

Social network body size is associated with body size norms of South Asian adults



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ABSTRACT

Aims: To examine the association between social network body size and body size norms in South Asian adults. **Methods:** Participants (n = 766) from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study (2014–2018) provided detailed information about their five closest network members. Participants' perceptions of their network members' body sizes, their own body size (self-body size), and a healthy body size for men and women (body size norms) were assessed using the Stunkard 9-figure scale. Adjusted hierarchical linear regression models were used to examine associations between the average body size of network members and perceived body size norms.

Results: Participants' average age was 59.1 years (SD = 9.2) and 44.1% were women. Participants reported an average network body size of 4.0 (SD = 1.1). The average body size norm for male and female Stunkard images was 3.6 (SD = 1.0) and 3.4 (SD = 0.8), respectively. Social network body size was positively associated with increasing body size norms (β -coefficient = 0.31, 95% CI: 0.26, 0.36), independent of self-body size.

Discussion: Social networks may influence body size norms in South Asian adults. Long-term follow up of the MASALA cohort will determine if social network body size and body size norms are associated with weight-control behaviors and weight change.

1. Introduction

Obesity is a major public health problem in the United States (U.S.). South Asians (individuals from India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, and Maldives) are the second fastest growing racial/ethnic group in the United States (U.S. Census Bureau, 2010), and they are at increased risk of obesity-related conditions, such as diabetes mellitus and coronary heart disease. South Asians have a higher prevalence of obesity compared to most other Asian groups (Holland et al., 2011; Joshi et al., 2007; Karter et al., 2013). Furthermore, cardiometabolic risk increases at a significantly lower body mass index in South Asians as compared to other racial/ethnic groups (Gujral et al., 2017; WHO expert consultation, 2004). Very little is known about the determinants of weight in South Asian immigrants; a better understanding

of the environmental, interpersonal, and individual factors that influence weight is necessary to strengthen obesity prevention efforts in an increasingly diverse U.S. population.

Previous research suggests that obesity clusters in social networks and that individual risk of becoming obese increases if network members become obese (Christakis and Fowler, 2007; Hruschka et al., 2011), although there are debates in their statistical approach (VanderWeele et al., 2012; Lyons, 2011). One of the proposed mechanisms of social influence on weight is through shared norms; group norms may influence individual perceptions of a healthy body size and related behaviors (Koehly and Loscalzo, 2009; Leahey et al., 2015). Social network members may also serve as role models for an individual and lead them to eat or exercise differently to approximate that ideal (Cutting et al., 1999). Population-level studies from the U.S. have found

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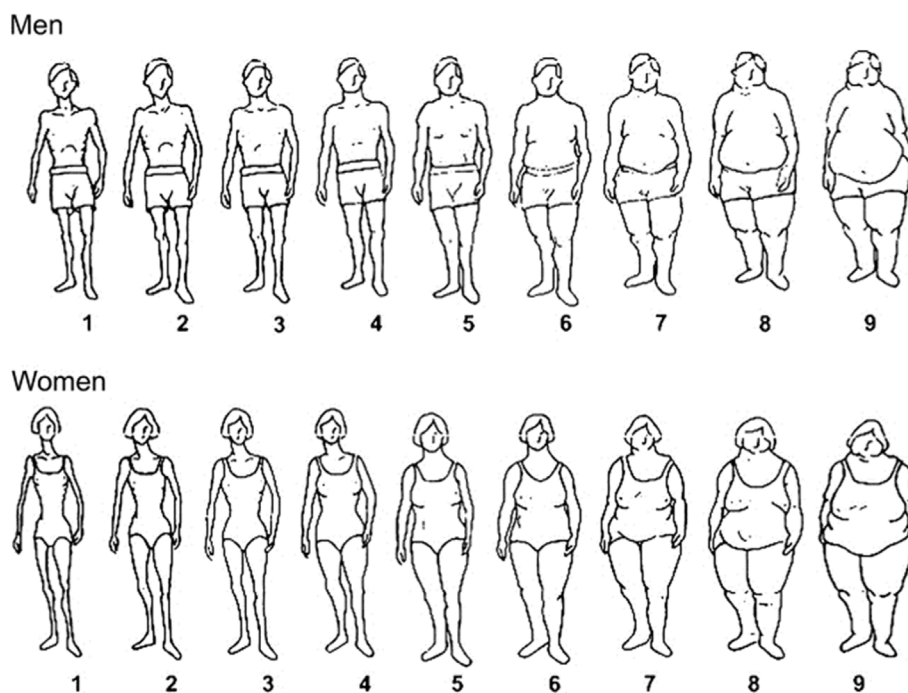


