Associations between body mass index and sexual functioning in midlife women: The Study of Women's Health Across the Nation (SWAN)

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Abstract

Objective—To examine baseline and longitudinal associations between BMI and sexual functioning in midlife women.

Methods—Midlife women (N = 2,528) from the Study of Women's Health Across the Nation (SWAN) reported on sexual functioning and underwent measurements of BMI annually beginning in 1995–1997, with follow-up spanning 13.8 years. Associations between baseline levels and longitudinal changes in BMI and sexual desire, arousal, intercourse frequency, and ability to climax were assessed with generalized linear mixed effects models. Models adjusted for demographic variables, depressive symptoms, hormone use, alcohol intake, and menopausal, smoking, and health statuses.

Results—Mean BMI increased from 27.7 to 29.1 kg/m², whereas all sexual functioning variables declined over time ($p < .001$). Higher baseline BMI was associated with lower intercourse frequency ($p = .003$; 95% CI: $-0.059, -0.012$). Although overall change in BMI was not associated with changes in sexual functioning, years of greater-than-expected BMI increases relative to women's overall BMI change trajectory were characterized by less frequent intercourse ($p < .001$; 95% CI: $-0.106, -0.029$) and reduced sexual desire ($p = .020$; 95% CI: $-0.078, -0.007$).

Conclusions—While women's overall BMI change across 13.8 years of follow up was not associated with overall changes in sexual functioning, sexual desire and intercourse frequency were diminished in years of greater-than-expected weight gain. Results suggest that adiposity and sexual functioning change concurrently from year to year. Further research should explore the impact of weight management interventions as a strategy to preserve sexual function in midlife women.

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Keywords

Sexual Functioning; Weight Change; Midlife Women

Introduction

Obesity has been linked to impaired health-related quality of life.¹ One important aspect of quality of life is sexual functioning. Female sexual dysfunction, or psychophysiological disturbances associated with sexual desire, arousal, orgasm, and pain disorders,² affects approximately 40% of the female population, with even greater prevalences in peri- and post-menopausal women.³ It is estimated that 20-30% of adult females experience sexual desire disorder, 15% suffer from arousal disorder, and 25% demonstrate difficulty with orgasm.³ Furthermore, approximately 40% of midlife women who reportedly engaged in sex within the past 6 months indicated low levels of participation in sexual intercourse.⁴ Within general populations of women, there does not exist clear associations between menopause and sexual functioning when controlling for covariates like chronological aging and menopausal symptoms; however, specific aspects of sexual functioning, such as desire and arousal, have been found to decline at various stages of the menopausal transition.⁵⁻⁸ A myriad of factors, such as relationship quality, partner availability, psychological functioning, overall health, age, and race/ethnicity have been shown to impact sexual functioning in midlife women.⁵⁻⁹ Current evidence regarding the association between weight status and female sexual dysfunction remains inconclusive.¹⁰

In multiple cross-sectional studies involving representative, non-clinical populations,¹¹⁻¹⁴ women's sexual functioning and frequency of intercourse have not been associated with obesity, defined by a body mass index (BMI) ≥ 30 kg/m². Consistent associations between BMI and sexual difficulties have, however, been documented in women seeking routine medical care, weight loss treatment, or bariatric surgery.¹⁵⁻²⁰ Furthermore, successful response to weight loss treatment has been linked to improvements in sexual functioning.¹⁹ Given that weight gain and sexual dysfunction are often experienced by women traversing the menopause,^{21, 22} it remains an important goal to better understand these potential associations during this phase of life. Regarding the menopausal transition, cross-sectional research involving 171 postmenopausal women suggests that a larger body weight and higher levels of subcutaneous fat tissue are significantly related to a more severe decrease in sexual interest following menopause.²³

Though some evidence supports a link between obesity and sexual functioning in treatment-seeking populations, it remains unclear whether weight status or weight change affect sexual functioning over time in the general female population, and specifically across the menopausal transition. The objective of this study was to determine whether BMI was associated with level of sexual functioning and whether changes in BMI were associated with changes in sexual functioning measured within a 14-year period in midlife women involved in the Study of Women's Health Across the Nation (SWAN).

