


Women with larger breasts are less satisfied with their breasts: Implications for quality of life and physical activity participation

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Isobel H Oon¹ , Jocelyn K Mara¹, Julie R Steele², Deirdre E McGhee², Vivienne Lewis³ and Celeste E Coltman¹ 

Abstract

Introduction: Although low breast satisfaction has been associated with a range of potential negative health implications, little is known about key factors that influence breast satisfaction across the lifespan. This study aimed to determine the impacts of age, body mass and breast size on breast satisfaction and how breast satisfaction impacts psychosocial and sexual well-being-related quality of life outcomes and physical activity behaviours.

Methods: Three hundred and forty-five women (age range: 18.1–83.7 years) had their body mass (kg), standing height (cm) and breast volume (ml) measured. A 13-item questionnaire comprising the Breast-Q and Active Australia Survey was used to assess breast satisfaction, quality of life outcomes and participation in physical activity.

Results: Breast satisfaction was influenced by breast size, such that women with larger breasts were less satisfied with their breasts compared to their counterparts with smaller breasts. Greater breast satisfaction was associated with improved psychosocial and sexual well-being-related measures of quality of life, and time spent participating in physical activity.

Conclusion: Interventions to improve breast satisfaction among women across the breast size spectrum should be encouraged in public health initiatives to better engage and encourage positive health behaviours and reduce potential adverse health implications.

Keywords

body image, body satisfaction, breast dissatisfaction, breast size, women

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Introduction

Body image is a complex multidimensional construct, influenced by intrinsic (e.g. personal beliefs and perceptions) and extrinsic (e.g. sociocultural expectations) factors.^{1,2} It can guide self-perception and impact upon individual well-being.³ Body satisfaction describes the discrepancy between an individual's perceived and ideal body image.⁴ Current evidence suggests that body satisfaction changes across the lifespan, with women reporting poorer overall body image satisfaction than their male counterparts.⁵ A unique component of body satisfaction among women is breast satisfaction; that is, a women's perceived discrepancy between her current and ideal breast size.² Low breast satisfaction has been associated with a range of negative health implications, such as decreased

body image and poor psychological well-being and decreased breast awareness. (breast awareness refers to an individual's ability to notice changes in their breasts, such

¹Discipline of Sport and Exercise Science, Faculty of Health, University of Canberra, Bruce, ACT, Australia

²Biomechanics Research Laboratory, School of Medical, Indigenous and Health Sciences, Faculty of Science, Medicine and Health, University of Wollongong, Wollongong, NSW, Australia

³Discipline of Psychology, Faculty of Health, University of Canberra, Bruce, ACT, Australia

Corresponding author:

Celeste E Coltman, Discipline of Sport and Exercise Science, Faculty of Health, University of Canberra, 11 Kirinari Street, Bruce, ACT 2617, Australia.

Email: Celeste.Coltman@Canberra.edu.au



as appearance and shape, which is vital for breast self-care and screening initiatives).²

As breast satisfaction is part of a woman's body image, it is influenced by sociocultural standards and heavily driven by ideal body types portrayed in social media, consisting of 'thin ideals' and, more recently, 'fit ideals'.^{4,5} These sociocultural standards often persuade women that their worth, femininity and sexuality are dictated by their body and breast appearance.⁶ The frequent portrayal of desirable and feminine icons as women with large breasts and a disproportionately thin figure, which is anthropometrically scarce,⁷ generates further discourse in self-perception and a failure to meet societal standards of 'normality'.^{5,6} It is therefore not surprising that researchers examining breast dissatisfaction among women from 40 nations (Western and non-Western) reported that only 29.3% of women were satisfied with their breasts (47.5% of women wanted larger breasts and 23.2% wanted smaller breasts).² Specifically, only 28% of women in Australia reported satisfaction with their breast size.² These elements are key factors influencing perceived body image among women,^{2,7} and central to understanding how variations in breast appearance affect a woman's breast satisfaction.

