JPRAS Open 37 (2023) 92–101

Contents lists available at ScienceDirect

JPRAS Open

journal homepage: www.elsevier.com/locate/jpra

Original Article

Self-reported breast size, exercise habits and BREAST-Q data – an international cross-sectional study of community runners

Claire R. Baxter [1], Tamara A. Crittenden [1,2], Nicola R. Dean [1,2,*]

[1] *Department of Plastic and Reconstructive Surgery, Flinders Medical Centre, Bedford Park, Adelaide, South Australia, Australia*
[2] *College of Medicine and Public Health, Flinders University, Bedford Park, Adelaide, South Australia, Australia*

ARTICLE INFO

Article history:
Received 29 May 2023
Accepted 23 June 2023
Available online 1 July 2023

KEY WORDS:
Breast reduction surgery
Exercise
Women's health
BREAST-Q
Breast health

ABSTRACT

Women with larger breasts tend not to participate in high-intensity exercise and exercise less frequently. This study investigates how breast size impacts exercise habits and how breast reduction surgery changes women's participation in recreational exercise. Recruitment was generated via parkrun Limited (Richmond, UK), an organization offering weekly community-based runs. Female parkrun members aged over 18 years with no history of breast cancer were invited to complete a survey, including questions about their exercise habits, breast size, any breast alteration surgery, and BREAST-Q questionnaires. A total of 1987 women completed the survey, including 56 women who had undergone breast reduction. Results demonstrate that women with bigger breasts believe that reducing their breast size would improve their exercise performance and participation and that their breast size significantly impacts their type of exercise. Women who had undergone breast reduction reported increased overall frequency, enjoyment, and willingness to exercise in a group. Additionally, women that have un-

* Corresponding author: Associate Professor Nicola Dean, Department of Plastic and Reconstructive Surgery, Flinders Medical Centre, Bedford Park, Adelaide, South Australia 5042, Australia, Telephone: +61 882045772, Fax: +61 882043031
E-mail address: nicola.dean@sa.gov.au (N.R. Dean).

https://doi.org/10.1016/j.jpra.2023.06.013

dergone breast reduction report higher BREAST-Q scores than their non-surgical counterparts. This study supports the existing literature that breast size can impact exercise habits and demonstrates that women who have undergone breast reduction participate in healthier lifestyle practices. We suggest that if breast size impacts women's participation in sport and fitness, health practitioners and policymakers should advocate for better access to reduction mammoplasty in the publicly funded health sector.

Introduction

Breast size and its impact on exercise habits vary significantly across women. Large breasts change the way women exercise and create barriers to achieving healthy lifestyle habits.[1,2] Women with large breast size tend to avoid high-impact exercise, which in turn leads to exercising less altogether.[1] Burnett and colleagues found that breast size was the fourth most significant barrier to physical activity for women, with women describing breast pain associated with vigorous activity and embarrassment by excessive breast movement.[3] With more deaths associated with being overweight than underweight globally, and with ischemic heart disease being the leading cause of mortality for Australians, it is evident that reducing the barriers to regular exercise participation for women with large breasts is essential.[4,5] The phenomenon of exercise-induced pain is not limited to women who exercise recreationally, with Brisbine et al. describing 44% of elite athletes experienced exercise-induced breast pain during training or competition.[6]

Currently, the Australian Medicare Benefits Schedule outlines that reduction mammoplasty is subsidized by the Australian Government "for patients with macromastia, experiencing pain in the neck or shoulder region."[7] The public health system is more stringent, including state-based requirements for breast reduction to be performed, for example, body mass index (BMI) restrictions in Queensland, Victoria, and Tasmania, with wait times for surgery often exceeding 12 months.[8,9] Breast reduction surgery via the National Health Service varies across locations in the UK, resulting in a "postcode lottery" as breast reduction is considered a lower priority procedure. As a result, significant wait times and restrictions on BMI are common.[10]

This study aimed to investigate how breast size impacts the exercise habits of women and how this compares to women who have undergone breast reduction surgery by investigating perceived exercise habits, BREAST-Q scores, and objective fitness data via the UK-based organization parkrun, which facilitates free, 5-km runs, weekly.

