The influence of the breast on physical activity participation in females.

Running Head: The Breast and Physical Activity

Original Research

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Abstract

Background: The importance of physical activity is well known[1]. However, previous research suggests that breast movement during exercise can be painful, embarrassing and anecdotally deter exercise participation[2,3]. Therefore, this research investigates whether the breast influences physical activity participation. *Methods:* Female respondents (n=249) completed a breast health and physical activity survey assessing; bras and bra fit, physical activity, breast pain, comments and improvements, breast history and demographics. *Results:* Results found that the breast was a barrier to physical activity participation for 17% of women. 'I can't find the right sports bra' and 'I am embarrassed by excessive breast movement' were the most influential breast related barriers to activity. Breast pain increased with vigorous activity and poor breast support. Breast health knowledge increased the use of a sports bra and levels of physical activity. *Conclusions:* The breast was the fourth greatest barrier to physical activity, behind energy/motivation (1st), time constraints (2nd), and health (3rd), despite its omission from previous physical activity literature. As 33 % of women were not meeting physical activity guidelines, increasing breast health knowledge may reduce barriers to physical activity.

Background

With rising obesity levels physical activity participation is an important topic among health professionals and the public[1]. The number of women that are considered obese in England (BMI ≥30 kg/m^2) has increased from 16% in 1993 to 26% in 2010[1] accounting for approximately 4,549,714 of women aged between 18 and 65 years in England and Wales[2]. There is a need to get women more physically active as increasing levels of obesity can lead to a greater risk of diseases such as heart disease, diabetes, stroke and even premature death[3]. Physical activity can help to reduce the risk of developing these conditions; therefore, it is crucial to understand factors that might discourage physical activity participation. Despite the positive benefits of physical activity research has shown that participation starts to decline in the female population during adolescence[4]. The reported reasons for this decline include time constraints, a lack of support from peers, family and teachers, and issues with self-worth/self confidence[4].

Independent breast movement occurs during physical activity due to limited intrinsic breast support and has led to the recommendation and development of external breast support[5,6]. Previous research has found that more vigorous movements such as running and jumping can cause an increase in breast movement compared to less vigorous activities such as walking[7]. Vertical breast displacement has been found previously to positively correlate with breast mass, suggesting that larger-breasted women are more likely to experience excessive breast movement[8]. This independent movement of the breast has been associated with a number of negative consequences; breast pain[6,9,10], the potential to damage the supporting structures of the breast[6,10], negative sports performance effects[9], and embarrassment[6].

Exercise-related breast pain has been reported in up to 72% of exercising females[11]. The aetiology of this breast pain is unknown, but is hypothesised to be caused by tension on the supporting structures of the breast[10]. Additional to any breast pain that females might feel associated with physical activity and the movement of the breast, it is well documented that cyclic and non-cyclic mastalgia affect a substantial proportion of the female population (between 40% and 60%)[12]. However, it is unknown whether women experiencing mastalgia may alter their levels of physical activity during symptomatic periods and whether this effect may be exaggerated in women with a greater breast mass.

Previous studies on cyclic and non-cyclic mastalgia have utilised qualitative, survey-based approaches to determine the prevalence, severity and impact of mastalgia on clinical populations[12,13]. Khan and Apkarian[14] developed the Breast Pain Questionnaire by adapting the McGill Pain Questionnaire[15] to assess sensory and affective factors. However, this has yet to be implemented on a general population or used to contribute to our understanding of factors that may influence physical activity participation in women.

The Cooper's ligaments along with the skin provide limited intrinsic support to the breast[10]. It has been suggested that if these ligaments are overstretched, the damage is irreparable and can cause breast sag[16]. Excessive breast movement during exercise could therefore be a causal factor of breast sag/damage. Wearing appropriate breast support during activity has been recommended to help to reduce the effect of breast movement and the risk of breast sag[16]. However, it has yet to be investigated whether this is a factor which may deter women from participating in physical activity.