Breasts of women in the general population vary in both size and shape because breasts are composed of varying amounts of fibroglandular and fibro-adipose tissue.⁸ Breast size and shape are also influenced by age^{9,10} and the many biological milestones that can occur over a woman's lifetime, including puberty, pregnancy, breastfeeding and menopause.^{5,10} Ageing is often accompanied by an increase in adipose tissue¹¹ and a change in breast appearance, ultimately resulting in a departure from typical 'beauty ideals' and standards imposed by media and society.⁵ Furthermore, the global obesity epidemic has resulted in many women worldwide being overweight or obese, further resulting in a departure from societally driven beauty standards.^{2,5} A higher body mass has also been associated with larger breasts,⁸ with breast sizes increasing among the general population over the past 30 years.¹¹ Although larger breasts are considered socially desirable, hypertrophic breast sizes (breast volumes > 1200 mL per breast) have been associated with increased breast dissatisfaction and reduced psychosocial and sexual well-being-related quality of life (QoL) measures.^{10,12,13}

Despite the established effects of age and body mass on breast size, limited research has investigated how these physical factors impact upon an individual's breast satisfaction. Understanding the effects of age, body mass and breast size on breast satisfaction is important because increased breast dissatisfaction has been associated with a decline in women aged 40 years and over participating in physical activity.¹⁰ This is concerning because reduced participation in physical activity has been linked to negative health outcomes, including cardiorespiratory disease, metabolic disorders, and a reduced QoL.¹⁴ Considering the relationship between poor breast satisfaction, reduced

physical activity and negative health implications, it is vital that we better understand factors that affect breast satisfaction across the age spectrum. It is also important to establish how breast satisfaction impacts women's QoL, in particular, psychosocial and sexual well-being-related measures of QoL. Therefore, this study aimed to determine: (1) the effect of age, body mass index (BMI) and breast size on breast satisfaction and (2) whether breast satisfaction influences psychosocial and sexual well-being-related measures of QoL and physical activity participation. There were three hypotheses tested as part of this study; Hypothesis 1 (H1): breast satisfaction would decrease with increasing age, BMI and breast size. Hypothesis 2 (H2): increased breast satisfaction would be associated with increased psychosocial and sexual well-being-related measures of QoL. Hypothesis 3 (H3): increased breast satisfaction would be associated with increased physical activity participation.

Materials and methodology

Participants

Three hundred and forty-five women over the age of 18 years volunteered to participate in this cross-sectional study. The participants' ages ranged from 18.1 to 83.7 years (mean: 43.0 ± 19.4 years), BMI ranged from 18.7 to 54.5 kg/m² (mean: 27.5 ± 6.1 kg/m²) and breast volume ranged from 70 to 2,789 mL per breast (mean: 653 ± 465 mL). The distribution of ages, BMI and breast volumes across the cohort are shown in Figure 1. Participants were recruited by advertising the study throughout the University of Wollongong (to all students and staff), the local community (via television and newspapers) and numerous Women's Health Centres in New South Wales, Australia. Exclusion criteria included participants who were pregnant or breastfeeding, had epilepsy induced by a flashing light, or an inability to assume the scanning position. These exclusion criteria were necessary because they affected either breast volume or the ability to collect breast volume data (described below). This study was approved by the University of Wollongong Human Research Ethics Committee (HE 13/424) and all participants provided written informed consent before testing commenced. All testing was conducted according to the National Health and Medical Research Council¹⁵ Statement on Human Experimentation. Data collection commenced in 2014 and was concluded in 2015.

Age, BMI and breast size

Each participant's date of birth (DOB) was recorded, and age was subsequently calculated in years based on the participant DOB and the date of testing. The participant's height was measured in centimetres using a portable stadiometer (Model: 214, Seca Corp., Maryland, USA) and

