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Education improves bra knowledge and fit, and level of breast support in adolesent female athletes: a cluster-randomised trial

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Abstract

Questions: Can an education booklet handed out by a physiotherapist improve bra knowledge and fit, and level of breast support, of bras worn by adolescent female athletes? Design: Cluster-randomised trial with intention-to-treat analysis. Participants: 115 adolescent females from four regional sporting academies aged 16 yr (SD 1) and with an average Australian bra size of 12B. Intervention: The experimental group received an education booklet on bra fit and breast support from a sports physiotherapist. The control group received no intervention. Outcome measures: The primary outcome was bra knowledge measured by a questionnaire. Secondary outcomes were a pass on the Bra Fit Assessment and the Level of Breast Support tests, and breast discomfort during exercise rated on a 10-cm visual analogue scale. Results: Four months after receiving the education booklet, the experimental group had improved their bra knowledge 19% (95% CI 14 to 25) more than the control group. In addition, 39% (95% CI 19 to 54) more of the experimental group passed the Bra Fit Assessment test and 30% (95% CI 11 to 47) more passed the Level of Breast Support test than the control group at 4 months. There was no difference in the level of breast discomfort during exercise. Conclusion: Bra knowledge, bra fit, and level of breast support in adolescent female athletes were all poor but improved significantly after receiving an education booklet about breast support designed specifically for them.

Keywords

female, adolesent, support, trial, breast, randomised, level, fit, knowledge, bra, improves, education, cluster, athletes

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Education improves bra knowledge and fit, and level of breast support in adolescent female athletes: a cluster-randomised trial

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Key words: Breasts, Sports equipment, Exercise, Adolescent, Physiotherapy, Randomized trial

Introduction

Sports bras have been designed to reduce excessive breast motion during physical activity because the tissues supporting breasts – skin overlying the breasts and fine hair-like ligaments within the breasts called Coopers' ligaments – offer insufficient support (Haycock 1988, Gehlsen and Stoner 1987, Eichelberger 1981, Mason et al 1999, Lorentzen and Lawson 1987). Although sports bras have been shown to reduce vertical breast displacement and breast discomfort during treadmill running compared to fashion bras or no bra (Gehlsen and Albohm 1980, Lawson and Lorentzen 1990, Lorentzen and Lawson 1987, Mason et al 1999, Haycock 1988), the bras best at limiting vertical breast displacement are also typically rated the most uncomfortable to wear (Lawson and Lorentzen 1990). Furthermore, Bowles et al (2008) reported that only 41% of 20–35 year old females actually wore a sports bra during exercise because they did not feel the need to or had never even considered wearing a sports bra during physical activity.

For a bra to be comfortable and provide adequate support, it must fit properly (Page and Steele 1999). However, it has been estimated that between 70% and 100% of women are wearing the wrong size bra, with this fitting discrepancy greatest in females with large breasts (McGhee and Steele 2006, Greenbaum et al 2003, Pechter 1998). Ill-fitting bras not only fail to provide adequate breast support, they can also contribute to poor posture and secondary musculoskeletal impairments in the upper body including: upper limb neural symptoms; deep bra furrows caused by excessive strap pressure; and neck and back pain (Greenbaum et al 2003, BeLieu 1994, Ryan 2000, Kaye 1972). These problems can be severe enough to inhibit females from participating in physical activity (Lorentzen and Lawson 1987, Mason et al 1999, Gehlsen and Albohm 1980) and can cause females with large breasts to seek reduction mammoplasty (Greenbaum et al 2003, BeLieu 1994, Ryan 2000, Wilson and Sellwood 1976, Maha 2000).

Correctly-fitted, supportive bras have been found to alleviate up to 85% of these problems, allowing females to exercise in greater comfort and potentially removing the need for breast reduction mammoplasty (Greenbaum et al 2003, Wilson and Sellwood 1976, Maha 2000). Consequently, assessing breast support should be routine when physiotherapists are managing musculoskeletal impairments in females secondary to poor posture. Furthermore, coverage by physiotherapists for female sporting teams and athletes provides an ideal opportunity to educate young females on correct bra fit and level of breast support so that they can participate in sport and recreational pursuits without breast discomfort. As breast support can be a sensitive issue, especially to adolescent females, their clinical background, together with their understanding of anatomy and the musculoskeletal system, makes physiotherapists the

ideal instigators of such education for their female patients and sporting teams. Despite this need for breast support education, no previous research has investigated educating adolescent females about the components of a well-fitted and supportive bra appropriate to their physical activity pursuits. Therefore, the research question for this study was:

> Can an education booklet handed out by a physiotherapist improve the bra knowledge and fit and level of breast support of bras worn by adolescent female athletes?