Methods

This cross-sectional study recruited women aged ≥18 years, those who were registered with the organization parkrun, and those without a history of breast cancer. This study was advertised on the global parkrun website and contained links to the participant information form and a direct link to the survey. Ethics approval for this study was obtained from Flinders University Human Research Ethics Committee (approval number 2642). The survey was generated using Qualtrics software (Qualtrics, Provo, UT). All participants were asked several screening questions, including age, weight, height, bra cup size, location, and exercise habits. The participants were then subdivided based on their history of breast surgery (no breast surgery, bilateral breast reduction, or augmentation). Each group then answered specific questions about how their breast size impacted their ability to participate in an exercise and completed appropriate BREAST-Q questionnaires—either post-augmentation or the pre-/post-reduction module as per their surgical profile.[11] A score between 0 and 100 was generated for

the BREAST-Q survey, with higher scores representing greater levels of satisfaction or wellbeing. Participants were also asked to provide their parkrun barcode number, which enabled cross-referencing of the women that completed the study and correlation of parkrun statistics such as average finishing times and the number of runs.

A separate ethics application was approved via the parkrun research board (support request number: 202010), which enabled the promotion of the survey via parkrun global websites and access to matched data for participants that completed the survey. This included the number of runs completed, average times, and personal best times at parkrun events.

Statistical analyses were performed in Qualtrics and SPSS v25.0 (IBM Corp., Armonk, N.Y.). Descriptive statistics were computed for continuous variables, including mean, standard deviation, and 95% confidence interval (CI). Comparisons between groups were made using *t*-tests or a one-way ANOVA with Tukey's post-hoc test for continuous variables. Data for categorical variables were summarized as frequencies and proportions, and the statistical significance of differences was assessed using the χ^2 test. The Pearson correlation coefficient was used to investigate the strength of the association between two continuous variables. Multiple regression analysis was used to assess the relationship between BREAST-Q scores and independent participant demographic variables. Statistical significance was established at a *p*- value of <0.05.

Results

The Qualtrics survey was completed by 1987 women who were registered with the organization parkrun. Of these, 1905 women had no surgical history, 56 had undergone a breast reduction, and 26 women reported a previous augmentation. Participant characteristics from the three surgical groups are shown in Table 1.

Exercise Habits

This study was conducted on women who were members of the running community parkrun. Over 40% of participants reported exercising four or more times per week, with less than 6% exercising less than once per week on average. This was then stratified by cup size, and a χ^2 test demonstrated a significant association between decreased breast size and increased exercise frequency (Figure 1). The non-surgical cohort was then asked whether they believed reducing cup size would increase exercise frequency and performance. Again, when stratified by cup size, women with larger cup sizes reliably believed reducing their cup size would significantly improve their performance and participation (Figure 2, Figure 3).

Parkrun

A total of 1408 participants (70.9%) had data matched via the organization parkrun, providing the total number of runs, volunteering efforts, personal best, and average times for entries into the 5-km weekly timed runs (Table 2). Average run times were then stratified by cup size, with a clear linear relationship between small cup size and faster 5-km finishing times (Figure 4).

BREAST-Q scores

BREAST-Q scores were stratified by surgical group, comparing mean values for satisfaction with breasts and psychosocial and physical wellbeing (Table 3). BREAST-Q scores were significantly lower in women who hadn't had breast surgery than those who had undergone a breast reduction for satisfaction with breasts, with a mean difference of 11.3 points (95% CI: 5.9 to 16.8, $p < 0.001$). Scores were not found to be significantly different for Psychosocial Wellbeing and Physical Wellbeing (Table 3). Scores were then compared with published Australian norms (513 women),[12] with the breast reduction cohort scoring significantly better in both satisfaction with breasts and psychosocial wellbeing (Figure 5). Comparing bra cup size in both the surgical and non-surgical groups, those with a bra cup

Table 1
Participant socio-demographics (n = 1987).