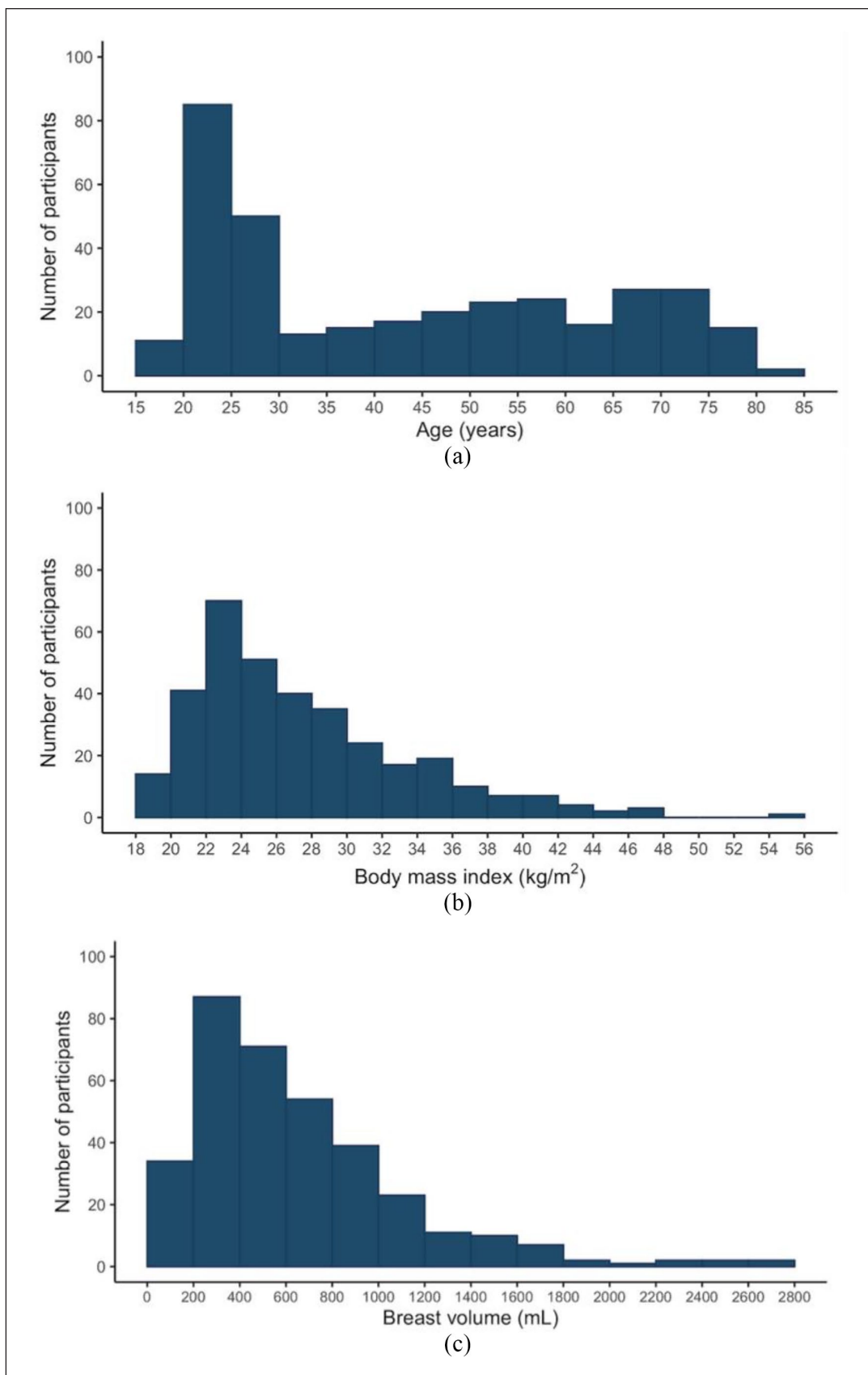


Figure 1. Distribution of (a) age, (b) body mass index and (c) breast volume are shown for the entire study cohort, including the number of participants (y-axis) for each age, BMI and breast volume increment (x-axis).

body mass was measured in kilograms using a calibrated Body Composition Analyser (Model: TISC24OMA, Tanita, Illinois, USA). From these data, BMI was calculated as body mass (kg) divided by height² (m). BMI was chosen to represent body size because BMI is widely used within the literature when discussing anthropometric characteristics at a population-level.¹⁶

The size of each participant's breasts was characterized by quantifying breast volume. Breast volume was measured using a hand-held three-dimensional scanner (Artec™ Eva 3D Scanner, Artec Group, San Jose) while the participant lay prone across two custom built tables such that her breasts hung away from her trunk.⁸ Before scanning, adhesive markers (approximately 1 cm in diameter) were positioned directly onto the participant's skin to mark the border of each breast. A three-dimensional model of the breasts and torso was created from the images captured by the scanner using Geomagic Studio® software (Geomagic Studio software; Version 12; 3DSystems, South Carolina, USA). The volume of each breast was then calculated using methods previously reported.^{17,18} Breast volume was chosen to represent breast size because of limitations in using other measures such as self-reported bra size.¹⁹ As there was no significant difference ($p=0.684$) between the volume of the left and right breasts of the cohort (determined using a Wilcoxon signed-rank test), the volume of each participant's left breast was taken to represent unilateral breast volume in all subsequent analysis.