Method

Design

A prospective, parallel-group, cluster-randomised trial was conducted at sporting academies located in regional areas of New South Wales, Australia (Figure 1). The academies were randomly allocated to either the experimental or control group using a computer-generated table of random numbers. The experimental group received an education booklet and the control group received no intervention. Outcomes such as bra knowledge were measured at baseline after randomisation, one month, and 4 months, while bra fit and level of support and discomfort were measured at baseline and 4 months. All outcomes were measured by the same person (DM), an accredited sports physiotherapist trained in professional bra fitting, who was not blinded to group allocation. Bra fit and level of breast support tests were conducted during training or competition to ensure that the bras measured were representative of those worn during sport. As with most trials of physical intervention, neither the physiotherapist delivering the intervention nor the participants were blinded to group allocation. However, to minimise bias, an independent assistant recoded the questionnaires of bra knowledge prior to marking so that the measurer (DM) was blind to group allocation.

Participants and centres

Regional sporting academies were included in the study if they currently provided sports science support, specialist coaching services and resources to assist adolescent athletes in the pursuit of netball and hockey, since these sports involved running and jumping necessitating adequate breast support. There were no exclusion criteria.

Physically active adolescent females were included in the study if they were currently involved in either hockey or netball and were in the age group 14–18 years. They were excluded if they were currently breast feeding or pregnant (since hormone levels can influence connective tissue within the breasts), had a history of breast surgery, or any cyclical mastalgia (as opposed to exercise-induced breast discomfort).

Intervention

The experimental group received an education booklet, 'Sports Bra Fit*ness*', which was designed to educate female athletes on the components of a well-fitted, well-designed, and supportive bra appropriate to their athletic pursuits. The booklet was intended primarily to guide the reader in selecting and fitting the next bra they purchased. Information within the booklet was written in a simple, easy-to-read format, with the text, graphics and pictures designed to appeal to the target group, following recommendations for producing community-based education effective in promoting behavioural change (Fritz et al 2005, Goldberg et al 2000, MacKinnon et al 2001). It contained targeted key messages and photos of high-profile academy athletes and coaches to act as role models (Fritz et al 2005, Youth Solutions 2005). To ensure optimal readability and educational soundness of the booklet for the target audience, readability tools were used in its development (Flesch-Kincaid Instrument, Microsoft Office Word 2000), as well as focus groups (Fritz et al 2005, Goldberg et al 2000, MacKinnon et al 2001) involving adolescents and their mothers from the target demographic profile. The participants were encouraged to read the booklet by harnessing commitment to the study (Goldberg et al 2000, Youth Solutions 2005), achieved by incorporating measurement sessions into their training and competition, where reminders were given to read the booklet (Fritz et al 2005).

The control group received no intervention. For both groups, a relationship was formed with the measurer, a sports physiotherapist, which assisted to remove the possible barrier of embarrassment (Robbins et al 2003, Shaw 1991, Taylor et al 1999b, Youth Solutions 2005) when discussing the potentially sensitive issue of breast support and bra fit.

Outcome measures

Bra knowledge – the primary outcome – was measured using a custom-designed, 50-item, self-administered questionnaire. Details of the questions which covered bra design, bra component parts, bra sizing, as well as correct and incorrect bra fit and bra wearing habits, can be found in Appendix 1 (see eAddenda for Appendix 1). Responses included multiple choice options, true/false, and short answers; an 'I do not know' response was offered for every question. Face validity was verified through focus groups.

