



Original article

The Influence of the Breast on Sport and Exercise Participation in School Girls in the United Kingdom



Joanna Scurr, Ph.D.^{a,*}, Nicola Brown, Ph.D.^b, Jenny Smith, Ph.D.^c, Amanda Brasher^a,
 Debbie Risius, Ph.D.^a, and Anna Marczyk^a

^a Department of Sport and Exercise Science, University of Portsmouth, Portsmouth, United Kingdom

^b School of Sport Health and Applied Science, St Mary's University, Twickenham, United Kingdom

^c Department of Sport and Exercise, University of Chichester, Bishop Otter Campus, Chichester, West Sussex, United Kingdom

Article history: Received May 27, 2015; Accepted October 13, 2015

Keywords: Bras; Physical activity; Adolescence; Health; Females

A B S T R A C T

Purpose: Emerging evidence suggests that breasts may be a barrier to physical activity for adult females. With only 12% of the UK 14-year-old girls achieving exercise guidelines, to understand deterrents to exercise in this population, we should consider whether breasts may also influence sport and exercise participation in school girls. This survey-based study investigated the influence of the breast on sport and exercise participation and breast-specific concerns in the UK school girls.

Methods: A survey was developed to assess demographics, breast characteristics, breast-specific concerns in sports, breast knowledge, views on breast education, and sport participation. Chi-squared tests assessed associations between participation and breast size, sports bra use, and breast concerns.

Results: Two thousand eighty-nine school girls aged 11–18 years completed the survey, for 97 their breasts had begun developing and 96% reported wearing breast support. Forty-six percent of girls reported that their breasts had some effect on their participation in compulsory sports and exercise, which was more prevalent in girls aged 13–14 years (51%) and in larger-breasted girls (63%). More than 50% reported never wearing a sports bra during sports. Breast concerns were high with 73% reporting ≥ 1 breast-specific concern in sports; with breast bounce being most prevalent (38%).

Conclusions: As most of the breast concerns raised in this survey could be addressed via education and 87% of girls wanted to know more about breasts, this study demonstrates a need for breast education for school girls, which may reduce the influence of the breast on sport and exercise participation.

© 2016 Society for Adolescent Health and Medicine. All rights reserved.

IMPLICATIONS AND CONTRIBUTION

This study identifies a substantial influence of the breast on sport and exercise participation in school girls. Breast concerns during sports were high with 73% of girls reporting ≥ 1 concern. Most concerns are addressable via education; therefore this study provides evidence for such an intervention in schools.

The physical changes that take place during puberty are considered of great psychological significance [1], and studies have reported that these physical changes have an influence on

body image [1] and self-esteem [2]. For girls, breast development is an important anatomical change that occurs during puberty. For approximately 85% of girls, the breasts are the first manifestation of puberty [3]. In 2012, the Women's Sport and Fitness Foundation reported that girls in the United Kingdom (UK) dropped out of sports around the time of puberty and that only 12% of 14-year-old girls reached physical activity guidelines [4]. Levels of physical activity among adolescent girls are known to be lower than those of boys [5] and associations have been found

Conflicts of Interest: There are no conflicts of interests.

* Address correspondence to: Joanna Scurr, Ph.D., Department of Sport and Exercise Science, University of Portsmouth, Spinnaker Building, Cambridge Road, Portsmouth, PO1 2ER, United Kingdom.

E-mail address: Joanna.scurr@port.ac.uk (J. Scurr).

between personal factors such as body image and physical activity [6–8].

The first research on the effect of the breast on sport and exercise participation was recently published [9] and identified that the breast was a barrier to sports participation for 17% of adult females. Burnett et al. [9] reported that the breast was the fourth greatest barrier to sport and exercise participation, behind energy/motivation (first), time constraints (second), and health (third); however, the breast has rarely been considered in physical activity research. “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. Interestingly, Burnett et al. [9] also demonstrated that increased breast health knowledge was related to increased levels of sport and exercise participation, concluding that increasing breast health knowledge may reduce barriers to exercise participation in adult females. With the additional pressures of adolescence, it is reasonable to suggest that the breast may also play a role in deterring sport and exercise participation in adolescent girls.