Previous research has shown that breast movement can alter running mechanics. Shivitz[17] and White et al.[18] found changes in ground reaction forces when the levels of breast support varied. Research has reported links between the magnitude of breast displacement and stride frequency and stride rate, while breast density, the angle of insertion of the breast, linear acceleration and centre of mass of the breast have also been shown to influence the forces acting on the breast[19,20]. However, it is unknown whether the influence of the breast on performance affects physical activity participation.

Finally, it has been suggested that the independent movement of the breast may cause embarrassment and reduce self-confidence particularly in larger-breasted women[21]. It was suggested by Bowles et al.[6] that women who are embarrassed by excessive breast movement may not participate in physical activity. However, the influence of these psychological factors on physical activity participation has yet to be investigated empirically.

The influence of these breast-related issues on levels of physical activity has yet to be investigated in the general population. Currently there is only one study that has incorporated the influence of the breast on physical activity participation[6]. Bowles et al.[6] implemented a questionnaire to investigate breast support choices in women undertaking physical activity. They found that 34% choose to wear a fashion bra during exercise, with only 32% choosing a sports bra. Whilst looking into the area of physical activity and breast pain, this study focused on a population in Australia, leaving the influence of the breast on physical activity participation in the general population in the UK unknown. Understanding whether the breast negatively affects physical activity participation in a UK cohort may help

inform intervention strategies designed to encourage physical activity participation in UK females.

Therefore, the aims of this study were firstly to investigate whether the breast has an influence on physical activity participation levels for women and secondly to determine the relationship between levels of physical activity participation and breast mass, breast pain and other breast health/bra usage factors.

H1: The breast will be reported as a barrier to physical activity participation.

H2: Respondents with a larger breast mass will have significantly lower levels of physical activity participation.

H3: Physical activity levels will be significantly less in respondents suffering from breast pain.

H4: Breast pain during physical activity, the frequency of whether respondents wore a sport bra during physical activity and breast mass will be negatively correlated with physical activity participation.

H5: Perceived rating of breast health knowledge will be positively related to sports bra use and consequently positively related to levels of physical activity.

Methodology

Procedures: Survey Development

Development began with a thorough literature search to identify existing, validated questionnaires on breast health and levels of physical activity participation. An appropriate breast pain questionnaire was identified and questions were chosen from The Breast Pain Questionnaire[14] (adapted from the McGill Pain

Questionnaire[15]). Questions relating to barriers to physical activity were chosen from the Allied Dunbar National Fitness Survey[22] and an additional five barriers specifically relating to breast health issues were added ('I can't find the right sports bra', 'My breasts are too big', 'I am embarrassed by excessive breast movement', 'I don't like the look of my breasts when I exercise' and 'I suffer from breast pain'). Further questions relating to physical activity participation were taken from the Global Physical Activity Questionnaire (GPAQ)[23].

To investigate the demographics of the respondents, a section including questions on age, self-reported bra size and menopausal status was added. Alongside this, questions from Bowles et al.[6] survey relating to breast history and bra usage/fitting history were also added. This resulted in 42 questions over six sections. The six sections of the survey were; bras and bra fit, physical activity, breast pain, comments and improvements, breast history and demographics. Perceived ratings of breast health knowledge was assessed using one question; 'How would you **rate** your **knowledge** (or awareness) of breast health issues (*such as bra fit, appropriate breast support and breast pain*)?'.

The survey contained a combination of question styles; open questions (to allow for descriptive answers) and closed questions (tick box). Surveys displayed the institutional logo and researchers contact information. Each survey was completed by hand or respondents were emailed the survey which they completed on a computer and then emailed back to the researcher.

The survey was piloted for wording issues by two respondents who met the inclusion criteria; following which small wording changes were made. Respondent information sheets were attached to the front of the survey introducing and

describing the research and notifying the respondent that by filling out the survey they were giving their consent to participate in the study.

Sample

The inclusion criteria for the study were that respondents had to be female, aged between 18 and 65 years and based in the United Kingdom. After gaining institutional ethical approval, a total of 274 surveys were distributed between July 2011 and November 2011. A snowball sampling strategy was used with a large number of surveys likely to have been completed by women in the Portsmouth and Southampton area due to the location of the researchers. Surveys were initially distributed to family, friends and work colleagues. There was a 91% response rate, with a total of 250 returned questionnaires, of which 239 were usable.

