Correlations between Social Support and Weight Status

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Introduction

Obesity is a multifactorial disease, characterized by high weight status and excessive adipose tissue. People affected by obesity have a higher risk of developing a multitude of comorbidities including Type 2 Diabetes Mellitus, cardiovascular disease, cancer, and mortality (Valenzuela 2023). Approximately 40% of the global population has overweight or obesity (Cani 2023), and presently within the United States, the Centers for Disease Control and Prevention reports that at least 20% of adults live with obesity (CDC).

Socioecological models of health posit that there are multiple layers of influence, upstream from one's personal behaviors, that guide one's decisions and actions (Ayala-Marín 2020). Factors such as socioeconomic status, physical environment, education level, and social relationships are established influencers of one's weight status (Glonti 2016, Mackenbach 2019, Wang 2007). While correlations have been recognized between nonbiological determinants (NBD) and weight status, more research is necessary to understand the directionality of these correlations (Javed 2021).

Social support (SS) is known to correlate with weight status throughout multiple cohort studies, although yielding mixed results. The lack of consensus within the results can be attributed to multiple factors: firstly, the term "social support" does not have an agreed-upon definition, and can quantify different aspects of social interactions depending on the study. A seminal study in the Framingham Heart Study found that an individual's risk of obesity increases by 45% if a member of their social circle had obesity (Christakis 2007). Interestingly, the increased risk of obesity remained significant through 3 degrees of separation. In this study, the variable in question is a person's social network, or the distance between a person and a member of their network, rather than the quality of the relationship. Using a similar metric, Wieland et al. 2020 found that self-identified Hispanic/Latino participants with obesity had more network members with obesity compared to participants without obesity (Wieland 2020).

In addition to the number and proximity of social networks, the structure and functionality of social networks are regularly researched. A cross-sectional study based in Europe specifically evaluated the relationship between social cohesion and trust within a neighborhood and BMI (Hoenink 2019). This aspect of social support was found to be significantly associated with BMI, as participants in neighborhoods with moderate and high social networks showed greater than 0.4kg/m^2 decrease in BMI compared to participants in neighborhoods with low social networking. In community-dwelling, Korean older adults, communication frequency and social network structure were significantly associated with BMI in men and women (Lee 2013). Self-identified Hispanic or Latino participants were four times more likely to experience intentions of weight loss if those in their social circles were trying to lose weight, suggesting that the inner-workings of social interactions are important, too (Wieland 2020).

Social support seems to interact with different racial, ethnic, sex, or gender cohorts differently. For example, Lee et al. 2013 found an interesting dimorphism concerning communication. BMI was strongly associated with network size and density compared to communication frequency in men, whereas communication and meeting frequency were significantly associated with BMI in women (Lee 2013). This discrepancy is observed across populations, as well. A cross-sectional study in the Latino Men's Health Initiative found that increased perceived social support was associated with an increased odds of having overweight or obesity status (Craven 2018). Conversely, a study in the Canadian Longitudinal Study on Aging found that the odds of general obesity were higher in women with the least amount of social support compared to those with the highest amount of support (Hosseini 2021). The differences observed between populations call for more research to further understand how certain populations interact with social support.

Objective

The objective of this study is to determine the relative contribution of social support to weight status, and if this relationship differs according to sex and racial backgrounds.

Methods

International Weight Control Registry (IWCR)

International Weight Control Registry is a web-based, longitudinal study seeking to identify weight management strategies in an international population (Roberts 2022). Eligibility criteria include adults over 18 years old in participating countries having attempted weight loss, or are interested in attempting weight loss. Participants are directed to an online, secure platform to complete a comprehensive set of questionnaires encompassing behavioral, environmental, psychosocial, and biological domains relevant to obesity and weight management. Measures are chosen within the framework of the Accumulating Data to Optimally Predict Obesity Treatment (ADOPT) initiative. For the purposes of this study, 3 questionnaires will be utilized measuring social support, weight history, and general health and demographic information. Additionally, this study will solely utilize data from a subset of the study population within the United States.

The Sallis Social Support for Diet and Exercise scale was utilized to derive three scores quantifying Diet Encouragement, Diet Discouragement, and Exercise Participation as measures of SS. Participants were asked to scale the frequency of the statements from 1-6, with 1 being "none", 5 being "very often", and 6 being "does not apply". Higher scores indicate greater support in the Diet Encouragement and Exercise Participation subscales, whereas a higher score in the Diet Discouragement subscale indicates more discouragement from family and friends.