Bra fit was measured using the Bra Fit Assessment test (Choice Magazine 2005) as pass/fail. To be ranked a pass, the front band had to be in contact with the sternum; the posterior and side band had to have no flesh bulging above its superior edge (too small) and was not to move upward if the arms were raised above the head three times (too big); the cup had to have no aspect of the breast bulging above its superior or medial edge (too small) and no wrinkles in the cup material (too big); the straps were not to be digging into (too small) or slipping off (too big) the shoulders; and the cup underwire had to be resting on the ribs and sternum, not on any breast tissue. If one or more of these six components were ranked a 'fail' grade in fit, and the straps or the band could not be adjusted by the assessor to achieve correct fit, an overall 'fail' grade was awarded in the Bra Fit Assessment test.

Level of breast support was measured using the Level of Breast Support test as pass/fail. To be ranked a pass for design, the bra had to be a sports bra, or any two bra combination for any bra size, or a crop top only for cup sizes A or B. Lifespan was ranked a fail (too old) if the material/elastic or underwire of any bra, of any design, had deteriorated. Both bra design and lifespan had to pass for an overall ranking of pass in the Level of Breast Support test.

Discomfort during exercise was measured using a 10-cm visual analogue scale where participants were asked to rate their breast discomfort when wearing this bra during sport.

Data analysis

Bra knowledge was calculated as the mean (SD) percentage of correct answers, while lack of bra knowledge was calculated