Data analysis

There were nine age categories (18 to 24 years, 25 to 29 years and five year brackets up to 60 to 64 years). Age was negatively skewed, shown in Figure 1.

Figure 1 here

Self-reported bra sizes ranged from an under band size of 28 to 42 inches and cup sizes of A to GG, with a mode bra size of 34D. Breast mass was calculated using the method determined by Turner and Dujon[24]. To calculate breast mass for respondents with under band sizes of 28 and 30 inches the cross grading system was applied; a method previously used by Brown et al.[25]. For analysis purposes, breast mass was grouped into small (<500 grams, 54%) and large (>500 grams, 46%)[26].

Demographic data are reported as modes when the data are ordinal. Percentages of responses have been reported for the categorical data and means and standard deviations have been reported for interval data. Where respondents left answers blank or their answer was uncertain the data were presented as a missing value. Within the results section sample sizes will be presented when missing values are present.

Statistical analysis was completed using IBM SPSS Statistics 20 software. The non-numeric data was numerically coded (e.g. 'yes =1' and 'no =2'). Sports bra usage and the extent to which breast pain occurred during physical activity was coded as 'never =1', 'rarely =2', 'sometimes =3', 'very often =4', 'always =5'. Last professional bra fitting was coded '1 =last 3 months', '2 =last 6 months', '3 =within the last year', '4 =over a year ago', '5 =can't remember' and '6 =I have never been fitted'. Respondents perceived ratings of breast health knowledge were coded as '1 =extremely poor', '2 =below average', '3 =average', '4 =above average', '5 =excellent'.

An inductive content analysis was completed to analyse the qualitative responses to; 'What kind of things relieve your breast pain?' and 'What kind of things increase you breast pain?' Responses were coded into themes by one researcher and the results triangulated by an experienced qualitative researcher; for example, any responses relating to movement and activity (manual work, vigorous movement, exercise) were grouped into the category 'physical activity'. The frequency of response for each theme was reported as a percentage of the total responses to allow for the identification of response variations[27].

Non-parametric, inferential statistics (Mann-Whitney U test) were chosen due to the level of data to investigate differences between breast mass and breast pain, whether respondents met physical activity guidelines and physical activity levels (days per week and time). The same test was used to investigate whether breast pain influenced whether physical activity guidelines were met and physical activity levels. A Wilcoxon signed-ranks test investigated differences between levels of breast pain during vigorous physical activity compared to moderate physical activity. A Spearmans rho correlation analysis identified relationships between; breast mass, bra fitting, sports bra usage, breast health knowledge ratings and physical activity levels. The criteria for relationships assessment were; 'very weak' =0 to 0.19, 'weak' =0.2 to 0.39, 'moderate' =0.4 to 0.59, 'strong' =0.6 to 0.79 and 'very strong' =0.8 to 1[30]. The alpha value for all tests was set at 0.05[27].

Results

Demographics

Respondents expressed their perceived knowledge of breast health with a mode response of 'average' (52%, n=123), while 25% stated their knowledge was 'below average' or 'extremely poor' (n=58) and 24% 'above average' or 'excellent' (n=56). Breast mass was negatively skewed with a mode bra size of 34 C. Breast pain was reported in 41% of respondents.

Forty nine percent of respondents completed some form of vigorous physical activity on a weekly basis (mode=3 days), compared to 78% completing moderate physical activity (mode=3 days). Total physical activity time per week for each respondent was calculated and compared to the physical activity guidelines[29]. The average time spent completing vigorous activity was 161 ± 297 minutes and

moderate activity was 241 ± 392 minutes each week. Current Department of Health guidelines recommend at least 150 minutes of physical activity per week therefore, 67% of women from this sample are meeting these guidelines[29].

Barriers to physical activity

Respondents identified multiple reasons (from a list of options) that deterred them from participating in more physical activity (Figure 2). At least one of the five barriers relating to the breast was reported in 17% of the respondents. The breast accounted for 8% of the total barriers reported (n=916). The barriers relating to the breast were; 'I can't find the right sports bra' (3%), 'I am embarrassed by excessive breast movement' (2%), 'I don't like the look of my breasts when I exercise' (1%), 'My breasts are too big' (1%), 'I suffer with breast pain' (1%).