Data preparation

Prior preparation was conducted to produce the current datasets. The preparation included removing records with implausible height, weight, BMI, and age (Koebnick 2012, Pyrkov 2021). Additional records were removed based on an executive committee decision, due to a possible website breach. Next, the individual surveys (Social Support, Weight History, and More About Me) were separated in order to remove participants with incomplete survey responses from the analysis. Of the initial 3,205 records, 1,356 participants completed Social Support. Additional participants were removed if BMI or age were not recorded. Our final sample size included 1,248 participants.

Statistical Methods

The three subscores for SS were categorized into Low, Medium, or High by dividing the maximum recorded score by 3. BMI was categorized into 6 groups (Underweight, Normal, Overweight, Obesity, Obesity II, and Obesity III), according to classifications defined by the NIH (Weir 2023). Linear models were used to determine the relationship between the three subscores and BMI. Covariates included age, sex, race, number of people in the household, education level, household annual income, and marital status. The assumptions of linear regressions (linearity, normality of errors, homoscedasticity, and influence of outliers) were validated with diagnostic plots prior to fitting the models.

Results

Our final sample included 1,248 participants. The combined participants had a mean BMI of 33.13 kg/m^2 +/- 8.40 (SD), and an average age of 51.79 years +/- 14.26 (SD). Participant characteristics can be found in Table 1. Of note, the participants primarily identified as female and white/Caucasian, comprising of 83.4% and 76.8% of the total sample, respectively.

Three subscores were used to assess Social Support: Diet Encouragement, Diet Discouragement, and Exercise Encouragement. Tables 2.1-2.3 show the breakdown of each score by BMI category.

Table 1 - Participant Demographics

Variable	Category	n	percent
Education Level	12th grade or GED	78	6.24
	College (includes multiple degrees)	434	34.69
	Doctoral degree (M.D., J.D., Ph.D., etc.)	128	10.23
	Non-doctoral graduate degree	310	24.78
	Some college/Associates degree	299	23.90
	NA	2	0.16
Employment Status	Full-time employment (35 hours a week or more year-round)	772	61.71
	Not employed, not seeking employment (student, retired, home-make, disabled, etc.)	305	24.38
	Part-time employment	125	9.99
	Unemployed, actively seeking employment	48	3.84
	NA	1	0.08
Ethnicity	Hispanic or Latino	55	4.40
	Not Hispanic or Latino	1163	92.97
	Prefer not to specify	19	1.52
	Unknown	10	0.80
	NA	4	0.32
Gender	Female	1043	83.37
	Male	198	15.83
	Other	10	0.80
Household Annual Income	$25,000-$49,999	230	18.39
	$50,000-$79,999	310	24.78
	$80,000-$130,000	315	25.18
	Greater than $130,000	270	21.58
	Less than $25,000	111	8.87
	NA	15	1.20
Race	American Indian or Alaska Native	6	0.48
	Asian	28	2.24
	Black or African American	194	15.51
	More than one race	31	2.48
	Native Hawaiian or other Pacific Islander	3	0.24
	Other	12	0.96
	Prefer not to specify	10	0.80
	Unknown	4	0.32
	White or Caucasian	961	76.82
	NA	2	0.16
Sex	Female	1051	84.01
	Male	200	15.99

Table 2.1 - Diet Encouragement Subscore

BMI Group	Low (n)	Low %	Medium (n)	Medium %	High (n)	High %
Underweight	2	0.15	NA	NA	NA	NA
Normal	86	6.35	71	5.24	47	3.47
Overweight	138	10.19	117	8.64	110	8.12
Obesity	99	7.31	120	8.86	91	6.72
Obesity II	72	5.32	80	5.91	79	5.83
Obesity III	73	5.39	87	6.43	82	6.06

Table 2.2 - Diet Discouragement Subscore

BMI Group	Low (n)	Low %	Medium (n)	Medium %	High (n)	High %
Underweight	2	0.15	NA	NA	NA	NA
Normal	75	5.54	63	4.65	66	4.87
Overweight	126	9.31	122	9.01	117	8.64
Obesity	105	7.75	113	8.35	92	6.79
Obesity II	65	4.80	80	5.91	86	6.35
Obesity III	80	5.91	80	5.91	82	6.06

Table 2.3 - Exercise Encouragement Subscore

BMI Group	Low (n)	Low %	Medium (n)	Medium %	High (n)	High %
Underweight	2	0.15	NA	NA	NA	NA
Normal	75	5.54	63	4.65	66	4.87
Overweight	126	9.31	122	9.01	117	8.64
Obesity	105	7.75	113	8.35	92	6.79
Obesity II	65	4.80	80	5.91	86	6.35
Obesity III	80	5.91	80	5.91	82	6.06

Diet Encouragement

The Diet Encouragement Subscore (DES) considered 5 questions from the Sallis Social Support for Diet and Exercise, measuring perceived encouragement towards healthy eating habits from family and friends. BMI, age, sex, and number of people in the household were considered in the final model.