Breast satisfaction

Participants were asked to respond to a series of questions related to their breast satisfaction from the Breast-Q survey instrument.¹³ The Breast-Q survey has been validated (Cronbach's alpha=0.76–0.95, test–retest reproducibility=0.73–0.96) using participants from the United States and Canada, nations that both have similar demographics to Australia.¹³ The questionnaire items were chosen due to the influence they exert upon breast satisfaction.^{2,5,10} The question items were grouped into two main sections pertaining to the breast: (1) satisfaction or dissatisfaction and (2) psychosocial and sexual well-being QoL measures (described below). The questionnaire was available online via Qualtrics or in a hardcopy version, with participants able to choose the method by which they responded.

Satisfaction or dissatisfaction with breasts. With their breasts and breast area in mind, participants responded to six question items on a 4-point Likert-type scale (from 1='very dissatisfied' to 4='very satisfied'), to indicate their satisfaction or dissatisfaction with: (1) how comfortably their bras fit, (2) the shape of their breasts when wearing a bra, (3) the shape of their breasts when not wearing a bra, (4) the size of their breasts, (5) how their breast size matches the rest of the body and (6) how their breasts look

in clothes. These six responses were individually scored (1–4) and then summed to provide a total breast satisfaction score out of 24.

Quality of life. Psychosocial and sexual well-being-related measures of QoL required participants to respond with their breasts in mind to five question items on a 5-point Likert-type scale (from 1='none of the time' to 5='all of the time') to indicate how often they felt (1) self-confident, (2) normal, (3) attractive, (4) sexually attractive in clothes and (5) confident sexually about how their breasts look unclothed. These responses were then summed to provide a QoL score out of 25.

Physical activity participation

Participants were asked to respond to eight questions from the Active Australia Survey²⁰ regarding their participation (frequency and duration) in walking, moderate-intensity activity, vigorous gardening and vigorous-intensity activity in the week prior to participating in the study. The time reported by the participants was calculated in minutes. The question regarding moderate-intensity activity was combined with the question regarding walking to determine total moderate-intensity activity as per the Active Australia reporting guidelines.²⁰ To determine the total time (minutes per week), the participants spent engaging in physical activity, the total moderate-intensity activity, vigorous gardening and vigorous-intensity activity were summed.

Statistical analysis

Statistical analysis was conducted using R (version 4.1.0)²¹ in R Studio (version 1.4.1717).²¹ A power analysis was conducted using the 'pwr' R package²² and determined that a sample size of 345 participants would result in 100% power to detect an F2 value (ratio of explained variance to variance not explained) of 0.20, if one existed. Descriptive statistics (mean, standard deviation and range) were calculated for all participant characteristic variables. To test H1, a multivariate ordinal regression model with a logit link function was developed using the 'mvord' R package²³ to determine the effect of age, BMI and breast volume on the six question items pertaining to breast satisfaction. There was no evidence of multicollinearity between any of the explanatory variables.

Separate ordinary least squares linear regression models were developed to determine the effect of total breast satisfaction (sum of all question items listed in section "Satisfaction or dissatisfaction with breasts," total score out of 24) on the total QoL score (out of 25) (to test H2) and total time spent in physical activity (to test H3). Interaction terms for age and breast satisfaction, and BMI and breast satisfaction were also included. The interaction between breast satisfaction and breast volume was not