Figure 2 here

Breast Mass

The number of days per week and length of time spent completing vigorous or moderate physical activity were similar for smaller- and larger-breasted women. Breast mass did not significantly affect whether physical activity guidelines were met. There was no significant difference in breast pain during vigorous or moderate physical activity across smaller- and larger-breasted women (Figure 3).

Figure 3 here

A comparison of physical activity levels was completed on women of differing breast masses and whether they were experiencing breast pain. Smaller breast

women demonstrated similar levels of moderate and vigorous physical activity, whilst larger breast women demonstrated greater levels of vigorous physical activity compared to moderate (z=-2.408, p=0.015; pain and z=-2.061, p=0.039; no pain).

Figure 4 here

Breast Pain

Breast pain sufferers (n=97) reported seven general themes that increased their breast pain and five that relieved it (Table 1). It is interesting to note that physical activity was the most frequently reported factor that increased breast pain. This was greater than the menstrual cycle, while breast support was reported as the key factor in relieving symptoms. Importantly, 24% of respondents reduced their physical activity levels (stopping exercise, relaxing, resting and lying down) as a means to relieve breast pain.

Table 1 here

Despite there being a difference in the number of symptomatic (41%) compared to asymptomatic women (59%), there was no significant difference between whether recommended physical activity levels were met,showing that the incidence of breast pain did not negatively affect whether women were meeting recommended physical activity guidelines. The incidence of breast pain was significantly higher during vigorous physical activity compared to moderate physical activity (n=93, T =110.00, p =<0.001). Breast pain significantly affected the duration of vigorous physical activity with a greater duration being completed by breast pain sufferers (z=-2.137, p=0.032).

Further Correlations

Respondents who wore a sports bra more often during physical activity undertook more vigorous (n=235, r=0.423, p=<0.001) and moderate (n=235, r=0.168, p=0.010) physical activity than those who wore a sports bra less often. A weak relationship (n=96, r=0.232, p=0.023) was found between the recency of respondents last bra fitting and the occurrence of breast pain during moderate physical activity. Respondents who had greater breast health knowledge were more likely to use a sports bra, although this relationship was very weak (n=235, r=0.144, p=0.027). The greater respondents reported their breast health knowledge the more recent their last bra fitting (n=237, r=0.386, p=<0.001).

Discussion

This was the first study to investigate the influence of the breast on physical activity participation; the key finding of this study was that the breast was a barrier to physical activity participation for 17% of the respondents, this accepts hypothesis one. Of the total number of barriers reported (n=916), the breast ranked 4th behind energy/motivation (1st), time constraints (2nd), and health (3rd). The occurrence of this response was higher than factors such as the 'cost of physical activity' and 'lack of facilities' which have often been reported as key barriers to physical activity[30,31]. This result demonstrates the importance of the breast as a factor to consider when investigating the decline in physical activity levels in women. The age range of the sample in this research is skewed which may limit the application of the findings to a younger population; however, these results identify this area as an appropriate one to investigate fully with a more representative sample.

One of the key physical activity barriers that women reported relating to the breast was ‘I can’t find the right sports bra’ (3%), this has important implications for bra manufacturers, suggesting that there is a gap in the market for these women. ‘I am embarrassed by excessive breast movement’ (2%) confirmed results from previous literature which reported many women may not exercise due to embarrassment and self-confidence issues[6]. As excessive breast movement can be reduced by finding the right sports bra these two barriers can be linked. Currently, 33% of women in this study did not meet physical activity guidelines, from these results it could be suggested that raising awareness of the benefits of sports bras may reduce the influence of these barriers to physical activity participation. It is recognised that self report surveys may be influenced by a number of factors[32], for example respondents may overinflate their self-reported levels of physical activity due to the known benefits of physical activity and because respondents know they should be doing more[32]. This could potentially mean that this figure of 33% of women not meeting physical activity guidelines could be higher. Despite breast mass being reported as a barrier to exercise (‘my breasts are too big’) by 1% of respondents, there were no differences in physical activity levels in women with a larger breast mass in comparison to their smaller-breasted counterparts, rejecting hypothesis two.