Methods

Participants

Participants were from SWAN, a longitudinal, multiethnic cohort study of community-based midlife women enrolled at seven sites in the United States. A full description of SWAN has been previously published.²⁴ Baseline assessments occurred between 1995 and 1997 and included 3,302 white, African American, Japanese, Chinese, and Hispanic women. Eligibility criteria included women aged 42 to 52 years with an intact uterus and at least one ovary who had experienced a menstrual period within the previous three months. Eligible women were not pregnant or breastfeeding and had not used reproductive hormones in the past three months. Participant assessments were conducted at study entry and annually thereafter and included both self- and interviewer-administered questionnaires assessing medical, social, psychological, economic, psychological, and lifestyle factors. Materials were available in English, Spanish, Japanese, and Cantonese with bilingual staff present as appropriate. In addition, height and weight measurements were obtained via standardized protocol across sites. All women provided written informed consent. All study procedures conformed to the Declaration of Helsinki and were approved by the Institutional Review Boards of each site.

Measures

Body Mass Index (BMI). The independent variable, BMI, was calculated as weight (kg)/height (m²) from measurements taken at SWAN baseline and annual assessments thereafter. Height was measured without shoes using a stadiometer; weight was measured without shoes with light indoor clothing using scales that were calibrated on a monthly basis to a standard.

Sexual Functioning. Sexual functioning variables were measured using a 20-item self-administered questionnaire designed to address sexual activity and function in midlife women. The questionnaire was derived from multiple sources: The Massachusetts Women's Health Study,²⁵ the National Health and Social Life Survey,²⁶ the National Survey of Family Growth,²⁷ and the Women's Health Initiative Daily Life Form.²⁸ These studies included large representative samples of white, African-American, Hispanic, and Asian women aged 15-79. All respondents were asked (yes/no) if they had engaged in sexual activity with a partner in the past 6 months, regardless of partner gender. Those women who responded affirmative were asked follow-up questions about various sexual practices. Four dependent variables that describe various dimensions of sexuality, including desire, arousal, frequency of intercourse, and ability to climax during sexual activity, were derived from survey questionnaires. All sexual functioning variables were measured using a five-category ordinal scale. Values on scales of desire and frequency of intercourse ranged from 1 (Not at all) to 5 (Daily), such that higher values indicated greater levels of sexual functioning. Values on scales of arousal and ability to climax ranged from 1 (Always) to 5 (Never). These scales were reversed, such that higher values also indicated greater levels of sexual functioning. Sexual desire, arousal, and frequency of intercourse were measured at baseline and each follow-up visit through visit 12, with the exception of visits 7, 9, and 11 when

sexual functioning data were not collected. For ability to climax, the first assessment occurred at visit 3.

Covariates—Covariates were chosen based on their potential to confound the associations between BMI and variables of sexual functioning, based upon previous literature.^{3–7, 29–32} Study site (Pittsburgh, PA, Chicago, IL, Oakland, CA, Los Angeles, CA, Boston, MA, Detroit-area, MI, and Newark, NJ), ethnicity/race (self-identified), age (calculated from birth date and date of exam), level of difficulty paying for basics (very hard, somewhat hard, and not hard at all), and education (no college education versus at least some college) were documented at baseline. Time-varying covariates, assessed at annual follow-up visits, included marital status (married or living as married versus not), elevated depressive symptoms indicated by scores ≥ 16 on the Center for Epidemiological Studies-Depression (CES-D) Scale (yes/no), menopausal status (late perimenopausal or postmenopausal versus otherwise) determined through menstrual bleeding patterns,³³ hormone therapy use (yes/no), self-reported overall health status (excellent/very good, good, and fair/poor), current smoker (yes/no), and number of alcoholic drinks per week (0, >0 and ≤ 3 , >3) assessed using three questions from the Block food frequency questionnaire.^{34–36}

Statistical Analyses

Analyses included a total of 2,528 women who responded to the sexual functioning questionnaire and indicated they had engaged in sexual activity with a partner within the past six months at one or more assessments. Given the small frequencies of extreme responses on all four sexual functioning outcome variables (i.e., Always and Never), the lowest two categories and the highest two categories were collapsed, creating a three category ordinal variable for each sexual functioning variable.

Analyses included continuous BMI data from baseline through visit 12. Expected level of BMI change over time (trajectory) was calculated for each participant using estimates from linear mixed models. Three aspects of the trajectory (baseline BMI, change in BMI over time, and deviation from the BMI trajectory at each observation) were included as independent variables. Change in BMI and deviation from the BMI trajectory at each observation were modeled as an individual slope and residual, respectively, in a longitudinal mixed effects model predicting BMI at each assessment point. These two terms, along with baseline BMI, were then included as predictors in a second set of generalized linear mixed effect models predicting aspects of sexual functioning. Analyses tested whether (1) baseline BMI was associated with baseline sexual functioning, (2) baseline BMI was associated with change of sexual functioning, (3) change in BMI was associated with baseline sexual functioning, (4) change in BMI was associated with change of sexual functioning, and (5) deviation from the expected BMI trajectory was associated with temporal change of sexual functioning at each time point. Analyses were conducted in separate models for each ordinal sexual functioning variable with and without covariates. All analyses were conducted utilizing SAS 9.2.