Variable	Value
Age, years	
Mean (SD)	46.5 (12.2)
Median (range)	46.0 (18–80)
Age group, years	
18–24	51 (2.6%)
25–34	305 (15.3%)
35–44	522 (26.3%)
45–54	584 (29.4%)
55–64	370 (18.6%)
≥65	155 (7.8%)
BMI, kg/m^2	
Mean (SD)	26.0 (5.5)
Obesity status, kg/m^2	
Underweight (<18.5)	39 (2.0%)
Normal weight (18.5–24.9)	968 (48.7%)
Overweight (25.0–29.9)	598 (30.1%)
Obese class I (30.0–34.9)	257 (12.9%)
Obese class II (35.0–39.9)	87 (4.4%)
Obese class III (≥40.0)	34 (1.7%)
Missing	4 (0.2%)
Bra cup size	
AA	46 (2.3%)
A	165 (8.3%)
B	316 (15.9%)
C	303 (15.2%)
D	231 (11.6%)
DD	306 (15.4%)
E	203 (10.2%)
F	154 (7.8%)
G	148 (7.4%)
H or greater	115 (5.8%)
Breast surgery	
No breast surgery	1905 (95.9%)
Breast reduction	56 (2.8%)
Breast augmentation	26 (1.3%)
Underlying health issues	
No underlying health issues	981 (49.3%)
Underlying health issues	927 (46.7%)
Asthma	199 (10.0%)
High blood pressure	170 (8.6%)
Anxiety	154 (7.8%)
Depression	175 (8.8%)
Obesity	107 (5.4%)
Arthritis	90 (4.5%)
Irritable bowel syndrome	121 (6.1%)
Thyroid gland disorder	114 (5.7%)
Hearing loss or impairment	51 (2.6%)
Diabetes	26 (1.3%)
Missing	79 (3.9%)
Location/country	
Australia	824 (41.5)
UK	856 (43.1%)
South Africa	284 (14.3%)
Ireland	5 (0.3%)
France	2 (0.1%)
Canada	4 (0.2%)
Switzerland	1 (0.1%)
Germany	2 (0.1%)
New Zealand	3 (0.2%)
The Netherlands	3 (0.2%)

(*continued on next page*)

Table 1 (*continued*)

Variable	Value
United States	1 (0.1%)
Poland	1 (0.1%)
Norway	1 (0.1%)

Values are numbers (percentages) unless stated otherwise.
Note: top 10 underlying health conditions individually listed only

Table 2
Parkrun data stratified by breast surgery.

	Overall (n = 1408)	No breast surgery (n = 1356)	BBR (n = 37)	Augmentation (n = 15)
Runs	82.6 (80.8)	83.5 (81.3)	60.8 (64.4)	52.1 (57.8)
Volunteering	23.8 (47.5)	24.1 (47.9)	15.5 (36.8)	13.5 (15.0)
Personal best	0:30:50 (0:07:02)	0:30:44 (0:07:01)	0:33:55 (0:07:39)	0:31:59 (0:06:05)
Average time	0:35:36 (0:08:02)	0:35:50 (0:08:01)	0:39:16 (0:08:08)	37:30 (0:07:48)

Values are mean (SD).

Table 3
Mean (SD) BREAST-Q scores stratified by breast surgery.

BREAST-Q scale	Overall (n =1987)	No breast surgery (n = 1905)	BBR (n = 56)	Augmentation (n = 26)
Satisfaction with breasts	53.6 (17.2)	53.1 (17.1)	64.4 (17.6)	68.5 (15.2)
Psychosocial Wellbeing	59.5 (20.1)	59.3 (20.1)	63.2 (19.1)	66.7 (21.4)
Physical Wellbeing	71.7 (16.3)	71.4 (16.1)	73.7 (16.3)	92.2 (11.0)