As expected the inductive content analysis showed that physical activity, vigorous movements and poorly fitting bras caused an increase in breast pain. This confirms previous research[21,33], and demonstrates a need to reduce excessive breast movement and its associated breast pain. A supportive bra was the most reported factor to relieve breast pain, more common than pain relieving medication or hormonal medication, which are often recommended as treatments for breast

pain[34]. This suggests that more clinical emphasis should be placed on the importance of appropriate breast support and bra fitting, which can be a non-pharmacological alternative to treating breast pain. Previous research has found sports bras can reduce breast movement by 59%[7] therefore helping to minimise breast pain during exercise. Education on the benefits of sports bras could help promote their usage.

The results showed that breast pain did not significantly affect whether the respondents met physical activity guidelines rejecting hypothesis 3. The incidence of breast pain was significantly higher during vigorous activity compared to moderate physical activity. This confirms previous literature that reported physical activity and vigorous movements increased levels of breast pain[10]. As breast support was reported as the most common factor used to relieve breast pain, it is suggested that women with breast pain may benefit from advice on appropriate breast support to reduce the effects of exercise-induced breast pain, or to limit any increase in breast pain if they are already experiencing cyclic or non-cyclic mastalgia. This advice may help to increase respondents' volume of physical activity per week to meet physical activity guidelines. The percentage of women meeting physical activity guidelines within this cohort was high (67%) compared to the 32% of women aged 16 and over found in the Health Survey for England[35]. This shows that the sample of women used in this research were typically more active than the average female population.

This is the first study to implement aspects of the Breast Pain Questionnaire on a general population as previously published research utilising this tool has focused on clinical populations. This study reports overall levels of breast pain of 41%, which falls within the ranges reported in earlier studies. Interestingly, although

previous research has reported increases in exercise-related breast pain as breast size increases[8], the results of this study showed no difference in the prevalence of breast pain between smaller- and larger-breasted women. It should however be noted that no distinction was made between modes of breast pain and whilst exercise-related breast pain may be linked to breast size, cyclic and non-cyclic breast pain may not.

Worryingly when investigating levels of physical activity, 24% of women reported 'reducing physical activity' as a means to relieve breast pain, suggesting that physical activity may be postponed or stopped altogether. This has important implications for physical activity intervention strategies which should consider interventions to overcome such strategies. Research has found multiple health benefits to participating in physical activity such as reductions in obesity, improved cardiovascular health and lower risk of diseases such as diabetes[36].

Results showed women benefit from greater breast health knowledge as sports bra use ($r=0.144$, $p=0.027$) and physical activity levels ($r=0.423$, $p=<0.001$; $r=0.168$, $p=0.010$) were higher for those who reported a greater knowledge, accepting hypothesis five. This suggests that education in this area may help increase the amount of time women are physically active. This links to previous research by McGhee et al.[37] who found that an educational booklet was effective at improving bra fit knowledge, although this research was not related to improving physical activity levels.

Conclusion

The breast was reported as a barrier to physical activity participation in 17% of women, and it was identified as the fourth largest barrier to physical activity ahead

of previously identified factors such as cost and lack of facilities. Despite previous suggestions, breast mass showed no relationship to physical activity participation. However, physical activity did cause an increase in breast pain. Sports bras were identified as the most effective relief for breast pain. Finally this study identified that those who reported greater breast health knowledge were more likely to wear a sports bra and more likely to participate in physical activity. As 33% of the women in this study were not undertaking enough physical activity to meet current guidelines, the results of this study suggest that increasing breast health knowledge may be an effective intervention to increase levels of physical activity participation in women.