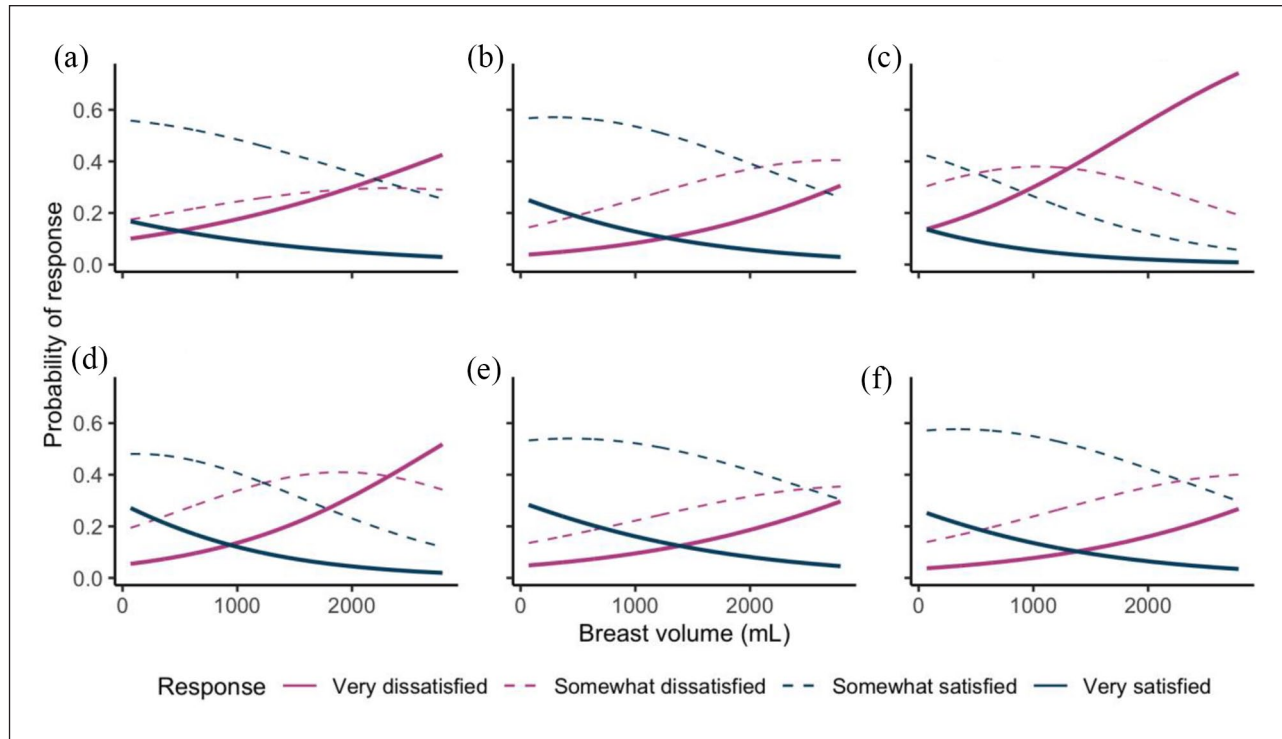


Figure 2. Marginal probabilities of participant responses for the six question items – (a) how comfortably your bras fit, (b) the shape of your breasts when you are wearing a bra, (c) the shape of your breasts when you are not wearing a bra, (d) the size of your breasts, (e) how your breast size matches the rest of your body, (f) how your breasts look in clothes – related to breast satisfaction, according to breast volume. The graphs represent the probability (y-axis) of participants responding to the question with ‘very dissatisfied’, ‘somewhat dissatisfied’, ‘somewhat satisfied’ and ‘very satisfied’, as a function of breast volume (x-axis).

assessed because these two variables were found to be highly related and therefore failed the assumption of multicollinearity. For the physical activity model, total time spent in physical activity was transformed using the natural logarithm. Non-complete cases were excluded from each of the models, resulting in sample sizes of $n=332$, 308 and 332 for the breast satisfaction, QoL and physical activity models, respectively. Where there were multiple candidate models developed, the Bayesian Information Criteria (BIC) was used to inform model selection. Statistical significance was accepted when $p < 0.05$.

Results

Breast satisfaction

In partial support of H1, breast volume was the only explanatory variable associated with the six breast satisfaction question items ($p < 0.001$ – 0.002), with the probability of responding with ‘*Very dissatisfied*’ or ‘*Somewhat dissatisfied*’ increasing as breast volume increased (Figure 2). Contrary to H1, there was no effect of age or BMI on any of the breast satisfaction question items, and no interaction effects were found ($p > 0.05$).

Quality of life

In support of H2, the total breast satisfaction score (out of 24) was significantly associated with the QoL score (out of 25; $b_{\text{satisfaction}} = 1.153$, $p < 0.001$), and this effect was moderated by BMI ($b_{\text{satisfaction} \times \text{BMI}} = -0.015$, $p = 0.034$; Figure 3). Total breast satisfaction score and BMI (with an interaction term) explained 44.2% of the variance (adjusted R -squared) in QoL scores. There was no interaction effect found between age and total breast satisfaction score ($p = 0.531$), and no main effect found for age ($p = 0.629$).