The breast contains weak internal support [10], and therefore, physical activity causes independent breast movement, which increases with breast size [11]. This independent movement has been associated with breast pain in up to 72% of exercising females [12]. Additionally, it has been hypothesized that repeated loading of the supporting structures of the breast may cause irreversible stretch of these structures leading to breast ptosis (sagging) [10]. This movement has also been suggested to cause embarrassment [13], and it may cause changes in functional movement [14]. Although research has identified that appropriate breast support can be effective at reducing the negative consequences of breast movement [15], the bra marketplace can be overwhelming and confusing for the consumer. Bra fit issues are common and more problematic for larger-breasted women [16]; poor bra fit may compromise the function of even the most appropriate breast support products [13]. Research has identified that getting changed is an issue associated with school sports participation [17–19] and therefore changing into a sports bra may also be difficult for school girls. These variables singularly or in combination add further rationale to the hypothesis that the breast may influence sport and exercise participation for school girls in the UK. However, school girl’s breast-specific concerns during sport and exercise have yet to be investigated, and without this knowledge appropriate interventions in this area are difficult.

A previous breast education intervention for girls aged 11–16 years in Australia demonstrated improvements in bra knowledge, bra fit, and levels of bra support worn [20]. This study focused on adolescent athletes connected to sporting academies that provided sports science support and other specialist coaching services. However, in the UK, little is known about the general adolescent female population’s knowledge of breast health or bras and the influence that this may have on sport and exercise participation. Therefore, the aim of this study was first to investigate the influence of the breast on school and college girls’ participation in sport and exercise and second to understand their breast concerns. Based on the previous literature in the area, it was hypothesized that lower levels of sport and exercise participation would be associated with girls with larger breast sizes, girls with lower sports bra use, and finally with a greater number of breast-specific concerns. It was also hypothesized that reported effects of breasts on sport and exercise participation would be greater in year 8 onward (from the age of 12 years

onward), compared with year 7 girls, and greater in larger-breasted girls compared with smaller-breasted girls.

Methods

Survey development

Following full institutional ethical approval, a survey was developed using the following procedure. First, a literature review was conducted to aid the development of a discussion guide for four focus groups. These focus groups aimed to explore opinions, perceptions, and experiences associated with the breast (not reported in this article). Three of the focus groups were conducted with pupils aged 11–12 ($n = 6$), 13–14 ($n = 6$), and 16–18 ($n = 6$) years, respectively, and one was conducted with teachers ($n = 6$). Focus group data were analyzed using inductive content analysis, whereby raw data were grouped into themes, and themes were grouped into higher order themes. Using these themes and the literature in the area as a framework, a group of four researchers (three breast health specialists and one psychologist) developed a six-part survey. The survey included multiple-choice, Likert scale, and free-text format questions and was designed to take no more than 10 minutes to complete. An information sheet and consent form was included at the start of the survey, to enable participants to provide written informed consent. The survey assessed participant’s demographics, sport and exercise participation, breast-related information (age, school attended, ethnic group, breast size, and breast support preference), breast-specific concerns relating to sport and exercise, and participants’ views on breast education. The survey was piloted with five school girls who met the inclusion criteria for this study, leading to minor amendments to the wording and question order.

Procedure

Adolescent girls ($n = 2,089$) aged 11–18 years (15% in year 7; age 11–12 years, 23% in year 8; age 12–13 years, 25% in year 9; age 13–14 years, 25% in year 10; age 14–15 years, 7% in year 11; age 15–16 years, 3% in year 12; age 16–17 years, and 2% in year 13; age 17–18 years) were recruited via schools and colleges (making it difficult to report a response rate). Inclusion criteria were minimal (female, in years 7–13). Schools and colleges were given the option to use an opt-in or opt-out procedure for parent/guardian consent. All schools and colleges chose the opt-out method which meant that if parents/guardians did not agree to their daughters’ participation in the survey they informed the head teacher and their daughter was excluded from the study. Surveys were provided to each school or college, either in paper format ($n = 1,869$) or online ($n = 220$). The questions and format of the online survey were identical to the paper-based survey to maintain equivalency and increase reliability of the mixed-mode strategy [21]. To establish descriptive statistics, electronic submissions were automatically logged and paper copies were collected and manually entered into Microsoft Excel (2010; Microsoft, Redmond, WA).