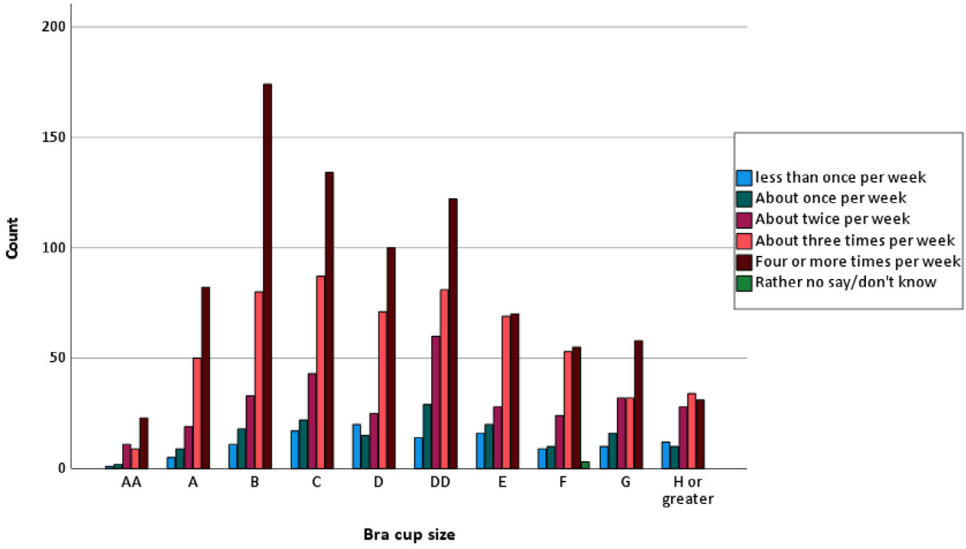

Figure 1. Exercise frequency (over the last 4 weeks; how often have you done at least 30 minutes of moderate exercise?) stratified by bra cup size.

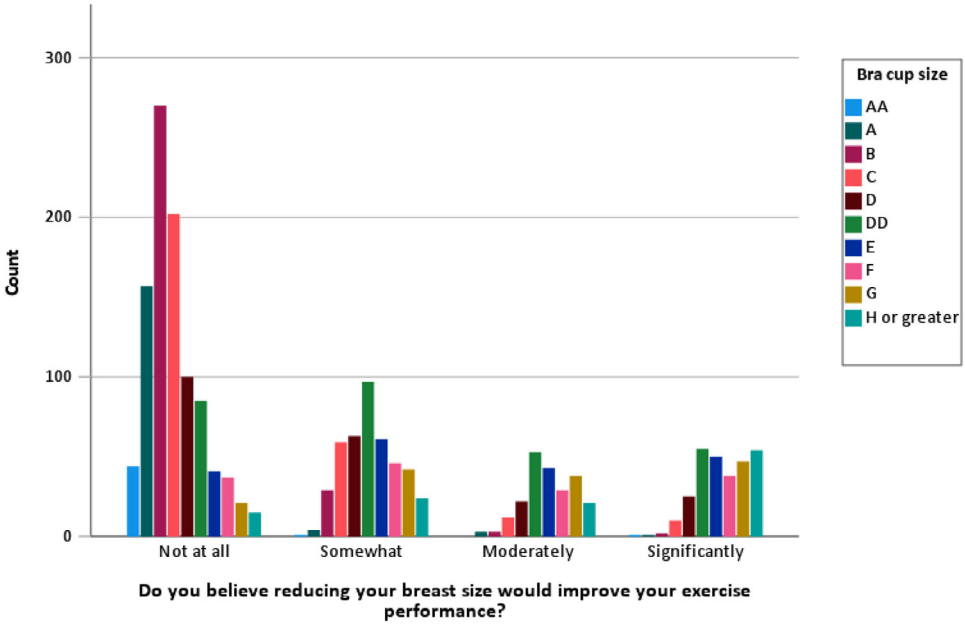

Figure 2. Belief that reducing breast size will improve exercise performance stratified by bra cup size.

Table 4
Exercise habits following breast reduction surgery.

Has the type of exercise changed since breast reduction surgery?	Decreased significantly	Decreased	No change	Increased	Increased significantly
Overall frequency	0 (0%)	0 (0%)	14 (24.6%)	23 (40.4%)	20 (35.1%)
Frequency of higher-impact exercise	1 (1.8%)	0 (0%)	11 (19.3%)	23 (40.4%)	22 (38.6%)
Duration of exercise sessions	0 (0%)	0 (0%)	21 (36.8%)	20 (35.1%)	16 (28.1%)
Tendency to participate in group sessions	0 (0%)	1 (1.8%)	17 (29.8%)	26 (45.6%)	13 (22.8%)
Tendency to exercise alone	0 (0%)	8 (14%)	27 (47.4%)	12 (21.0%)	10 (17.5%)

Values are numbers (percentages).

size of at least DD cup reported significantly lower BREAST-Q scores than those with a smaller cup size, D cup or less (Figure 6).