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University of Portsmouth

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Figures:

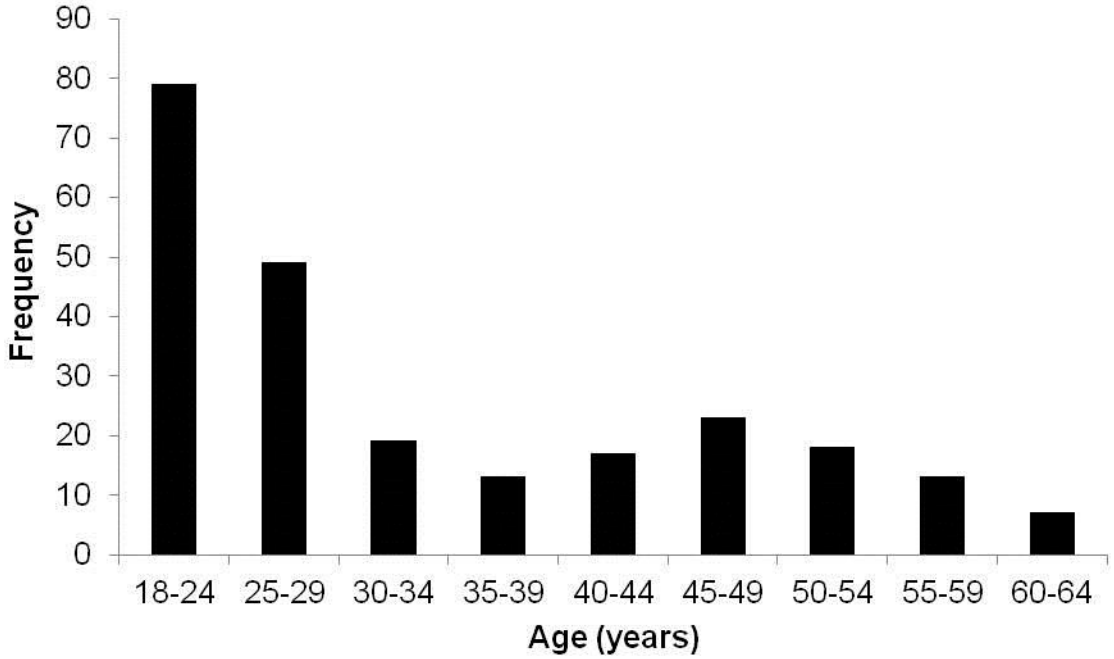

Figure 1: Distribution of age across the respondents (n=238)