Fig. 1. Stunkard Figure Rating Scale for Men and Women. Reprinted with permission from *The Genetics of Neurological and Psychiatric Disorders* Copyright 1983, Raven Press (Stunkard et al., 1983).

that norms around appropriate body weight have trended upward over the past 25 years, concurrent with a similar shift in population body weight (Burke et al., 2010; Chandler-Laney et al., 2009; Winston et al., 2015a). In addition to social influence, culture shapes perceptions of body weight and health. The vast majority of South Asians in the U.S. are immigrants, whose cultural values may also shape conceptualizations of a healthy body weight. Effective treatment and prevention of obesity and related co-morbidities in South Asians requires recognition and understanding of the social and cultural aspects of weight. To our knowledge, no studies have examined social influences on body size norms in South Asians living in the U.S.

The primary objective of this study was to examine associations of social networks with body size norms among South Asian adults who participated in the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study. For the purpose of this analysis, we defined an individual's social network as the set of people with whom they "discuss important matters." This definition is consistent with what has been used in other nationally representative surveys to define a personal network with potential for social influence (Cornwell et al., 2009). We hypothesized that the average perceived body size of network members would be positively associated with body size norms, independent of cultural factors.

2. Materials and methods

2.1. Setting and study population

The Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study is a community-based cohort of South Asians. The study recruitment, methods and baseline measurements have been published previously (Kanaya et al., 2013). Briefly, using surname-based recruitment methods, a community-based sample of 906 South Asians was recruited between October 2010 and March 2013 from the San Francisco Bay Area and in Chicago and surrounding suburbs. To be eligible for the baseline MASALA exam, participants had to self-report South Asian ethnicity, be between the ages of 40–84 years, and be able to speak and/or read English, Hindi or Urdu. Exclusion criteria included

a physician diagnosed heart attack, stroke or transient ischemic attack, heart failure, angina, use of nitroglycerin, a history of cardiovascular procedures, current atrial fibrillation, active treatment for cancer, life expectancy < 5 years due to a serious medical illness, impaired cognitive ability, plans to move out of the study region in the next 5 years, living in a nursing home or on a waiting list, and weight > 300 pounds. The study protocol and procedures were approved by two institutional review boards and all study participants signed informed consent.

From 2014 to 2018, MASALA study participants were re-enrolled for a 2nd study visit where personal network characteristics were measured using an egocentric approach that examined the network members (alters) reported by the respondent (ego). The social network measurement methods have been described previously (Kandula et al., 2018). Briefly, for the social network visit, participants were asked to enumerate relevant alters by using a name generator; interviewers asked participants to list the people with whom they discuss "important matters." This name generator was selected to identify network "confidants" who have opportunities to exert social influence and normative pressure and with whom the participant may exchange information or advice regarding health, diet, physical activity, and weight. Participants were asked to provide further, detailed information on social, cultural and health-related questions for the first five confidants who were named.

2.2. Measures

Participants' sex, age, and other socio-demographic characteristics were collected at the baseline interview (2010–2013). Social network, body norm data, cultural characteristics, and clinical measures were collected from participants at the social network visit (2014–2018). Participant BMI was calculated based on height measurements from the baseline visit and weight measurements from the social network visit. For a small number of participants missing weight measurements at the social network visit, values from the baseline visit were used to calculate BMI.

Table 1
Characteristics of MASALA social network study sample, 2014–2018.

