BMI compared to ~~whites~~ Caucasians [21]; hence, the current established BMI cut-off points are inappropriate for Asian Americans. The Asian American specific BMI cut-off points would be most appropriate to use in the screening for diabetes and other cardiovascular diseases [21]. A study by Liu and colleagues [36] compared the Asian specific BMI cut-off points and the BMI cut-off points for the general population and found an additional three million non-Hispanic Asians to be obese using the Asian specific BMI cut-off points. Using ethnic-specific BMI cut-off points is important in establishing a reliable index for obesity, which has public health policy consequences.

Another finding in the study was that both Bangladeshi men and women living in Hamtramck have high body fat measurements. Additionally, Bangladeshi women were found to have both high BMI and excess body fat. This finding is inconsistent with the study by Shaikh et al. [37] that showed Bangladeshi women living in rural areas have excess adipose tissue (body fat) despite having a substantially lower BMI. Although BMI is a widely used index of obesity, it does not accurately reflect body adiposity or body fat for some racial and ethnic groups [36,38]. There is evidence that showed Asians have a higher total body fat compared to other ethnic groups [38,39]. This excess amount of body fat makes Asian Americans more likely to develop visceral fat around their abdomen, which is associated with a higher risk for CVD and diabetes.

5. CONCLUSION

Our study showed that Bangladeshi women living in Hamtramck, MI have a higher BMI and body fat measurements, which may put them at higher risk of developing CVD. It also showed a need for an aggressive screening for risk factors for CVD among Asian Americans. With the U.S. population increasingly becoming diverse, it is imperative to direct screening using culturally appropriate metrics when assessing the risks for CVD. Our present study has several new contributions to the literature. The present study adds to the limited health data on Bangladeshi Americans outside larger states such as New York and outside their native country. It also supports the use of culturally appropriate screening methods such as the culture-specific cut-off for BMI category to diagnose overweight and obesity and to include body fat measurement as part of screening Asian Americans for risk of CVD or metabolic syndrome.

6. LIMITATIONS

The authors acknowledge several limitations in the present study. The sample size was small and only included one Asian subgroup from a single city in MI, hence limiting its generalizability. In 2020, the lockdown from the COVID-19 pandemic has significantly affected our methodology in that the second event was as drive-thru since no indoor gatherings were allowed. We also used multiple methods in gathering data, particularly for the body fat measurement. Since privacy was required to measure waist circumference and skinfold, in addition to the mandate related to the COVID-19 pandemic, an accelerator was used at the drive-thru event, causing instrument bias due to inconsistent tools used in measuring body fat. It is recommended that this study will be repeated using a larger sample size and using consistent metrics.

CONSENT

Informed consent, verbal or physical signature, was obtained from the community health event attendees and participants included in this study. Below it is explained how consent forms were obtained from each community event.

The first community event was in-person, which was conducted before the COVID-19 pandemic. The event included several activities which included some invasive procedures such as needlestick for blood glucose and blood cholesterol check, six-minute-walk test, and skinfold measurements. Participants were also requested to complete several surveys. These

are in addition to just having the blood pressure, height and weight checked. Therefore, the first event required a physical signature from attendees to participate in the event and study.

The second community event was a drive-thru, which was conducted during the COVID-19 pandemic and because of the CDC guidelines on social distancing and ~~no~~ indoor gatherings, we deleted several activities including the surveys, taking blood glucose, cholesterol, and obtaining waist circumference and skinfold measurement. We used a body fat analyzer, which can be done at a safe distance from the tester, to test body fat measurements. Hence, no actual physical informed consent was obtained and attendees had the choice of whether to have their height, weight, and body fat measurement collected. Attendees who agreed to have all three collected served as consenting to participate in the study, therefore, only data from these attendees were included in the analysis.

ETHICAL APPROVAL

This study was reviewed and approved by the Eastern Michigan University Institutional Review Board.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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