Physical activity

The effect of breast satisfaction score on total physical activity per week (log; $b_{\text{satisfaction}} = 0.182$, $p = 0.001$) was moderated by BMI ($b_{\text{satisfaction} \times \text{BMI}} = -0.005$, $p = 0.010$), where in general, higher breast satisfaction scores were associated with higher participation in physical activity (log) for participants with a lower BMI. However, this effect declined as BMI increased (Figure 4). In addition, breast satisfaction and BMI (with an interaction term) explained only 6.3% of the variance (adjusted R -squared)

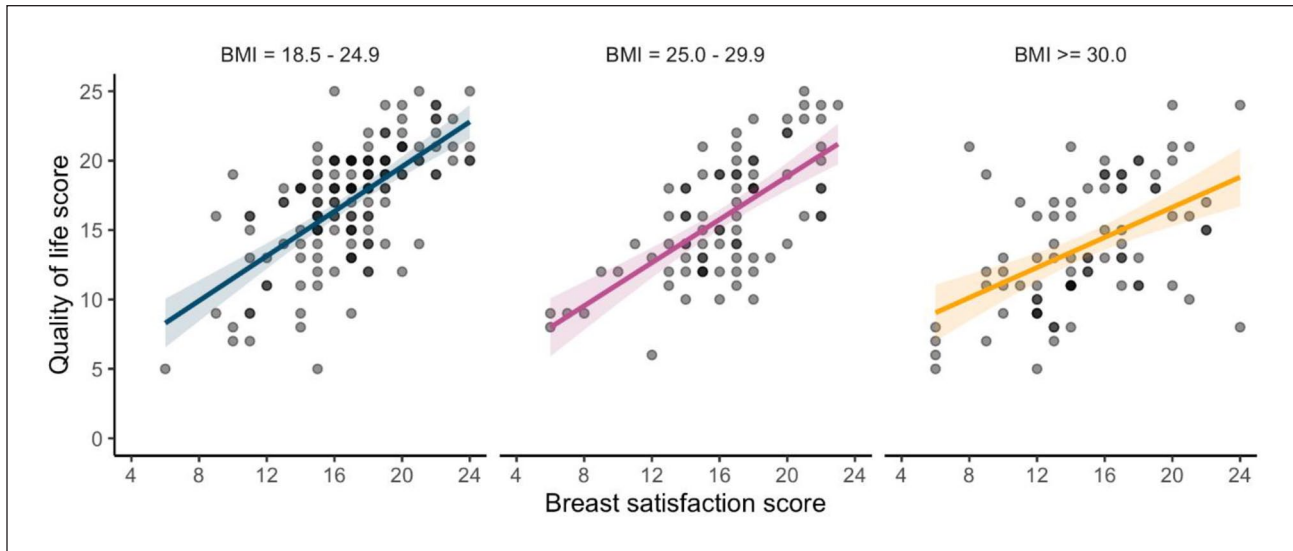


Figure 3. The relationship between total breast satisfaction score and quality of life score, moderated by body mass index (BMI). Note: The linear regression model used the continuous variable BMI as a moderator. However, for visualization purposes BMI has been grouped according to typical BMI ranges for normal (BMI = 18.5–24.9 kg/m²; left graph), overweight (BMI = 25.0–29.9 kg/m²; middle graph) and obese (BMI > 30.0 kg/m²; right graph) categories. The shaded ribbon shows the 95% confidence interval for the model fit.