BREAST-Q scores were then compared with the objective parkrun data, which demonstrated higher BREAST-Q scores across all domains were associated with an increased number of runs and decreased average times, both with a small correlation strength but a significance of $p<0.001$. Although scores from the augment participants were recorded, it should be noted that a direct comparison cannot be made between the two different BREAST-Q modules.[13]

Breast reduction cohort

The breast reduction cohort (n=56) was asked several additional questions on their exercise habits and how they had changed post-breast reduction. Participants reported an increase in overall exercise frequency, higher-impact exercise, duration of exercise sessions, and willingness to participate in a group setting (Table 4).

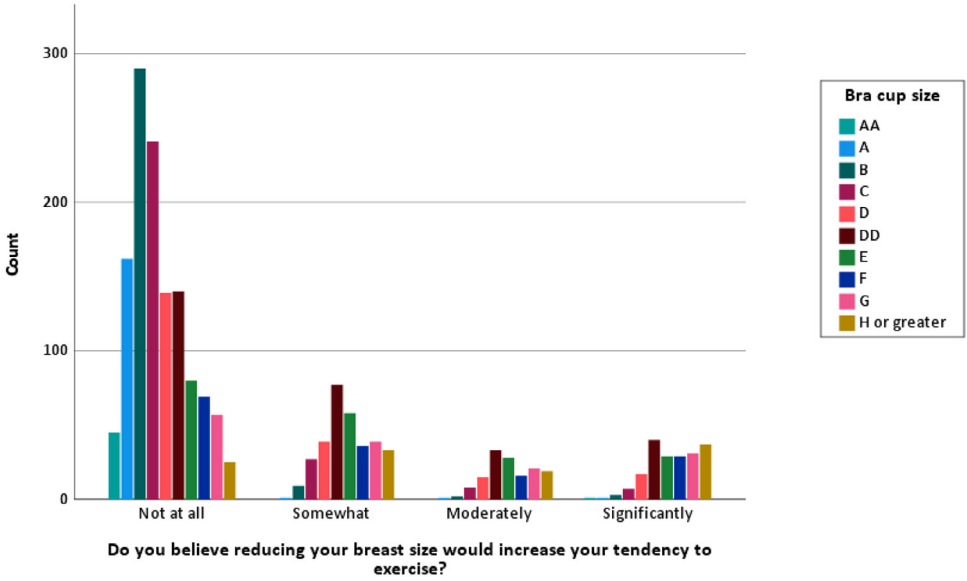

Figure 3. Belief that reducing breast size will increase exercise tendency stratified by bra cup size.

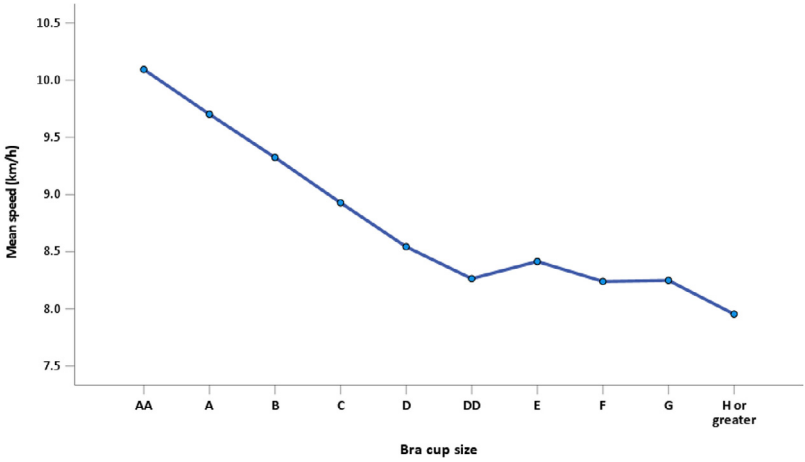

Figure 4. Mean speed of 5-km runs stratified by bra cup size.

Discussion

Recent data from the Australian Institute of Health and Welfare suggest that adults aged 18 to 64 should participate in an accumulation of two and a half to five hours of moderate-intensity physical activity and muscle-strengthening activities at least two days per week.[14] Self-reported Australian data from the Australian Bureau of Statistics (ABS) 2017-2018 National Health Survey suggests three in five Australian women are insufficiently physically active.[15] This is echoed globally, with the World Health Organization (WHO) suggesting that 32% of women are not meeting the above-recognized fitness guidelines.[16] These survey findings were seen again in our data collection, with only 42% of participants reaching WHO guidelines. When stratified by breast size, women with a smaller cup size of DD or less represented 75% of the total number of women who reached fitness guidelines.