Characteristic	Ego Characteristics (N = 766)	Alter Characteristics (N = 3261)
	N (%) or Mean (SD)	N (%) or Mean (SD)
<i>Socio-demographics</i>		
Study site (Chicago)	318 (41.5)	1288 (39.5)
Age, years	59.1 (9.2)	50.0 (16.3)
Sex (female)	338 (44.1)	1787 (54.8)
Education ^{a,b} — college graduate or higher	684 (89.3)	2723 (84.8)
Household income < \$40,000 ^a	78 (10.2)	NA
Married/living with partner ^a	685 (89.4)	NA
<i>Clinical</i>		
Body mass index (BMI) kg/m ^{2c}	26.5 (4.1)	NA
<i>Cultural characteristics, mean (SD)</i>		
Percent of life in the US	46.9 (17.7)	65.7 (26.3)
Traditional Cultural Belief Score ^{a,d}	14.1 (6.2)	NA
South Asian identity ^e	7.9 (2.1)	NA
American identity ^e	5.5 (2.4)	NA
<i>Body size perceptions^f</i>		
Self-body size	4.7 (1.5)	NA
Body size norm – male image	3.6 (1.0)	NA
Body size norm – female image	3.4 (0.8)	NA
<i>Social network characteristics</i>		
Number of network members	4.2 (1.1)	NA
Proportion of network Family	0.72 (0.28)	NA
Proportion of network South Asian	0.88 (0.23)	NA
Average network body size ^f	4.0 (1.1)	NA
<i>Alter characteristics</i>		
Relationship to ego		
Spouse/Partner	NA	616 (18.9)
Family	NA	1674 (51.3)
Other	NA	971 (29.8)
South Asian ethnicity	NA	2869 (88.0)
Body size ^f reported by ego	NA	4.0 (1.7)

^a Measured at baseline visit.

^b N = 3212 for SN sample.

^c 7 participants were missing weight at the social network visit; we used baseline BMI values.

^d This score ranges from 0 to 28 with lower scores reflecting stronger South Asian traditional cultural beliefs and higher scores reflecting weaker cultural beliefs.

^e Scale 1–10 with 1 being not at all and 10 being very much so.

^f Measures on Stunkard scale (1–9).

2.3. Network body size, female and male body size norm, and self-body size

Participants were asked to report on their perceptions of their network members' body sizes (network body size), perception of their own body size (self-body size), and perception of a healthy male and female body size (body size norms) using the Stunkard 9-figure scale (Stunkard et al., 1983). The Stunkard scale is a silhouette figure rating scale that consists of 9 male and 9 female figures of increasing body size (range 1–9) (Fig. 1). The figures have been classified in previous literature as follows: Fig. 1 = underweight, Figs. 2–4 = healthy weight, Figs. 5–6 = overweight, Figs. 7–9 = obese/very overweight (Winston et al., 2015a; Bulik et al., 2001). The scale has been used to measure body image perception in different ethnic groups (Winston et al., 2015a; Cachelin et al., 2002; Fitzgibbon et al., 2000; Sanchez-Johnsen et al., 2004).

The primary exposure was average network body size which was calculated as the average rating on the Stunkard scale for the first five network members' size. Female and male body size norms were the primary outcomes and treated as continuous variables using the

Stunkard scale rating. Self-body size was also treated as continuous, and included as a covariate in models predicting body size norms.

2.4. Cultural characteristics

In addition to the number of years living in the U.S., we examined if other cultural characteristics were associated with body size norms. We asked participants about cultural self-identity by asking them to report on a scale of 1(not at all) to 10 (extremely), “How South Asian do you feel,” and “How American do you feel?” The traditional cultural beliefs scale was a continuous measure asking participants how much they wished South Asian cultural traditions would be practiced in the U.S. Examples of these cultural traditions centered upon food related activities (fasting, eating traditional South Asian foods) and partaking in arranged marriage practices (Kanaya et al., 2014). The scale had a Cronbach's alpha coefficient of 0.81 and ranged from 0 to 28 with lower scores reflecting stronger South Asian traditional cultural beliefs and higher scores reflecting weaker cultural beliefs.