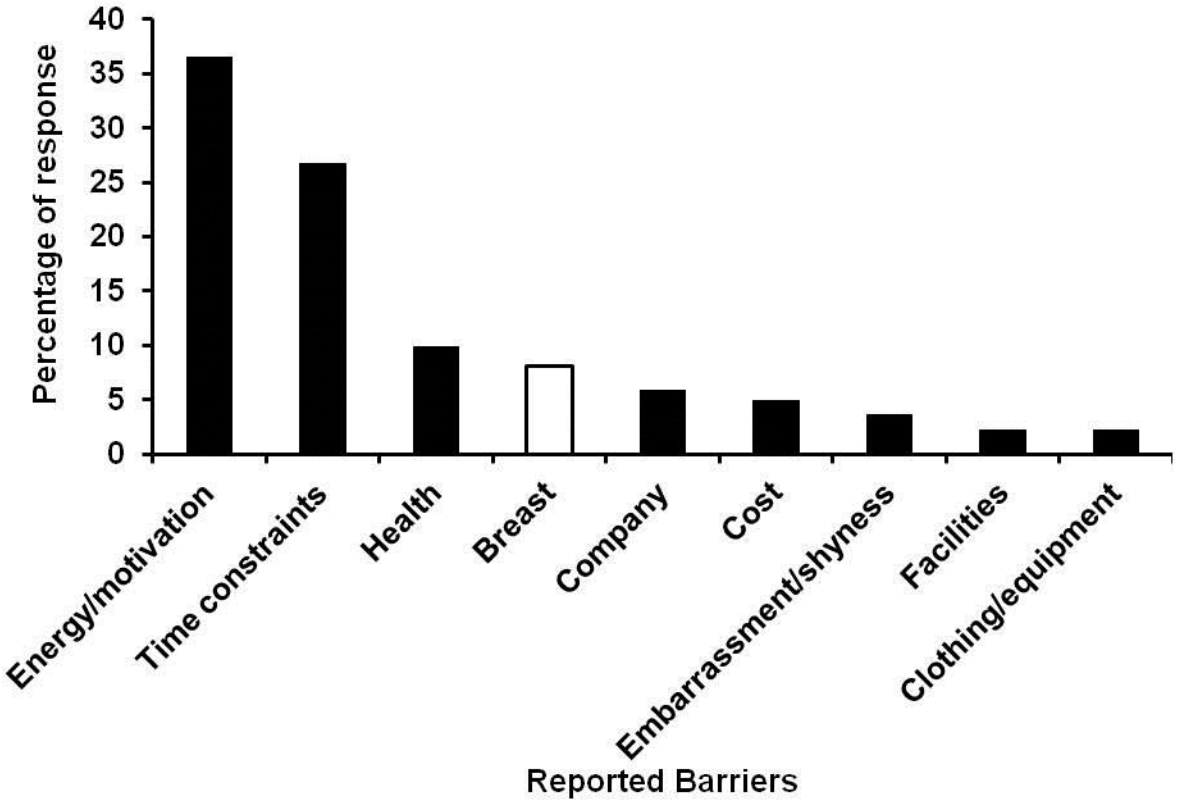

Figure 2: Percentage barrier to physical activity participation by respondents (n=916).

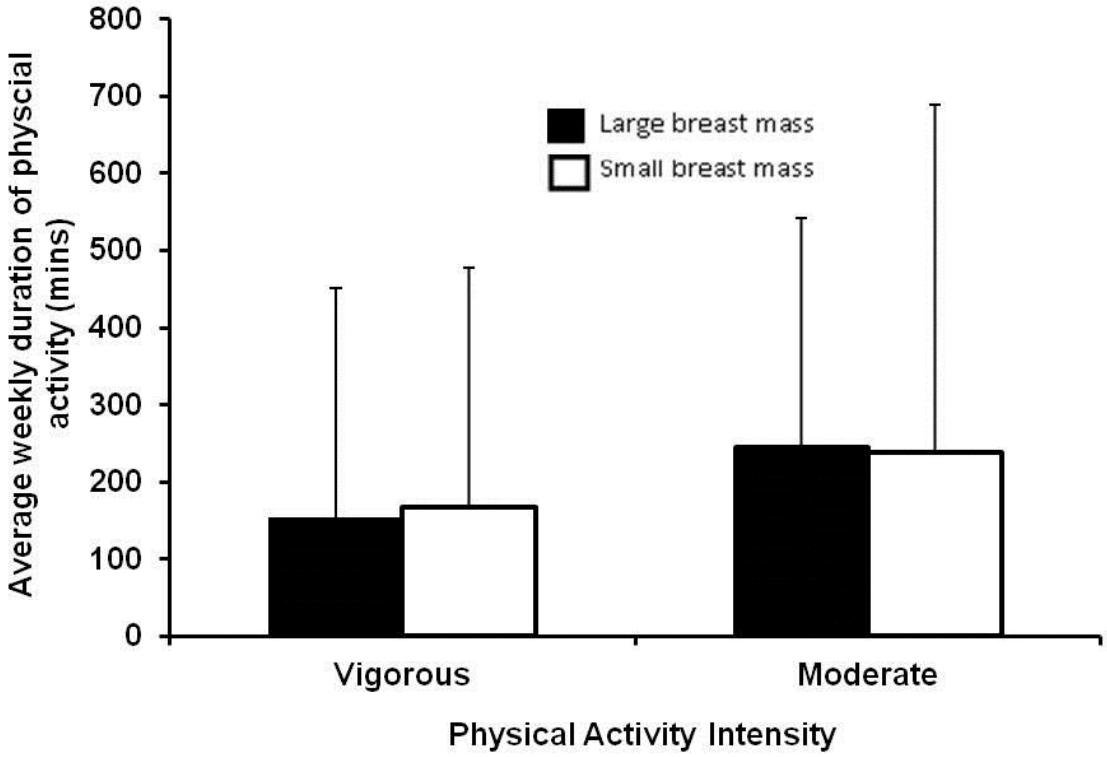

Figure 3: Average time spent per week completing vigorous and moderate intensity physical activity.