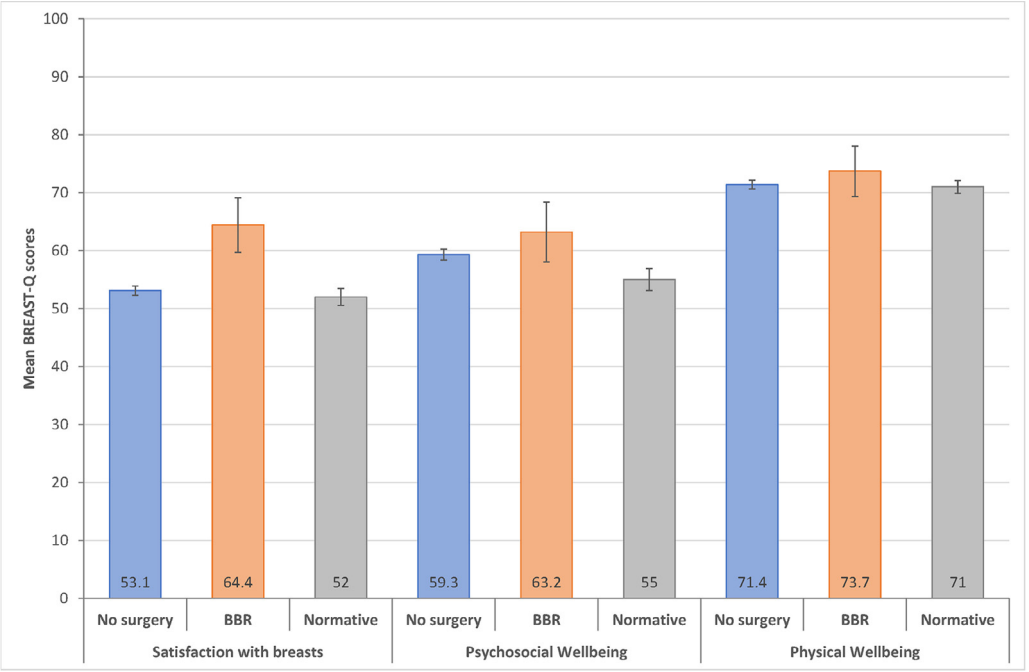

Figure 5. Mean BREAST-Q scores for no surgery and bilateral breast reduction (BBR) vs. published Australian population norms. Error bars represent 95% confidence intervals.

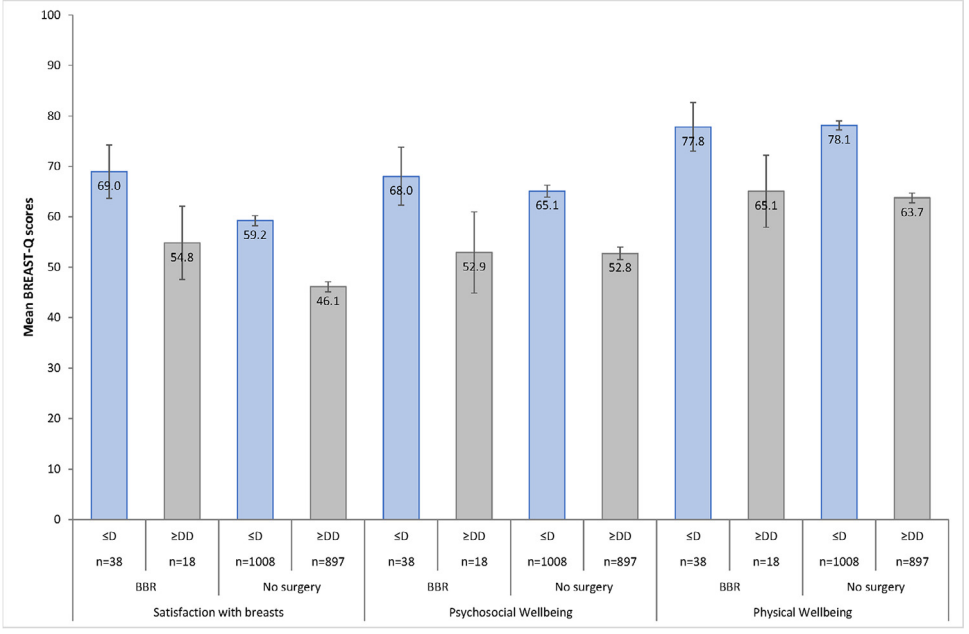

Figure 6. Mean BREAST-Q scores stratified by BREAST-Q domains, surgical groups, and cup size categories (cup size D or less and cup size DD and greater). Error bars represent 95% confidence intervals.