For every unit increase in BMI, DES increased by 0.073 (p-value$<$0.001). For every one-year increase in age, DES decreased by 0.051 (p-value$<$0.001). Average mean DES for males is 0.92 points higher than females (p-value=0.0199). For every one-person increase in the household, DES increased by 0.255 (p-value=0.0121). Approximately 4.77% of variability in DES is explained by BMI, age, sex, and people in the household (R^2=0.0477). Race, education level, marital status, and annual household income were not significant covariates.

Diet Discouragement

The Diet Discouragement Subscore (DDS) considered 5 questions measuring perceived discouragement towards healthy eating habits from one's social circle. BMI, age, number of people in the household, and marital status were considered in the final model.

For every unit increase in BMI, DDS increased by 0.038 (p-value=0.026). For every year increase in age, DDS decreased by 0.035 (p-value=0.0027). For every person added to household, DDS increased by 0.49 (p-value<0.001). Participants that were married at the time of the survey, on average, had a higher DDS compared to other categories, by 1.62 points (p-value 0.0001). 6.7% of the variability observed in DDS can be explained by the aforementioned variables (R^2 = 0.0670). There were no significant differences observed when race, education level, and household annual income were accounted for. BMI was only statistically significant in the third model.

Exercise Encouragement

The Exercise Encouragement Subscore (EES) considered 13 questions in the Sallis Social Support for Diet and Exercise scale that measured perceived encouragement towards exercising from family and friends. Age was the only additional covariate included in the final model, as sex, race, number of people in the household, education level, annual household income, and marital status were not statistically significant covariates.

For every one unit increase in BMI, EES decreased by 0.21 (p-value<0.001). For every one year increase in age, EES decreased by 0.067 (p-value=0.006). 4.02% of the variance observed in EES is explained by BMI and age (R^2=0.0402).

Discussion

Participants with higher BMIs tended to score higher in the DES, along with male participants and participants with more people in their household, compared to participants that had a lower BMI, were female, and had less people in their household. This suggests that having a higher BMI might be correlated with having more positive social interactions when related to healthy eating habits. Craven et al. (2018) reported a comparable finding in that participants with higher social support had greater odds of being overweight or obese. A reason for this could be that social support tends to be more focused on those needing it the most, i.e. those with greater BMIs need greater support to eat healthier (Craven 2018). However, as BMI increased in our population, DDS tended to increase, as well. A higher DDS score indicates more discouragement (or a lack of support) towards healthy eating habits. Similarly as BMI increased, EES tended to decrease in our population, indicating less support towards exercising. Our findings conflict the previous theory, however, confer with Winston's et al. (2015) findings that participants in "negative" social networks, defined by negative or discouraging comments towards healthy habits, tended to gain more weight than those in "helpful" social networks.

Winston et al. (2015) also found that participants having at least one child aiding in healthy eating had greater weight loss than participants without. The number of people in the household tended to influence both DES and DDS in our population, with participants with more people in the household scoring higher in both scores, on average. Interacting with more people on a daily basis can introduce different dynamics that were not accounted for in our measure of household size.

Sex and race did not seem to influence SS significantly in our population, which is interesting considering the differences observed in other studies (Ashida 2012, Hosseini 2021, Lee 2013, Wieland 2020).

A limitation of this study is in its cross-sectional nature, as any correlations observed do not infer causation. Additionally, the participants were primarily female-identifying and Caucasian/White. The lack of diversity in the study population adds difficulty in generalizing the results to a wider population.

Conclusion

With obesity rates continuing to increase globally, there is a great need to understand the complexity of the disease. Advancing research in non-biological determinants of health aids in developing more interventions for obesity, with generally more accessibility and affordability than personalized nutrition interventions.

This study utilized data from a subset of the International Weight Control Registry, focusing on participants from the United States. Certain factors such as BMI, age, and number of people in the household were found to significantly influence social support as defined by scores of the Sallis Social Support for Diet and Exercise scale. Despite statistical significance, relatively low correlations suggest that there may be additional variables to consider in understanding the relationship between social support and weight status.

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