Results

Participant Characteristics

Of the original 3,302 sample of SWAN participants, 472 were excluded from the current analyses for either indicating they had not engaged in sexual activity with a partner within the past six months or for opting not to complete the sexual functioning measures during any assessment within the study period. Participants who were not included due to lack of engagement in sexual activity or completion of questionnaire had a higher mean baseline BMI (30.5 versus 27.7 kg/m²; $t(2989) = 7.68, p < .001$), and were less likely to be married or living as married (24.6% versus 74.1% married in excluded versus included participants, respectively; $X^2(1) = 428.91, p < .001$). An additional 302 participants who reported they were sexually active were excluded for failure to complete the sexual functioning measures or provide relevant covariate information during at least one assessment. Compared to those who were included, these participants also had a higher mean baseline BMI (29.6 kg/m²; $t(2795) = 4.30, p < .001$) and were less likely to be married or living as married (63.5%; $X^2(1) = 14.63, p < .001$). Table 1 provides demographic information and baseline characteristics for the final analytic sample of 2,528 women. The average duration of follow-up for each participant was 7.9 (SD = 5.2) years. On average, participants completed 5.4 assessments over the total study timeframe of 13.8 years. A number of covariates were found to be significantly associated with the sexual functioning variables (see Table, Supplemental Digital Content 1). Table 2 outlines both unadjusted and adjusted effects of the analyses.

Baseline BMI and Sexual Functioning

At baseline, average BMI was 27.7 kg/m². In adjusted models, higher baseline BMI was associated with participants reporting lower frequency of intercourse ($p = .003$). No associations were found between baseline BMI and baseline levels of desire, arousal, or ability to climax. Baseline BMI was also not associated with change in any sexual functioning variables throughout followup, and baseline levels of sexual functioning were not significantly associated with change in BMI throughout the study period.

Trajectories of Change in BMI and Sexual Functioning Across Time

All sexual functioning variables declined significantly over time (i.e., desire, frequency of intercourse, and ability to climax $ps < .001$; arousal $p = .001$). Conversely, BMI increased significantly over time ($p < .001$) with average BMI measuring 29.1 kg/m² at the end of visit 12. Overall changes in desire, arousal, frequency of intercourse, or ability to climax were not associated with overall change in BMI across the study period.

Deviations from Trajectories of Change in BMI and Sexual Functioning

The extent to which each participant's BMI in a given year deviated from their expected BMI, based on their individual trajectory, was examined as a predictor of sexual functioning. Frequency of intercourse was significantly associated with deviations from each women's expected BMI trajectory, such that greater deviations above (or below) the expected trajectory resulted in lower (or higher) than expected frequency of intercourse (p

< .001). Similarly, as BMI in a given year deviated from the expected trajectory in either an increased or decreased direction, participants reported either lower or higher than expected levels of desire, respectively ($p = .020$). Deviation from the expected BMI trajectory at each time point was not associated with levels of arousal or ability to climax.

Discussion

The current study assessed whether BMI was associated with sexual functioning in midlife women and whether changes in BMI were associated with changes in sexual functioning across a nearly 14-year total study time frame. There were four key findings from the models, which were adjusted for important covariates. First, baseline levels of desire, arousal, and ability to climax were not associated with BMI at the start of the study period when all participants were pre- or early perimenopausal. Results are consistent with previous population-based cross-sectional studies that found no association between BMI level and sexual functioning in women,^{12, 14} although previous studies included a wide age range of adult women and did not control for menopausal status. Lower frequency of intercourse, however, was associated with higher BMI after controlling for covariates. This suggests that within the general population of midlife women, sexual functioning in the form of desire, arousal, and ability to climax does not vary according to BMI level, but that frequency of intercourse may be somewhat lower in women of higher BMI. This association was observed even though models excluded women who reported no sexual activity within the previous six months. Women who were excluded from analyses due to lack of sexual activity with a partner or non-response to the sexual functioning measures were also of higher BMI and less likely to be married than women included in the analyses. It is unclear whether these self-selected women who did not engage in sexual activity with a partner or chose not to complete the sexual functioning questionnaire were more or less concerned with sexuality or experienced differential levels of sexual distress compared to the participants included in the present analyses.