Data reveal that over half of women who have not undergone breast surgery with a bra cup size DD or larger believe that reducing their breast size would increase their tendency to exercise. Three-quarters of the cohort believe it would improve their exercise performance; it is difficult to argue that breast size is not a significant barrier to healthy lifestyle habits, as demonstrated in the literature.[3] In 2012, a systematic review completed by Singh & Losken concluded that not only do women appear more willing and comfortable to participate in regular exercise following breast reduction surgery, but it may serve as a promoter of weight loss for women.[17] Additionally, Boschert and colleagues surveyed 72 women who had undergone breast reduction surgery, all of whom reported a consistent increase in physical activity participation postoperatively.[18] Literature suggests that Australian women who undergo breast reduction surgery report greater satisfaction and psychological and physical well-being in relation to their breasts postoperatively, with questions including their ability to complete vigorous exercise.[12] Brown et al. reported 100% of women stated exercise was easier following breast reduction, in addition to breast-feeding and performing self-health examinations.[19]

Furthermore, in 2018, Knox et al. evaluated the effects of breast reduction surgery on fitness levels, looking specifically at women enlisted in the US Army.[20] The study demonstrated that 63% of women showed improvement in their objectively measured fitness scores postoperatively, with improvements evident in most domains—including aerobics, upper, lower, and abdominal strength. This study supports the notion that the impact of breast size is not limited to encouraging and increasing regular physical activity but plays a measurable and significant role in performance.

The BREAST-Q is a validated, patient-reported outcome measure that provides information on several health-related domains, including breast satisfaction and psychosocial and physical wellbeing.[11] The breast reduction surgical group in the study demonstrated higher satisfaction with breasts than both the non-surgical group and the published Australian norms. Furthermore, compared with objective parkrun data, BREAST-Q scores were correlated with decreased average run times and increased attendance. Exercise frequency, as well as intensity, contributes significantly to overall health, leading to a reduction in all-cause mortality risk.[14] This finding was consistent with a previous study assessing outcomes of breast reduction surgery in Australian women.[12]

Women who had undergone breast reduction surgery were also asked specifically about how their exercise habits had changed since their breast reduction surgery. Most women stated that the amount of exercise they participated in post-surgery increased or increased significantly. Also, they engaged in higher-impact exercise more often and tended to increase the duration of their sessions. There was a significant range in the time since breast reduction across participants, creating a more diverse and interesting cohort and suggesting the benefits of exercise habits following breast reduction are persistent and long-lasting.

The strengths of this study include the large and diverse participant population, which also represents the global norms of exercise habits. Additionally, the study gathers information on patient-reported exercise habits, breast surgery history, BREAST-Q data, and objective exercise data and allows direct comparison across these data points. The primary limitation of this study is that bra cup size is used as a surrogate for breast size, and the authors acknowledge the wide disparity in cup size across bra band length. Future studies would address this limitation with a standardized breast size classification incorporating variety in cup size and band lengths. Additional studies may continue to investigate the impact of breast size on exercise performance and how BREAST-Q data relates to performance outcomes for professional athletes.

Conclusion

Women with smaller breasts engage in more frequent and intense exercise, and most women who took part in this survey with a bra cup size DD or greater believe that reducing their breast size would allow them to improve exercise habits. Breast reduction surgery is associated with higher satisfaction with breasts as per the BREAST-Q patient-reported outcome measure, and higher BREAST-Q scores were associated with increased participation and better performance at the weekly 5-km timed run. The advantages of breast reduction surgery deserve to be promoted and freely accessible for patients with macromastia globally.

Acknowledgments

The authors of this study would like to thank Steve Haake and Mike Graney from the parkrun research board.

Conflict of Interest

None.

Financial Disclosure Statement

No funding was received for conducting this study.