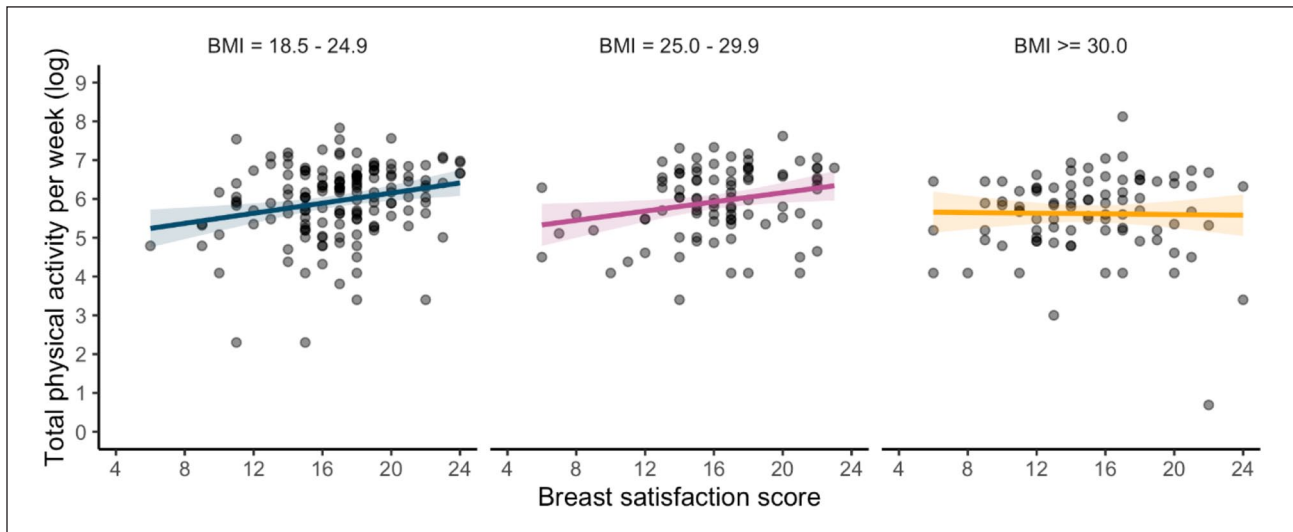


Figure 4. The relationship between total breast satisfaction score and total time spent in physical activity (min per week), moderated by body mass index (BMI).

Note: The linear regression model used the continuous variable BMI as a moderator. However, for visualization purposes BMI has been grouped according to typical BMI ranges for normal (BMI = 18.5–24.9 kg/m²; left graph), overweight (BMI = 25.0–29.9 kg/m²; middle graph) and obese (BMI > 30.0 kg/m²; right graph) categories. The shaded ribbon shows the 95% confidence interval for the model fit.

in total physical activity per week (log), showing partial support for H3. There was no interaction effect found for age and breast satisfaction ($p=0.975$), and no main effect found for age ($p=0.914$).

Discussion

Understanding key factors that influence breast satisfaction across the lifespan is vital, given the association

between low breast satisfaction and negative health outcomes. In our cohort of women, who represented a broad range of ages, BMI and breast sizes, breast volume was the only variable we assessed that was found to significantly influence breast satisfaction, whereby women with larger breasts were less satisfied with their breasts. Positive associations were also observed between greater breast satisfaction and improved psychosocial and sexual well-being-related measures of QoL and time spent

participating in physical activity. The implications of these unique findings are discussed below.

Our finding that women with larger breasts were significantly less satisfied with their breasts conflicts with societal standards and beliefs that suggest large breasts are congruent with femininity, beauty and sexual attractiveness.⁵⁻⁷ Previous research has reported women with perceived large breasts have greater breast satisfaction compared to their counterparts with perceived small breasts.⁶ It is noted, however, that breast size in this study was objectively quantified, with participants in this study representing a wide range of breast sizes (48–2,789 mL per breast) and with ~10% of participants ($n=37$) having hypertrophic breasts (breast volumes $>1,200$ mL).¹⁷ Importantly, hypertrophic breast sizes have been shown to be associated with increased breast dissatisfaction.¹⁰ Participants in this study also represented women in the general population who were not seeking breast reduction surgery. Therefore, nonsurgical interventions to increase breast satisfaction, particularly the satisfaction of women with larger breasts, are required and should be considered for public health initiatives. Furthermore, the question items surrounding breast satisfaction included the shape and appearance of women's breasts, as well as breast size. As breast size increases, breast shape changes from non-ptotic to very ptotic.⁹ It is therefore likely that breast appearance (shape), combined with breast size (volume), influences breast satisfaction, although this notion warrants further investigation.

The importance of implementing public health initiatives to increase total breast satisfaction was reinforced by the result whereby less total breast satisfaction was associated with decreased psychosocial and sexual well-being-related measures of QoL. Therefore, to enhance women's psychosocial and sexual well-being-related measures of QoL, it is imperative that breast satisfaction is also maximized. Interestingly, however, the association between breast satisfaction and QoL measures was influenced by BMI, whereby the effect of breast satisfaction on QoL measures was reduced among participants with a higher BMI (Figure 3). That is, as BMI increased, psychosocial and sexual well-being-related measures of QoL were less influenced by breast satisfaction, suggesting that other factors are implicated in QoL outcomes among women with larger BMIs. It is important to note that breast satisfaction and BMI (including their interaction) accounted for approximately 44% of variance in QoL scores. This result indicates that while there are a multitude of other factors not investigated in this study that influence QoL, breast satisfaction and BMI accounted for nearly half of the variance in the QoL scores. It is therefore important to address the association between breast satisfaction and BMI when implementing public health initiatives regarding women's body image and psychosocial and sexual well-being.