Statistical analysis

Data were analyzed using predictive analytic software (IBM Predictive Analytic Software, Armonk, NY), the alpha level for statistical significance was set at .05 for all analyses. Chi-squared

tests were used to assess the association of both compulsory (school) and noncompulsory sport and exercise participation with the following variables: breast size, school year, the frequency of sports bra use, and breast-specific concerns in relation to sport and exercise. For larger cross tabulations, if the overall chi-squared test was significant, standardized adjusted residuals for the cell percentage of each subgroup were examined to determine which cell differences contributed to the chi-squared test results. An adjusted residual score greater than 1.96 for a given subgroup percentage indicated that the subgroup differed significantly ($p < .05$) from the overall group percentage. Effect size estimates for chi-square analyses were determined with the phi coefficient (Cramer's variance (V): $V = .1$ is a small effect size, $.3$ is a medium effect size, and $.5$ is a large effect size [22]).

Participants were asked to rate the effect of their breasts on their sports participation on a scale of 1–5 and were categorized as no effect [1] and some effect (2–5). To explore if any of the associations outlined previously differed between smaller- and larger-breasted participants, participants were categorized as having smaller breasts (A–C cup) or larger breasts ($\geq D$ cup) [23–27].

Results

All participants attended a secondary school or college in England (40% single sex, 26% mixed sex, and 34% single sex with boys only at sixth form). Of the respondents, 57% were white, 22% were Asian, 10% were black/African/Caribbean or black British, 5% were mixed/multiple ethnic groups, and 6% reported other ethnic groups. Of those that responded to the question ($n = 1,984$), 97% stated that their breasts had started to grow and 96% reported wearing some form of breast support.

The mode participation in compulsory school sports and exercise was twice a week ($n = 831$) compared with less than once a week ($n = 685$) for noncompulsory sports (Figure 1). Participation in compulsory sport was significantly associated with breast size ($\chi^2 = 16.160, p = .001, \text{Cramer's } V = .121$), there was a significantly greater number of larger-breasted girls undertaking less than one compulsory session per week compared with

smaller-breasted girls. Interestingly, there was no association between breast size and participation in noncompulsory sport. Mode sports participation rates changed across school year reaching lower levels in years 10 and 11 for compulsory sport and 9, 10, and 11 for noncompulsory sport (Figure 2). Chi-squared analysis revealed no association between breast size and participation rates across any school year.

Overall, 46% of girls reported that their breasts had some effect on their sport and exercise participation, and this was significantly greater in larger-breasted girls (63%) compared with smaller-breasted girls (45%) ($\chi^2 = 24.864, p < .001, \text{Cramer's } V = .153$). There was also a significant association between school year and the reported effect of the breast on participation, with significantly less year 7 girls (38%) and more year 9 girls (51%) reporting that the breast had some effect on their participation in sport ($\chi^2 = 14.323, p = .026, \text{Cramer's } V = .086$) (Figure 3).

More than half of the girls surveyed reported never wearing a sports bra, with only 10% always wearing a sports bra during sports and exercise. The frequency of sports bra use was significantly greater in those participating in more sport (compulsory $\chi^2 = 22.301, p = .008, \text{Cramer's } V = .105$, and noncompulsory $\chi^2 = 65.592, p < .001, \text{Cramer's } V = .181$). Of those that reported their breast size, significantly more smaller-breasted girls reported never wearing a sports bra during compulsory sport (49%) compared with larger-breasted girls (35%) ($\chi^2 = 36.368, p < .001, \text{Cramer's } V = .181$).

Seventy-three percent of girls reported at least one breast-specific concern in relation to sports and exercise, with breast bounce when exercising (38%) and embarrassment when getting changed because of breasts or bra (34%) being the most common concerns (Figure 4). Additionally, 15% of girls were concerned that their breasts were too big to exercise. There was a significant association between the number of breast-specific concerns in sports and exercise and participation in compulsory sports ($\chi^2 = 51.315, p = .009, \text{Cramer's } V = .160$), indicating that significantly more girls who experienced ≥ 8 of 9 concerns participated in sports and exercise less than once a week compared with girls with less concerns. Compared with smaller-breasted girls, significantly more larger-breasted girls reported being