2.5. Statistical analysis

Means and proportions were used to calculate descriptive statistics. One way analysis of variance (ANOVA), *t*-test, and Pearson's correlation were used to compare body norms to individual, social network, and cultural characteristics. We examined the relationship between network body size and male and female body size norms using scatterplots and nonparametric smoothers. Hierarchical regression models were used to examine the relationship between average network body size and male and female body norms as reported by the participant. A random intercept term was included at the participant level to account for clustering of male and female body norms within a participant. Models were adjusted for covariates that have been previously identified as being associated with body size norms in literature on body norms including age, sex, self-body size and BMI (Hruschka et al., 2011; Winston et al., 2015a; Bulik et al., 2001). In addition, we adjusted for total network size because the predictor of interest (average network body size) is a summary measure that does not take into account the number of network members named, and study site, due to potential differences across study site locations. Models were also adjusted for cultural factors that were significant in bivariate analyses. Interactions between covariates and network body size were examined in adjusted models. None were significant, and were not included in the final model. All statistical tests were performed using two-sided tests with $\alpha = 0.05$ and were conducted using Stata version 13.1 (StataCorp, 2013).

3. Results

3.1. Participant characteristics

Among 906 participants who were enrolled in the MASALA study at baseline, 771 completed the social network study visit by February 2018 and 766 participants had complete response data on body size norms and were included in the primary analysis. Participants had a mean (SD) age of 59.1 (9.2) years and were 44.1% women with mean (SD) body mass index 26.5 (4.1) kg/m². Baseline characteristics of participants are shown in Table 1.

3.2. Egocentric network characteristics

The 766 study participants identified 3261 network members with a mean (SD) network size of 4.2 (1.1). The mean (SD) network body size was 4.0 (SD = 1.7) on the Stunkard Scale. Table 1 shows characteristics of participants' social networks. A large proportion of listed network members were family members (0.72) and of South Asian descent (0.88).

Table 2
Bivariate associations of ego characteristics and body size norms (N = 766).

Characteristic	Male Figure		Female Figure	
	Correlation coefficient (r) or Mean (SD)	P value ^a	Correlation coefficient (r) or Mean (SD)	P value ^a
Site		0.161		0.133
Chicago	3.70 (1.00)		3.43 (0.83)	
San Francisco	3.60 (0.95)		3.34 (0.83)	
Participant sex		0.288		0.206
Male	3.67 (0.99)		3.41 (0.84)	
Female	3.60 (0.95)		3.33 (0.82)	
Participant age (years)	-0.098	0.007	-0.051	0.159
South Asian Identity	-0.046	0.208	-0.082	0.024
Sum of Traditional Cultural Beliefs	-0.034	0.348	-0.052	0.153
Percent of life in the US	-0.022	0.553	0.037	0.314
Self-body size	0.240	< 0.001	0.219	< 0.001
BMI	0.009	0.815	-0.022	0.538
Number of network members	-0.055	0.131	-0.006	0.878
Network body size	0.383	< 0.001	0.410	< 0.001

^a Pearson correlation coefficient for continuous, t-test for binary variables.

3.3. Association of network body size and body size norms

Participants reported a mean (SD) body size norm of 3.4 (0.8) on the Stunkard scale for the female image and 3.6 (1.0) on the Stunkard scale for the male image. Table 2 shows bivariate associations between body size norm and socio-demographic, cultural, clinical, and network characteristics. Fig. 2 shows scatterplots of male and female body size norm by network body size. In Fig. 2 there is an approximately linear