Most prior studies that support an association between BMI and sexual dysfunction have been conducted in clinical samples of women seeking or undergoing weight loss treatment and have observed lower sexual functioning at higher levels of BMI.^{15–20} For example, Kinzl and colleagues¹⁷ found that more than half of women seeking bariatric surgery in their sample reported sexual problems associated with desire, avoidance, or physical problems. In addition, women seeking gastric bypass indicate significantly greater impairment in sexual functioning than obese women not seeking weight loss surgery.¹⁸ Women seeking weight loss treatment may experience greater physiological or psychological distress, which may account for differences in sexual functioning outcomes in population versus clinical-based studies.

A second finding in the present study demonstrated that desire, arousal, frequency of intercourse and ability to climax declined over time. Sexual interest declines in approximately 40% of women following the menopausal transition.²³ Assessments of frequency of sexual activity also demonstrate decreases from early to late postmenopause.³⁷ In addition, longitudinal studies assessing sexual functioning show decreases in desire,

arousal, lubrication, excitement, and orgasm during intercourse following menopause.^{8, 21, 38}

A third finding of the current study demonstrated that, while a general increase of 1.4 kg/m² was seen in BMI and all components of sexual functioning were found to decrease, the overall changes in desire, arousal, frequency of intercourse and ability to climax over the 13.8 year study timeframe were not significantly associated with cumulative changes in weight over the same period. Possible explanations for decreases in sexual function include aging, hormonal changes, psychological function, general health status, relationship quality, and partner availability.³⁹ For midlife women in the menopausal transition, changes in body composition and body proportions may be associated with decreased perceived attractiveness and negative body image.^{23, 40} Body image and self-esteem are consistently associated with sexual functioning often regardless of weight status,^{14, 41–43} and therefore may also contribute to declines in sexual functioning in post-menopausal women.

Fourth, and perhaps most importantly, it was observed that changes in reported sexual desire and frequency of intercourse were associated with deviations from each woman's individual BMI trajectory. This suggests that in years of greater-than-expected weight gain, there existed concurrent decreases in desire and frequency of intercourse. Also, in years of greater-than-expected weight loss, concurrent increases in desire and frequency of intercourse were observed. These associations remained significant after adjusting for covariates. Prior research on the impact of large weight gain on sexual functioning is limited, while findings on intentional weight loss on sexual functioning is mixed. Weight loss was not significantly associated with resolution of female sexual dysfunction following a one-year lifestyle intervention,²⁰ but reduced weight after one year has been associated with increased sexual frequency⁴⁴ and even resolution of female sexual dysfunction for a majority of patients six months post-bariatric surgery.¹⁵ Improvements in sexual functioning following intervention may be driven less by actual weight loss^{15, 17} than by improved body image, increased self-esteem, and perceived sexual attractiveness.^{15, 17, 19, 43}

The present study had several limitations. First, the sample size did not provide adequate power to examine associations within specific subgroups, including racial/ethnic groups or by marital status or sexual orientation. Within SWAN, only 1.4% of the 3,302 total participants indicated they have generally had sex with a woman, while 0.9% reported sometimes having sex with a woman and sometimes with a man. Second, some potential mediators of the observed associations were not measured across the study period, including body image or self-esteem. Given previous associations between these variables and sexual functioning in women,^{15, 17, 19, 43} it remains unknown whether the declines seen in sexual functioning in the present study were due in part by negative self-perceptions. Third, given the study was focused on assessing levels of sexual functioning and weight, it did not include a number of mechanistic variables that could potentially affect sexual functioning. While a number of well-documented covariates were included in the model, additional unstudied or unmeasured variables include the quality of women's romantic relationships, characteristics of sexual partners, presence of menopausal symptoms, various sociocultural issues, hormonal profile, and specific health issues that could impact sexual positioning. Fourth, measuring sexual functioning and weight status on an annual basis may have missed

subtle fluctuations within these variables and may have created bias in subjective responses. Finally, the study only assessed sexual activities that occurred with a partner and excluded individual acts like masturbation.

This study also had several notable strengths. First, SWAN is comprised of a large sample of women from a variety of races/ethnicities, education levels, and socioeconomic strata. These women also completed an average 5.4 assessments during a mean duration of 7.9 years throughout the entire 13.8 years of the study. The overall attrition rate was low. Thus, SWAN includes a highly diverse sample of women followed over a key life transition period. In addition, questions of sexual functioning were taken from questionnaires specifically applicable to midlife women. Finally, given few longitudinal research studies assessing sexual functioning and weight have been conducted in a representative population of U.S. women, findings from this study uniquely contribute to the literature.