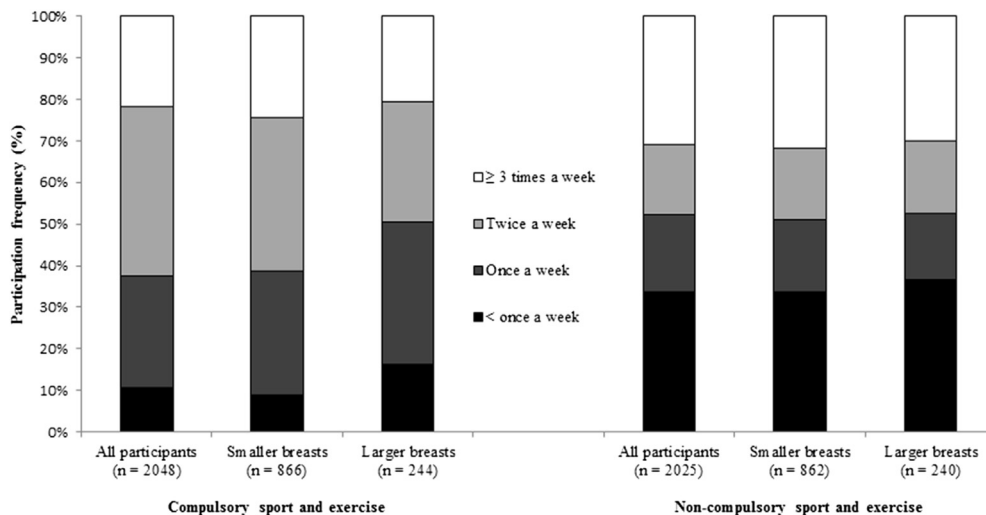


Figure 1. Frequency of participation in compulsory and noncompulsory sports and exercise reported by all participants and by participants with smaller (A–C cup) and larger ($\geq D$ cup) breasts (938 participants did not report their breast cup size).

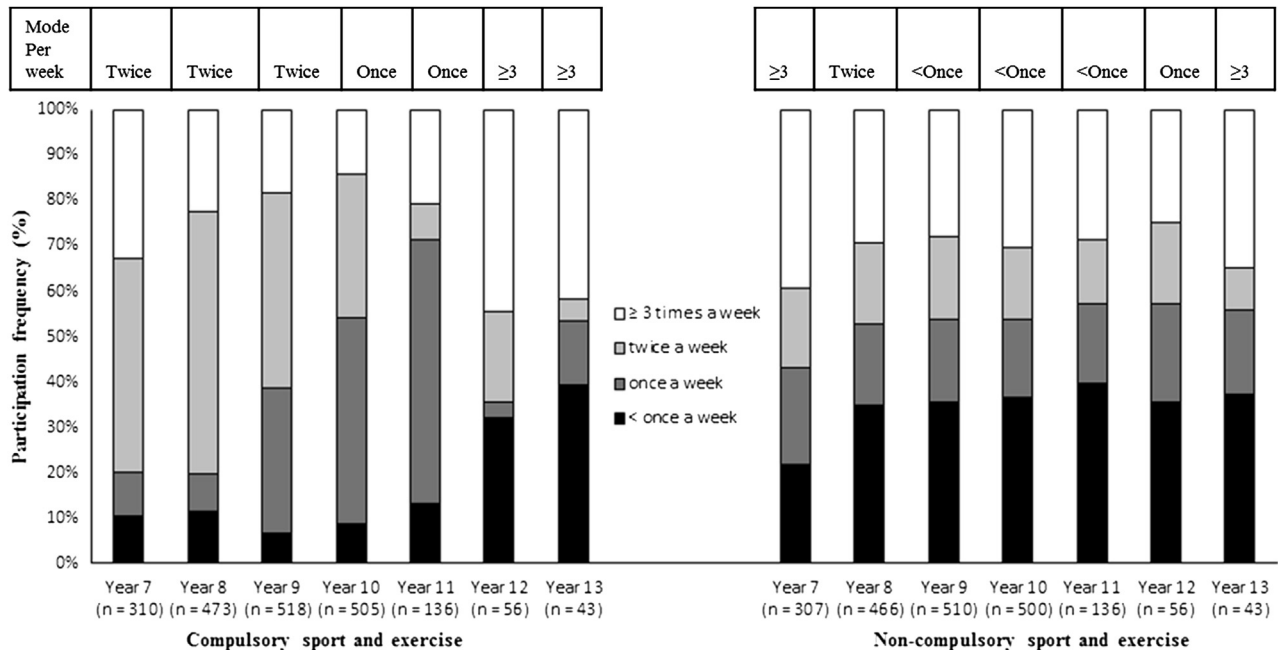


Figure 2. Frequency and mode participation in compulsory and noncompulsory sports and exercise reported by participants across each school year (7–13).

concerned about breast bounce when exercising (26%, $\chi^2 = 52.621$, $p < .001$, Cramer's $V = .221$) (Figure 4). Significantly more school girls taking part in compulsory sport more than 3 times a week were concerned about "how sports bras should fit" ($\chi^2 = 13.375$, $p = .004$, Cramer's $V = .083$) and "the way breasts look during exercise" ($\chi^2 = 10.551$, $p = .015$, Cramer's $V = .074$) than those taking part in compulsory sports less than three times a week (Table 1).