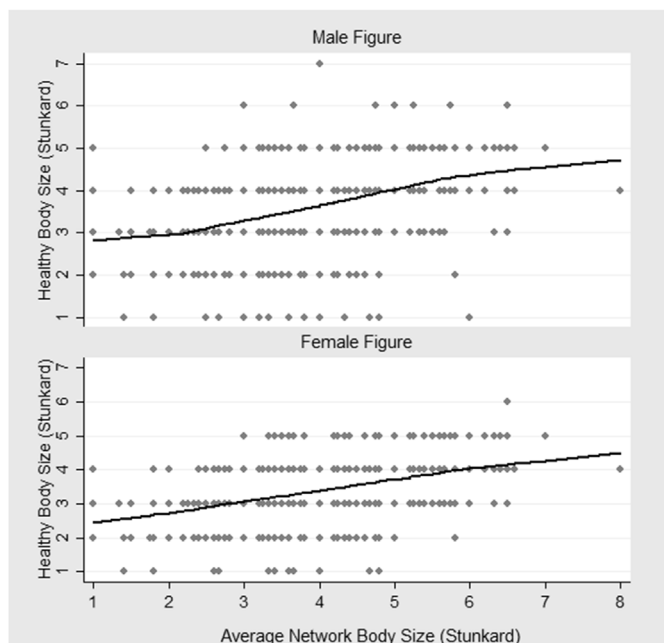


Fig. 2. Scatterplots of male and female body size norm by network body size. These scatterplots show the relationship between body size norm and average network body size for male figures (top panel) and female figures (bottom panel) with nonparametric smoother lines. The body sizes 2, 3, and 4 represent “healthy” body sizes on the Stunkard scale (Winston et al., 2015a; Bulik et al., 2001).

Table 3
Results of hierarchical regression models predicting body size norms (N = 1532).

	Coefficient	95% CI	P value
Model Intercept	2.47	(1.94, 3.00)	< 0.001
Average Network Body Size	0.31	(0.26, 0.36)	< 0.001
Image Gender (Female vs Male)	-0.26	(-0.31, -0.21)	< 0.001
Site (Chicago vs San Francisco)	0.04	(-0.07, 0.14)	0.525
Age (years)	-0.003	(-0.01, 0.003)	0.388
Ego gender (Female vs Male)	-0.03	(-0.14, 0.08)	0.587
Self-Body Size	0.17	(0.13, 0.22)	< 0.001
South Asian Identity	-0.03	(-0.05, -0.004)	0.023
Network Size	-0.02	(-0.07, 0.02)	0.316
Between cluster variance		0.419	
Within cluster variance		0.246	
ICC		0.630	

relationship between healthy body size norm and average network body size (as shown by the nonparametric smoother lines) such that increases in average network body size are associated with increases in a participant's perception of a healthy body size. This relationship holds for both male norms (top panel) and female norms (bottom panel). Participant BMI was not associated with male or female body size norms in bivariate analyses (p = 0.815 and p = 0.538, respectively). Cultural factors including traditional cultural beliefs and percent of life in the U.S. were also not associated with body size norms in bivariate analyses. These variables were not included in the final adjusted model.

In adjusted regression models, perceptions of body size norms increased 0.31 points on the Stunkard scale for every unit increase in mean network body size (p < 0.01; 95% CI: 0.26, 0.36) (Table 3). Participant's self-body size was also positively associated with larger body size norms (p < 0.01). Body size norm for the female Stunkard image was 0.26 points lower than for the male image (p < 0.01; 95% CI: -0.31, -0.21).

4. Discussion

This study found support for the hypothesis that having social network members with larger body sizes would be associated with larger body size norms, and self-body size was also associated with larger body size norms in South Asian adults. To the best of our knowledge, this is the first study to provide evidence of these relationships in South Asian adults. Importantly, the results move beyond individual-level determinants and add to current understanding of social, inter-personal processes that may influence weight-related norms.

Our findings are similar to a study by Winston et al. that looked at network influence on body size norms in Black and Hispanic adults and found an association between number of obese network members and body size norms (Winston et al., 2015a). That study used a different measure of network body score than the present study (see Winston et al. for calculation) and found for every unit increase in network body score, the normal body size increased by 0.03 (95% CI 0.01–0.04, p < 0.01) on the Stunkard scale. We also computed this measure for the MASALA study population, and compared to Winston, we found a larger increase of 0.09 (95% CI 0.07–0.11, p < 0.01) in body norm for every unit increase in network body score.

Body size norms are important to consider for weight loss or obesity prevention because they can influence perception of need for weight-related behavior change (Chandler-Laney et al., 2009; Shin et al., 2014), or selection of partners to engage in weight loss behaviors (i.e. exercise) (Simpkins et al., 2013; Valente, 2010). This may be particularly salient for South Asians because they develop cardiovascular risk factors at significantly lower BMI compared with other racial/ethnic groups (Gujral et al., 2017; Shah et al., 2012). Upward shifts in body

size norms among South Asians could lead to small increases in weight that result in increased cardiometabolic risk. While the determinants of weight gain are complex, body size norms and clustering of obesity in networks should be considered with other multilevel factors in obesity prevention and treatment (Koehly and Loscalzo, 2009).