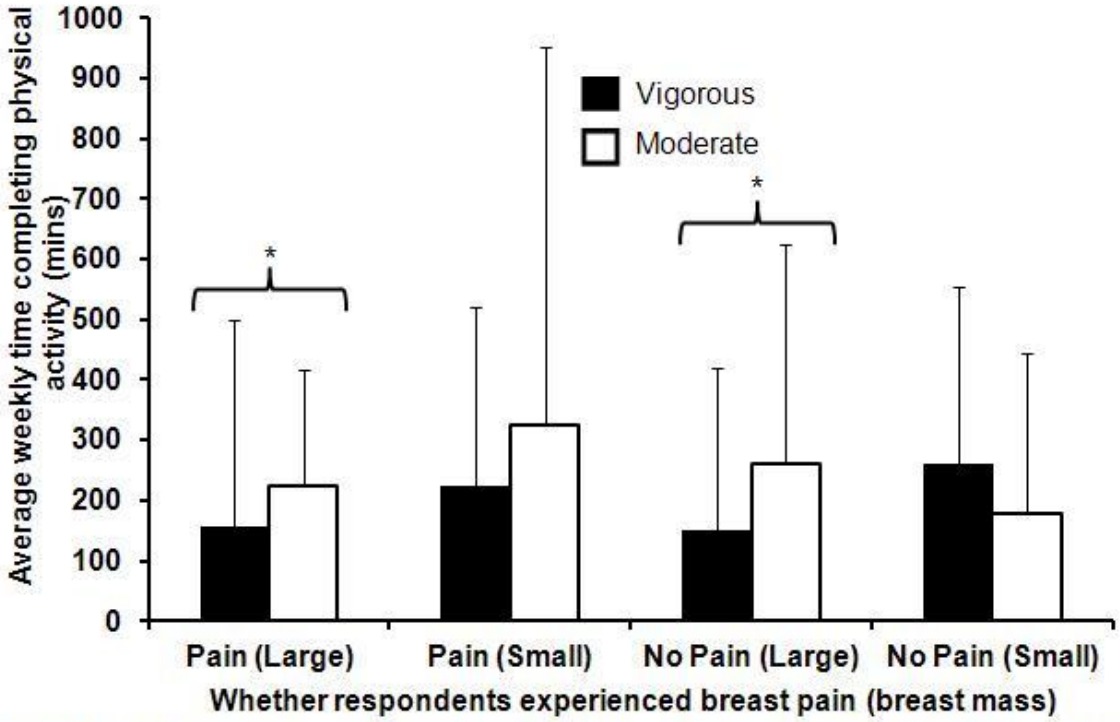

Figure 4: Mean (± SD) time spent completing moderate and vigorous intensity activity across respondents to compare across breast mass and incidence of breast pain (n=239).
* denotes a significant difference where p = <0.05

Tables:

Table 1: Factor reported to relieve or increase breast pain

Increase breast pain		
Themes	**% of Response**	**Examples**
Physical Activity	34.0	Running, Jumping, Exercise, Sports,
Menstrual Cycle	26.4	Being Due on, During Period
Clothing	17.0	Poorly Fitted bra, Tight Clothing, Tight Uniform, Wearing Bra to Bed,
Daily Activities	8.5	Vigorous housework, having intercourse, running up stairs
Not sure	8.5	Nothing/Unsure
Physical Feelings	3.8	Tired, stressed
Trauma	1.9	Mammograms, Nipple Piercing
Relieve breast pain		
Themes	**% of Response**	**Examples**
Reductions in Physical Activity	23.7	Resting, Relaxing, Not exercising
Breast Support/Clothing	21.9	Removing bra, wearing a supportive bra, wearing loose clothing
Nothing	21.1	Just leave it, ignore it, menstrual cycle finishing
Alternative interventions	17.5	Rubbing my breasts, mild massage, compress
Medication	15.8	Pain killers, paracetamol, contraceptive pill