Of those surveyed, 87% wanted to know more about breasts in general and 44% wanted to know more about breasts or sports bras for sports and exercise specifically. This was significantly lower among those undertaking less compulsory sport than those taking part in more compulsory sport ($\chi^2 = 19.234$, $p < .001$, Cramer's $V = .101$). A significantly higher proportion of larger-breasted girls wanted to know more about breasts or sports bra use during compulsory sport and exercise compared with smaller-breasted girls (60% and 48%, respectively, $\chi^2 = 10.984$, $p < .001$, Cramer's $V = .103$).

Discussion

This study addresses important gaps in the literature related to the influence of the breast on sport and exercise participation and breast-specific concerns in school girls in the UK. The results of this study show that the breast has a substantial influence on sports and exercise, with 46% of girls reporting that their breasts had an effect on their participation in compulsory sport. It was hypothesized that the reported effect of breasts on sports participation would be greater from year 8 onward compared with year 7; the results showed that the proportion of girls reporting an effect of their breasts on sports participation was lowest in year 7 (girls aged 11–12 years), and highest among year 9 girls (girls aged 13 and 14 years), supporting this hypothesis. With the later stages of puberty generally occurring in school year 9 (13–14 years of age; [28]), it is interesting to note that

more than half of the girls in year 9 reported that their breasts had some effect on their participation in sports and exercise. Year 9 is also the age at which the Women's Sport and Fitness Foundation [4] reported the lowest participations rates for girls, with only 12% of 14 year olds meeting physical activity guidelines.

Additionally, it was hypothesized that compared with smaller-breasted girls, more larger-breasted girls would report an effect of their breasts on sport and exercise participation. Although the effect size was small, results showed that the proportion of girls reporting an effect of their breasts on sport and exercise participation was 18% greater in larger-breasted girls, supporting this hypothesis. Although it is recognized that other physical characteristics may also deter exercise participation, more larger-breasted girls reported taking part in compulsory sports and exercise less than once a week, compared with smaller-breasted girls, confirming the hypothesis that lower levels of sport and exercise participation would be associated with girls with larger breast sizes. If compulsory participation was truly compulsory, participation levels should

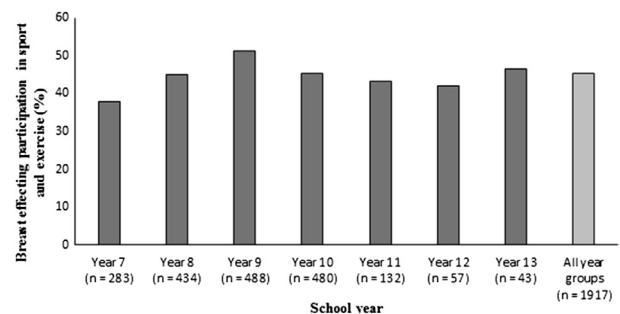


Figure 3. The percentage of participants that reported that their breasts had some effect on their participation in sports and exercise across each school year (7–13).