Our analysis did not find strong evidence that cultural identity or years in the U.S. were associated with perceptions of a health body size in South Asians. Although empiric data have shown that body size ideals differ across cultures (McCabe et al., 2015) and that immigrants may adopt the body size norms of their host culture over time (Altman et al., 2017), the associations between acculturation with body size norms and behaviors have not been consistent. Others have found that psychosocial stressors, socioeconomic status, and other cognitive processes may be more predictive of body size ideals or weight-related behaviors in immigrant adolescents and that these factors may also interact with acculturation and immigrant generation (Fialkowski et al., 2015; Sutin et al., 2015). Interestingly, a recent review found that the largest differences in body size ideals were no longer those between Western and non-Western cultures, but between sites differing in socioeconomic status (Swami, 2015). Because the MASALA study largely included individuals from high socioeconomic backgrounds, our study was unable to explore the potential role of socioeconomic status on South Asian adults' body size norms.

Although not the main focus of our study, we also found gender influences on body size norms in South Asian adults. Although participants' sex was not significantly associated with body size norms among South Asians, participants perceived a larger body size as healthy for male images compared to female images. Other studies have reported that the perceived norms for body size are smaller for girls and women compared to boys and men (Bulik et al., 2001; Pallan et al., 2011). Some of this appears to be driven by exposure to “thin ideals” of women in the media, which drives perception of what constitutes a ‘normal’ female body versus a male body (Byrd-Bredbenner et al., 2005). Future research is needed to understand if differences in body size ideals for females and males drive different weight-related behaviors between South Asian men and women.

This study has some limitations that should be taken into consideration. We used the Stunkard scale for our primary outcome and exposure measures. It has been used in various ethnic/minority groups, but it has not been validated in South Asian populations. Body shape/adiposity appears to be distributed differently in South Asian adults (Misra and Khurana, 2011; Razak et al., 2007), and these figures may not represent clinically meaningful differences in South Asian body sizes. Although the effect of network body size on body size norms was statistically significant, the magnitude of the effect was modest. A one standard deviation increase in average network body size resulted in an increase in body size norm of 0.31 (Table 3). Still, the average body size norms in our sample were 3.6 and 3.4 for male and female norms, respectively. These values are just within the upper range of a “healthy” body size value of 4, and 18% of study participants reported body sizes norms greater than 4. Together, these results suggest that increases in network body size may be sufficient to result in an ego reporting larger body size norms. It is also possible that participants' perceptions of their network members' body size was different than objectively measured BMI, or that perceptions varied by unmeasured confounders such as projection bias (Henry et al., 2011). Body image perceptions, however, may influence health behaviors including diet and physical activity (Winston et al., 2015b), and are important to consider in addition to objectively measured body size. If study respondents accurately reported their perceptions of network members' weight, this could be even more important than the network members' actual weight (Schneider et al., 2013; Valente et al., 1997). Individuals may to some extent, however, justify their current size, physical inactivity, or food consumption by believing that others look or behave similarly to them (Valente, 2010). Because these are cross-sectional data, we could not examine causal processes leading to these associations or factors

driving the selection of network members. Additionally, the MASALA study included middle-aged South Asian adults, most of whom were Asian Indians with higher socioeconomic status, who lived in California and Illinois. The participants do not reflect the diversity of South Asian immigrants in the U.S.

In summary, this study showed that increasing social network body size was associated with larger body size norms in South Asian adults. This new information about social and cultural influences on perceptions of body weight and health can be used to develop more effective, tailored obesity treatment and prevention strategies for South Asian populations, among whom even small amounts of weight gain can have detrimental health consequences (Hammond and Ornstein, 2014). Interventions to promote healthy weight may be more effective if in addition to addressing individual health behaviors, they address the interpersonal processes, including family and social networks, that influence body size norms and weight-related behaviors (Barabasi, 2007). Additional research, including long term follow-up of the MASALA cohort and evaluation of interventions that target networks or network norms is necessary to determine if network body size and body size norms are associated with weight-control behaviors and weight change in South Asians.

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Declarations of interest

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