It has previously been established that increased breast size is associated with a decrease in physical activity

participation.¹² Building on this notion, results of this study highlighted that increased breast satisfaction, which is strongly influenced by breast size, was associated with higher reported engagement in physical activity (total time in physical activity per week). This effect, however, decreases as BMI increases (Figure 4) and only accounts for approximately 6% of the variance in total time spent in physical activity. Therefore, while breast satisfaction and breast volume are known factors influencing physical activity behaviour,¹² it is important to acknowledge the numerous other factors that were not measured in this study that further influence physical activity behaviour. These include variables such as cultural factors, existing physical activity participation habits, personal control (decision-making regarding self and health situations), interpersonal support systems and smoking status.^{24,25} Regardless, results of this study provide further evidence to inform insights into physical activity behaviour, for example, where a woman may find it challenging to engage in physical activity. This is likely further exacerbated due to low breast satisfaction combined with increased discomfort through poor bra fit or musculoskeletal pain,^{12,26-29} ultimately resulting in some women avoiding physical activity. It is important to understand the effect that breast satisfaction has upon physical activity behaviours when implementing future public health initiatives to engage women in physical activity, and how breast satisfaction is influenced by factors such as breast size and BMI.

As with all research, the results of this study must be interpreted considering the limitations of the study. First, the breast satisfaction data were collected using a survey, with several limitations associated with subjective, self-reported survey data such as recall bias, as well as under or over reporting.³⁰ Second, although this study provided data from a substantial number of participants ($n=345$), there were some non-responses, resulting in a small number of incomplete cases that were removed from the multivariate modelling ($n=13$, 37 and 13 incomplete cases for the breast satisfaction, psychosocial and sexual well-being measures of QoL, and physical activity models, respectively). Third, although the women in the study cohort were reflective of a broad spectrum of ages, BMIs and breast volumes, participants' BMI and breast volume were skewed towards the right, resulting in a smaller number of participants at the extreme left, possibly impacting the data analysis. Furthermore, literature suggests that there is a difference between cultural and ethnic backgrounds when discussing body image and breast satisfaction,^{2,6} and socioeconomic status has also been identified as an influencing factor for individual perception of breast satisfaction.² For example, it was theorized that greater financial security allows for the ability to remove oneself away from the pressure of breast appearance dictating self-worth when compared to financially insecure women.² Unfortunately, it was beyond the scope of this study to

collect and analyse data on these factors that may have impacted on breast satisfaction in our cohort.

Conclusion

Breast satisfaction was influenced by breast volume such that women with larger breast sizes were less satisfied with their breasts compared to their counterparts with smaller breast sizes. While breast satisfaction was found to have a mild affect upon physical activity behaviours, the impact upon psychosocial and sexual well-being-related measures of QoL was substantial and needs to be considered when implementing future public health initiatives. These findings highlight the potential increased risk of negative health effects among women with low breast satisfaction, such as decreased psychosocial and sexual well-being and decreased physical activity engagement. Furthermore, the relationships identified in this study may help to understand challenges for women engaging in physical activity and assist public health initiatives to better engage and encourage positive health behaviours and reduce potential adverse health implications.

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Author contribution(s)

Isobel H Oon: Data curation; Writing – original draft.

Jocelyn K Mara: Formal analysis; Methodology; Software; Writing – review & editing.

Julie R Steele: Conceptualization; Methodology; Supervision; Writing – review & editing.

Deirdre E McGhee: Conceptualization; Methodology; Supervision; Writing – review & editing.

Vivienne Lewis: Conceptualization; Writing – review & editing.

Celeste E Coltman: Conceptualization; Formal analysis; Investigation; Methodology; Project administration; Supervision; Writing – original draft; Writing – review & editing.

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ORCID iDs

Isobel H Oon  <https://orcid.org/0000-0003-2568-3808>

Celeste E Coltman  <https://orcid.org/0000-0003-3803-441X>

Supplemental material

Supplemental material for this article is available online.

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