Conclusion

While previous research relied mainly on cross-sectional data and offered mixed results on whether associations exist between changes in sexual functioning and adiposity over the menopausal transition, the present study provides clarification on this important issue. Though women with a higher BMI had a lower average frequency of intercourse, various aspects of sexual functioning were not associated with BMI at baseline or with overall BMI change across 13.8 years of follow-up. Instead, frequency of intercourse and level of sexual desire were found to vary with year-to-year changes in BMI, with lower sexual functioning in years characterized by greater-than-expected weight gain and higher sexual functioning in years of greater-than-expected weight loss. Clinicians are thus encouraged to monitor patient weight changes throughout the menopausal transition and be aware of the potential implications for sexual functioning. The mechanisms underlying these associations, the impact of weight management strategies on sexual functioning, and other aspects of sexual quality of life (e.g., sexual satisfaction) should be explored in future studies.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1Baseline characteristics of 2,528^a midlife women in the analytic sample

	Mean	SD
Age, years	45.8	2.7
Weight, kg	73.2	19.4
BMI, kg/m ²	27.7	6.9
	n	%
Site		
Detroit area, MI	388	15.4
Boston, MA	340	13.5
Chicago, IL	359	14.2
Oakland, CA	385	15.2
Los Angeles, CA	420	16.6
Newark, NJ	264	10.4
Pittsburgh, PA	372	14.7
Race/Ethnicity		
African American	683	27.0
White	1212	47.9
Chinese	214	8.5
Hispanic	183	7.2
Japanese	236	9.3
Married or living as married (n=2,500)	1853	74.1
Some college education or higher	1935	76.5
Overall health (n=2,499)		
Excellent/very good	1520	60.8
Good	694	27.8
Fair/poor	285	11.4
Elevated depressive symptoms ^b	574	22.7
Current smoker (n=2,510)	401	16.0
Difficulty paying for basics		
Very hard	187	7.4
Somewhat hard	732	29.0
Not very hard at all	1609	63.7
Alcohol drinks per week (n=2,401)		
0 per week	1209	50.4
>0 and 3 per week	763	31.8
>3 per week	429	17.9

^aNot all participants provided complete data at baseline. The actual number of observations per variable is noted when different from 2,528^bScored 16 on the Center for Epidemiological Studies-Depression (CES-D) Scale*Note:* All women were either pre-or early perimenopausal and were not taking hormone therapy at baseline.

Associations of BMI and sexual functioning variables

Table 2

	Unadjusted estimates (95% Confidence Interval)				Deviations in expected BMI and variable
	Baseline BMI and baseline variable	Baseline BMI and change in variable	Change in BMI and baseline variable	Change in BMI and change in variable	
Desire	0.041 (0.022, 0.062) ^d	-0.001 (-0.003, 0.002)	1.193 (0.017, 2.369) ^b	-0.033 (-0.179, 0.112)	-0.055 (-0.091, -0.019) ^c
Arousal	-0.016 (-0.038, 0.006)	0.003 (-0.000, 0.006)	0.819 (-0.518, 2.155)	0.052 (-0.124, 0.228)	-0.051 (-0.096, -0.006) ^b
Frequency of intercourse	0.002 (-0.019, 0.025)	-0.002 (-0.005, 0.001)	0.469 (-0.837, 1.774)	0.008 (-0.164, 0.180)	-0.073 (-0.111, -0.035) ^d
Ability to climax	0.007 (-0.026, 0.039)	0.004 (-0.001, 0.008)	1.280 (-0.496, 3.055)	-0.069 (-0.305, 0.167)	-0.024 (-0.090, 0.041)
Adjusted ^d estimates (95% Confidence Interval)					
Desire	0.010 (-0.011, 0.031)	-0.000 (-0.003, 0.002)	0.434 (-0.711, 1.579)	-0.059 (-0.200, 0.083)	-0.043 (-0.078, -0.007) ^b
Arousal	-0.010 (-0.034, 0.013)	0.003 (-0.000, 0.006)	0.612 (-0.679, 1.903)	0.023 (-0.151, 0.197)	-0.038 (-0.083, 0.007)
Frequency of intercourse	-0.036 (-0.059, -0.012) ^c	-0.002 (-0.005, 0.001)	-0.279 (-1.581, 1.023)	-0.016 (-0.186, 0.155)	-0.068 (-0.106, -0.029) ^d
Ability to climax	-0.006 (-0.042, 0.029)	0.004 (-0.000, 0.008)	0.560 (-1.207, 2.327)	-0.039 (-0.268, 0.190)	-0.023 (-0.088, 0.041)

^a Adjusted models included the following covariates: study site, ethnicity/race, age, education, difficulty paying for basics, marital status, depressive symptoms, menopausal status, hormone therapy use, overall health status, smoking status, and number of alcoholic drinks per week

^b $p < .05$;

^c $p < .01$;

^d $p < .001$