Ethical Approval Statement

Ethics approval for this study was obtained from Flinders University Human Research Ethics Committee (approval number 2642).

References

1. Coltman CE, Steele JR, McGhee DE. Does breast size affect how women participate in physical activity? *J Sci Med Sport*. 2019;22(3):324–329.
2. Scurr J, Hedger W, Morris P, Brown N. The prevalence, severity, and impact of breast pain in the general population. *Breast J*. 2014;20(5):508–513.
3. Burnett E, White J, Scurr J. The influence of the breast on physical activity participation in females. *J Phys Act Health*. 2015;12(4):588–594.
4. Australian Bureau of Statistics. Causes of Death, Australia. 2021 [Accessed 6 March 2023]. Available from: https://www.abs.gov.au/statistics/health/causes-death/causes-death-australia/latest-release
5. World Health Organization. Obesity and overweight. 2021 [Accessed 5 December 2022]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.
6. Brisbine BR, Steele JR, Phillips EJ, McGhee DE. Breast pain affects the performance of elite female athletes. *J Sports Sci*. 2020;38(5):528–533.
7. Australian Government Department of Health and Aged Care MBS Online. 2022. Medicare Benefits Schedule - Item 45523. [Accessed 5 December 2022]. Available from: http://www9.health.gov.au/mbs/fullDisplay.cfm?type=item&q=45523&qt=ItemID.
8. Crittenden TA, Ratcliffe J, Watson DI, Mpundu-Kaambwa C, Dean NR. Cost-utility analysis of breast reduction surgery for women with symptomatic breast hypertrophy. *Med J Aust*. 2022;216(3):147–152.
9. Crittenden T, Watson DI, Ratcliffe J, Griffin PA, Dean NR, Research Group Afesa. Does breast reduction surgery improve health-related quality of life? A prospective cohort study in Australian women. *BMJ Open*. 2020;10(2):e031804.
10. Wraight WM, Tay SK, Nduka C, Pereira JA. Bilateral breast reduction surgery in England: a postcode lottery. *J Plast Reconstr Aesthet Surg*. 2007;60(9):1039–1044.
11. Pusic AL, Klassen AF, Scott AM, Klok JA, Cordeiro PG, Cano SJ. Development of a new patient-reported outcome measure for breast surgery: the BREAST-Q. *Plast Reconstr Surg*. 2009;124(2):345–353.
12. Crittenden TA, Watson DI, Ratcliffe J, Griffin PA, Dean NR. Outcomes of breast reduction surgery using the BREAST-Q: A prospective study and comparison with normative data. *Plast Reconstr Surg*. 2019;144(5):1034–1044.
13. Mundy LR, Homa K, Klassen AF, Pusic AL, Kerrigan CL. Reply: Breast cancer and reconstruction: Normative data for interpreting the BREAST-Q. *Plast Reconstr Surg*. 2018;141(1) 181e-2e.
14. Australian Institute of Health and Welfare. Insufficient physical activity. Cat. no. PHE 248. 2021 [accessed 16 Dec 2022]. Available from: https://www.aihw.gov.au/reports/risk-factors/insufficient-physical-activity/contents/insufficient-physical-activity.
15. Australian Bureau of Statistics. National Health Survey: First results. 2018 [Accessed 19 December 2022]. Available from: https://www.abs.gov.au/statistics/health/health-conditions-and-risks/national-health-survey-first-results/2017-18.
16. World Health Organization. Physical activity (Fact sheets). 2022 [Accessed 19 December 2022]. Available from: https://www.who.int/news-room/fact-sheets/detail/physical-activity.
17. Singh KA, Losken A. Additional benefits of reduction mammaplasty: A systematic review of the literature. *Plast Reconstr Surg*. 2012;129(3):562–570.
18. Boschert MT, Barone CM, Puckett CL. Outcome analysis of reduction mammaplasty. *Plast Reconstr Surg*. 1996;98(3):451–454.
19. Brown JR, Holton LH, Chung TL, Slezak S. Breast-feeding, self-exam, and exercise practices before and after reduction mammoplasty. *Ann Plast Surg*. 2008;61(4):375–379.
20. Knox JA, Nelson DA, Latham KP, Kurina LM. Objective effects of breast reduction surgery on physical fitness. *Ann Plast Surg*. 2018;80(1):14–17.