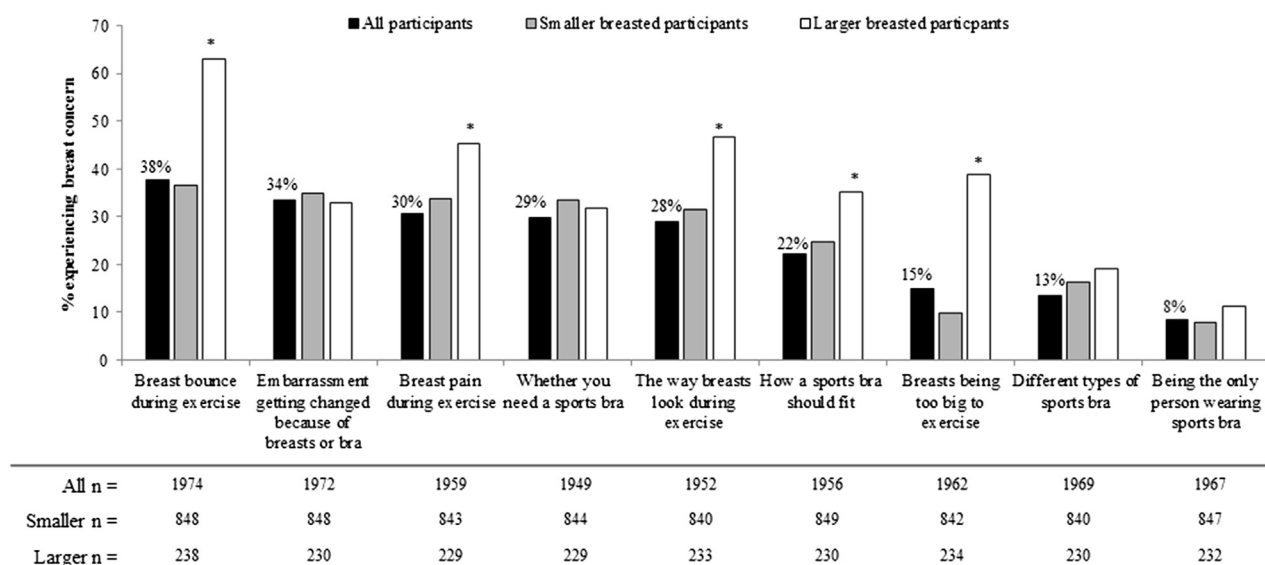


Figure 4. Frequency of breast-specific concerns related to sports and exercise reported by all participants and by participants with smaller (A–C cup) and larger ($\geq D$) cups (938 participants did not report their breast cup size). (*Significantly higher in larger-breasted participants).

be comparable across breast sizes. These findings suggest that despite its compulsory nature, those who are self-selecting out of sport and exercise at school or college reported a larger breast size. This supports previous research that identified the breast as a barrier to physical activity for adult females. However, the prevalence of the effect in school and college girls (46%) is substantially higher than for the adult females who reported the breast as a barrier to exercise (17%) [9]. This suggests that compared with adult females, it may be even more important to consider interventions for encouraging sports and exercise in school girls that incorporate breast-specific aspects.

Interestingly, there was no association between breast size and participation in noncompulsory sport. The limited research in this area makes it difficult to justify this finding; however, it may be that the types of compulsory sports are more challenging for larger-breasted girls and they opt to take part in different sports outside school. Additionally, it may be that when taking part in non-compulsory sport, girls can avoid the use of communal changing rooms. Embarrassment getting changed because of their breasts or bra was reported by more than a third of all school girls in this study.

Despite the influence of the breast on sport and exercise participation, half of the girls in this study never wore a sports bra, with only 10% reporting that they always wore a sports bra for sports and exercise. It was hypothesized that those reporting lower sports bra use would undertake less sport and exercise. The results showed that for those taking part in more sports, sports bra use was more prevalent, supporting this hypothesis. Although the associated effect size was small, interestingly, the statistics for sports bra use in school and college girls is much lower than that previously reported in adult females. Brown et al. [29] reported 32% of a random cohort of adult females always wore a sports bra during sports and exercise, rising to 78% in active adult females, and Brown et al. [23] reported sports bra adherence as high as 91% in adult female runners in the 2012 London marathon. The lower levels of sports bra use in school and college girls, suggests an opportunity for breast education which has been previously shown as effective at increasing

engagement in sports bra use in other populations [20] and may be even more important for young girls than adult females. Additionally, more than a third of girls in the present study reported embarrassment when getting changed because of their breasts or bra. Previous research has identified that adolescent girls are reluctant to get changed in front of their peers [17–19],

Table 1
Frequency of breast-specific concerns related to sport and exercise participation in compulsory sport and exercise for all participants and for participants with smaller ($\leq C$ cup) and larger ($\geq D$ cup) breasts^a

Participation in compulsory school sports and exercise	Breast concerns					
	How a sports bra should fit		Way breasts look during exercise		Different types of sports bra	
	(n = 1,949)		(n = 1,945)		(n = 1,962)	
	n	%	n	%	n	%
All participants						
<Once a week	204	16.2	205	34.1	207	14.5
Once a week	522	20.1	526	25.7	522	11.9
Twice a week	795	22.1	790	27.5	800	12.9
≥ 3 times a week	428	27.8	424	33.5	433	15.5
χ^2	1,949	13.375 ^b		10.551 ^b		3.055
Smaller-breasted participants						
<Once a week	75	16.0	73	37.0	75	16.0
Once a week	252	21.8	230	27.6	362	13.5
Twice a week	311	24.1	305	30.2	314	15.9
≥ 3 times a week	208	32.7	209	36.8	209	20.1
χ^2		11.328 ^b		5.771		3.647
Larger-breasted participants						
<Once a week	37	29.7	39	59.0	37	18.9
Once a week	75	28.0	77	36.4	76	15.8
Twice a week	69	30.4	70	40.0	69	13.0
≥ 3 times a week	49	57.1	47	63.8	48	33.3
χ^2		13.217 ^b		12.465 ^b		8.461 ^b