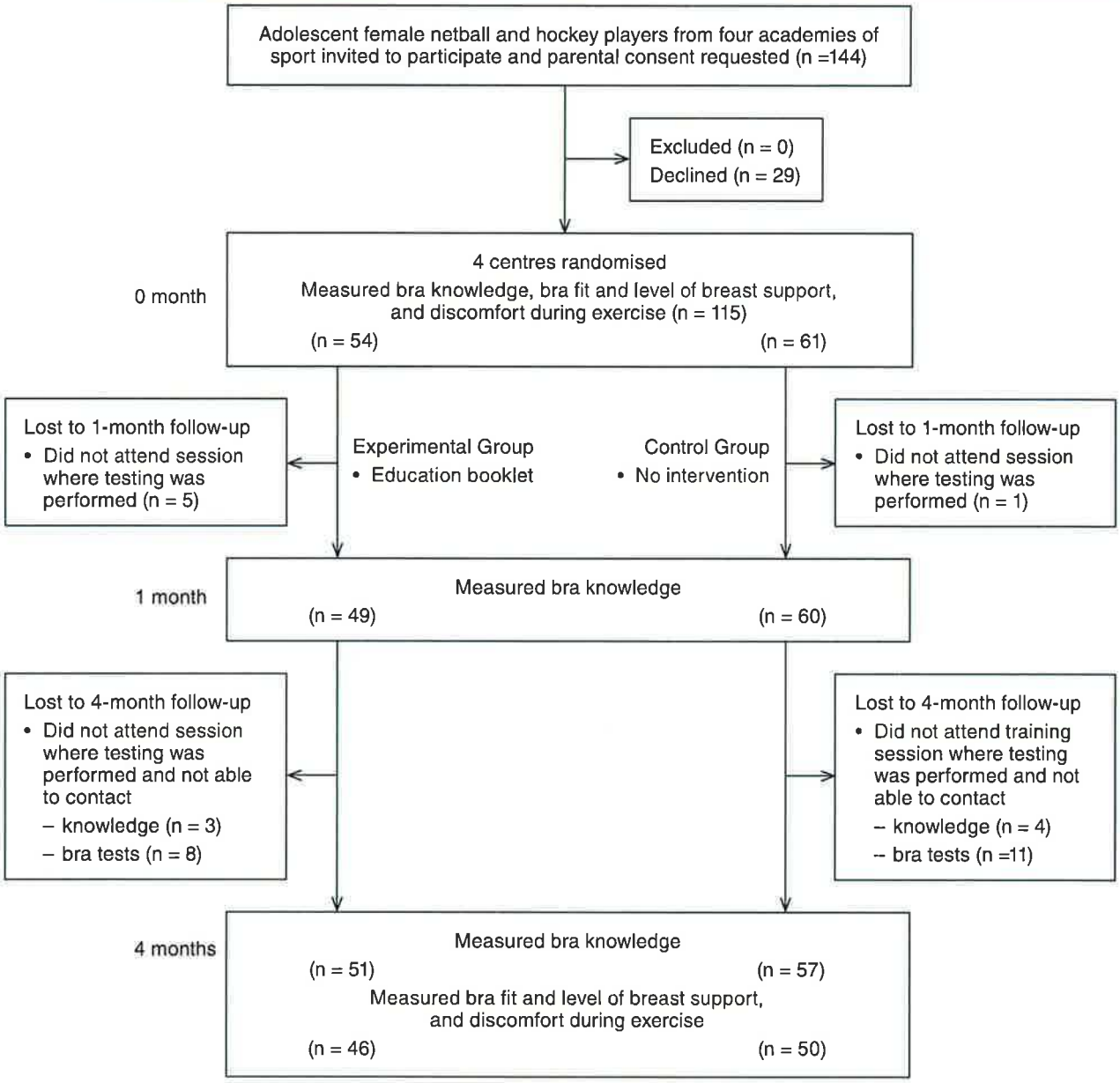

Figure 1. Design and flow of participants through the trial.

as the mean (SD) percentage of 'I do not know' answers. Number of participants passing the Bra Fit Assessment and Level of Breast Support tests was reported. Analysis was by intention-to-treat, whereby all participants were analysed in the groups that they were randomised to and all available data were included in the analysis. Statistical significance was set at $p < 0.05$, so mean difference (95% CI) or risk difference (95% CI) between groups are presented.

Results

Flow of centres and participants through the trial

Four sporting academies agreed to participate. Three academies declined due to time constraints of their teams and coaches. Two academies with 54 participants were randomised to the experimental group while two with 61 participants were randomised to the control group.

One hundred and fifteen adolescent females participated. The primary outcome – bra knowledge – was measured on 108 (94%) participants (51 experimental, 57 control). However, while bra knowledge could be collected later on participants who missed training or competition sessions, bra tests could not. Therefore, bra fit and level of breast support was measured on 96 (83%) participants (46 experimental, 50 control) (Figure 1). The baseline characteristics of participants are presented in Table 1. The average bra size of the participants was Australian size 12B (band size range = 10–14; cup size range = A–DD cup.)

Compliance with trial

One hundred percent of the experimental group reported reading the booklet before the 1-month follow-up. There were no reported adverse effects.

Effect of intervention

Group data for all outcomes are presented in Tables 2 and 3 while individual data are presented in Table 4 (see eAddenda for Table 4). At baseline, 98 (85%) participants

Table 1. Baseline characteristics of participants and centres.

Characteristic	Randomised (n = 115)		Lost to follow-up (n = 19)	
	Exp (n = 54)	Con (n = 61)	Exp (n = 8)	Con (n = 11)
Participants				
Age *(yr)*, mean (SD)	15.6 (1.0)	15.5 (1.0)	15.5 (0.9)	15.9 (0.6)
Sport played, n (%)				
Netball	28 (52)	30 (49)	3 (38)	5 (46)
Hockey	26 (48)	31 (51)	5 (62)	6 (54)
Bra worn, n (%)				
Sports	9 (17)	12 (20)	2 (25)	1 (9)
Crop top	17 (32)	18 (30)	3 (38)	4 (36)
Fashion	16 (30)	12 (20)	2 (25)	2 (18)
Fashion + crop top	9 (17)	18 (30)	1 (12)	4 (36)
Sports + crop top	2 (4)	0 (0)	0 (0)	0 (0)
Skins	0 (0)	1 (2)	0 (0)	0 (0)
Fashion + sports	0 (0)	0 (0)	0 (0)	0 (0)
Bra band size, mean (SD)	12 (1.3)	12 (1.4)	12 (1.9)	12 (1.6)
Bra cup size, mean (SD)	B (1 cup size)	B (1 cup size)	B (1 cup size)	B (1 cup size)
Passed bra fit test, n (%)	6/53 (11)	10 (16)	0 (0)	0 (0)
Passed level of breast support test, n (%)	9/53 (17)	16 (26)	0 (0)	1 (9)
Centres, n participants (%)				
1	31 (57)		2 (25)	
2	23 (43)		6 (65)	
3		31 (51)		6 (55)
4		30 (49)		5 (45)

failed to achieve 50% for bra knowledge. After reading the booklet, the experimental group scored 11% (95% CI 7 to 15) higher at one month and 19% (95% CI 14 to 25) higher at 4 months than the control group (Table 2). At baseline, there was little bra discomfort in either group and little change over time despite the improvements in bra fit and level of breast support. There was little difference between the groups at 4 months (mean difference 0.2 out of 10, 95% CI-0.6 to 1.0) (Table 2).