Bold cells show significant-adjusted standardized residuals.
^a Nine hundred thirty-eight participants did not report their breast cup size.
^b Statistically significant association between breast concern and participation in compulsory school sports and exercise.

and therefore, the lower sports bra use among this population could also be attributed to lack of private changing facilities in schools.

The second aim of this study was to understand school girls' breast-specific concerns during sports and exercise. Seventy-three percent reported at least one breast-specific concern in relation to sports and exercise. Breast bounce during sports was the most prevalent concern, and it was significantly more prevalent in larger-breasted girls. The results of this study also showed that the girls who reported more breast-specific concerns during sports, participated in less compulsory school sport. Concerns with how a sports bra should fit and the way breasts look during exercise were more prevalent in those girls undertaking more sports. With 15% of girls concerned that their breasts were too big to exercise, at this sensitive life stage, these findings contribute to our understanding of why the breast may deter sport and exercise participation in school girls.

Within this study, 87% of girls reported wanted to know more about breasts and 44% specifically wanted to know more about the breast related to sport and exercise participation. Therefore, the results of this study provide an evidence base for the opportunity for a breast education intervention. When considering an intervention to address the breast-specific concerns related to sports that were reported by the girls in this study, appropriate breast support is known to significantly reduce breast bounce and breast pain during sports, which may limit embarrassment about their breasts and the way their breasts look during exercise. Education on these breast-specific concerns may redress the balance between the pros and cons associated with the breast during exercise, encouraging behavior change [20]. Along with other interventions such as consideration of changing facilities in schools, a breast education intervention that promotes the benefits of appropriate breast support for sports and exercise and incorporates training on bra selection and fit may help reduce these breast-specific concerns and encourage greater participation in sports and exercise in school girls.

In conclusion, this is the first study in the UK to investigate the influence of the breast on sport and exercise participation in school girls. With nearly half of school girls reporting some effect, the results of this study show that the breast has an influence on sport and exercise participation. This effect was more prevalent in year 9 (13–14 years of age) and in larger-breasted girls, with these girls reporting lower participation levels in compulsory sport. These findings suggest that the breast may have more of an effect on participation in sports and exercise at this life stage than has been previously reported in adult females [9]. Of those school girls surveyed, only 10% reported always wearing a sports bra during sport and exercise, whereas half reported never wearing one. Nearly three quarters of school girls reported one or more breast concerns, with breast bounce being the most prevalent issue. Results also showed that girls who reported more breast-specific concerns participated in less sports and exercise. Most school girls reported that they wanted to know more about breasts, and most of the breast-specific concerns reported in this survey could be addressed via an educational intervention covering the benefits of appropriate breast support during sport and incorporating training on bra selection and fit. Any such intervention may encourage greater participation in sports and exercise for school girls, contributing to healthy living.

Acknowledgments

The authors acknowledge the schools/colleges and girls that participated in this study. Additionally, the authors acknowledge Sophia Chantizara for initial work on the focus groups. The first draft of the manuscript was written by J.S.

Funding Sources

Internal funding was from the University of Portsmouth. This study received no external funding. No form of payment was given to anyone to produce the manuscript.

References

- [1] Davies E, Furnham A. Body satisfaction in adolescent girls. *Br J Med Psych* 1986;59:279–87.
- [2] Robins RW, Trzesniewski H. Self-esteem development across the lifespan. *Curr Dir Psychol Sci* 2005;14:158–62.
- [3] Gunn JB, Newman DL, Holderness C, et al. The experience of breast development and girls' stories about the purchase of a bra. *J Youth Adolesc* 1994;23:539–65.
- [4] Women's Sport and Fitness Foundation. Changing the game for girls. Available at: <https://www.womeninsport.org/wp-content/uploads/2015/04/Changing-the-Game-for-Girls-Teachers-Toolkit.pdf>. Accessed November 11, 2015.
- [5] Collings PJ, Wijndaele K, Corder K, et al. Levels and patterns of objectively-measured physical activity volume and intensity distribution in UK adolescents: The ROOTS study. *Int J Behav Nutr Phys Act* 2014;11:23.
- [6] Davison KK, Werder JL, Trost SG, et al. Why are early maturing girls less active? Links between pubertal development, psychological well-being, and physical activity among girls at ages 11 and 13. *Social Sci Med* 2007; 64:2391–404.
- [7] Kantanista A, Osinski W, Borowiec J, et al. Body image, BMI, and physical activity in girls and boys aged 14–16 years. *Body Image* 2015;15:40–3.
- [8] Kirkcaldy BD, Shephard RJ, Siefen RG. The relationship between physical activity and self-image and problem behaviour among adolescents. *Soc Psychiatry Psychiatr Epidemiol* 2002;37:544–50.
- [9] Burnett E, White J, Scurr J. The influence of the breast on physical activity participation in females. *J Phys Act Health* 2015;12:588–94.
- [10] Page K, Steele J. Breast motion and sports brassiere design: Implications for future research. *Sports Med* 1999;27:205–11.
- [11] Haake S, Milligan A, Scurr J. Can measures of strain and acceleration be used to predict breast discomfort during running? *J Sports Eng Tech* 2012; 227:209–16.
- [12] Gehlsen G, Albohm M. Evaluation of sports bras. *Physician Sports Med* 1980;8:89–96.
- [13] Starr C, Branson D, Shehab R, et al. Biomechanical analysis of a protocol type sports bra. *J Textile Apparel Tech Manufacturer* 2005;4:1–14.
- [14] White J, Scurr J, Smith N. The effect of breast support on kinetics during over-ground running performance. *Ergonomics* 2009;52:492–8.
- [15] Scurr J, White J, Hedger W. The effect of breast support on the kinematics of the breast during the running gait cycle. *J Sports Sci* 2010;28:1103–9.
- [16] White J, Scurr J. Evaluation of professional bra fitting criteria for bra selection and fitting in the UK. *Ergonomics* 2012;55:704–11.
- [17] Dudley D, Okely AD, Pearson P, Peat J. Engaging adolescent girls from linguistically diverse and low income backgrounds in school sport: A pilot randomised controlled trial. *J Sci Med Sport* 2010;13:217–24.
- [18] Curtis P. The experiences of young people with obesity in secondary school: Some implications for the healthy school agenda. *Health Soc Care Community* 2008;16:410–8.
- [19] Van Daalen C. Girls' experiences in physical education: Competition, evaluation, & degradation. *J Sch Nurs* 2005;21:115–21.
- [20] McGhee DE, Steele JR, Munro BJ. Education improves bra knowledge and fit, and level of breast support in adolescent female athletes: A cluster-randomised trial. *J Physiother* 2010;56:19–24.
- [21] Kaplowitz MD, Hadlock TD, Levine R. A comparison of web and mail survey response rates. *Public Opin Q* 2004;68:94–101.
- [22] Cohen J. *Statistical power and analysis for the behavioral sciences*. 2nd edition. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc; 1988.
- [23] Brown N, White J, Brasher A, Scurr J. An investigation into breast support and sports bra use in female runners of the 2012 London Marathon. *J Sports Sci* 2014;32:801–9.

- [24] Dundas KL, Atyeo J, Cox J. What is a large breast? Measuring and categorizing breast size for tangential breast radiation therapy. *Australas Radiol* 2007;51:589–93.
- [25] Lorentzen D, Lawson L. Selected sports bras: A biomechanical analysis of breast motion while jogging. *Phys Sports Med* 1987;15:128–39.
- [26] Scurr J, White JL, Hedger W. Supported and unsupported breast displacement in three dimensions across treadmill activity levels. *J Sports Sci* 2011; 29:55–61.
- [27] White J, Mills C, Ball N, Scurr J. The effect of breast support and breast pain on upper extremity kinematics during running: Implications for females with large breasts. *J Sports Sci* 2015;33:2043–50.
- [28] Van De Graaff KM. *Human anatomy*. 6th edition. Boston, MA: McGraw Hill; 2002.
- [29] Brown N, Burnett E, Scurr J. Is breast pain greater in active females compared to the general population in the UK? [e-pub ahead of print]. *Breast J* 2015. <http://dx.doi.org/10.1111/tbj.12547>.