After reading the booklet, 39% (95% CI 19 to 54) more of the experimental group passed the Bra Fit test than the control group (Table 3). Similarly, 30% (95% CI 11 to 47) more passed the Bra Level of Support test than the control group.

Discussion

The high percentage of participants in the present study who failed the initial bra knowledge questionnaire confirms that there is a need to provide adolescent females with education about correct breast support and bra fit. The significant improvement in bra knowledge post-intervention reveals that an intervention as simple as a booklet provided by a physiotherapist, with strategies to encourage reading of the given material, can be effective in improving the knowledge of adolescent females about this important topic. The high level of compliance in participation in the study and in reading the material was attributed to the behavioural change strategies incorporated into the intervention. Therefore, such a booklet could be used by physiotherapists to educate adolescent females about effective breast support and bra fit.

The low percentage of participants who passed the Bra Fit Assessment and Level of Breast Support tests at baseline suggests that adolescent females, like their adult counterparts (Greenbaum et al 2003, McGhee and Steele 2006, Pechter 1998), have a poor ability to choose and fit a bra appropriate to their breast size and level of physical activity. Only 13% of the adolescent participants physically assessed during training or competition were wearing a sports bra, in contrast to 41% usage (Bowles et al 2008) reported in adult females. Despite the poor level of bra fit and breast support in these adolescent athletes, only low levels of breast discomfort during exercise were reported. Furthermore, this did not significantly improve, despite improvement in bra fit and level of breast support. The relatively small average breast size of the participants (12B) and their age may explain this finding, as breast discomfort during exercise is more problematic in females with large breasts (Gehlsen and Albohm 1980). In addition, changes in the mechanical properties of the tissues supporting the breasts or the habitual lack of adequate breast support over time in adult females may decrease their anatomical level of breast support, although this notion requires further investigation. The improvement in level of support post-intervention in the experimental group shows that the improvement in knowledge was accompanied by an improvement in choice of bra (in terms of design and lifespan) relative to the level of physical activity and breast size. For this age group, the improved breast support may be more effective in decreasing the embarrassment of physical appearance, a known barrier to physical activity in adolescence (James 1998, Robbins et al 2003, Shaw 1991, Taylor et al 1999a), by reducing breast bounce during exercise rather than breast discomfort.

Table 2. Mean (SD) of bra knowledge and discomfort for each group, mean (SD) difference within groups, and mean (95% CI) difference between groups.

Outcome	Groups						Difference within groups				Difference between groups	
	Month 0		Month 1		Month 4		Month 1 minus Month 0		Month 4 minus Month 0		Month 1 minus Month 0	Month 4 minus Month 0
	Exp (n = 54)	Con (n = 61)	Exp (n = 49)	Con (n = 60)	Exp (n = 51)	Con (n = 57)	Exp	Con	Exp	Con	Exp minus Con	Exp minus Con
Bra knowledge *(0 to 100)*	41 (10)	40 (10)	56 (13)	43 (11)	65 (17)	44 (12)	14 (15)	3 (10)	24 (16)	4 (12)	11 (7 to 15)	19 (14 to 25)
Bra lack of knowledge *(0 to 100)*	15 (8)	14 (8)	6 (5)	12 (8)	4 (5)	12 (9)	−8 (8)	−2 (8)	−11 (7)	−1 (8)	−7 (−10 to −4)	−10 (−12 to −7)
Discomfort (0 to 10 VAS)	2.4 (1.9)	2.4 (2.0)	n/a	n/a	2.4 (1.7)	2.5 (2.2)	n/a	n/a	0.0 (1.5)	−0.2 (2.5)	n/a	0.2 (−0.6 to 1.0)
	n = 53				n = 46	n = 50						

Exp = experimental group, Con = control group, VAS = visual analogue scale

Table 3. Number of participants (%) passing bra tests in each group and risk difference (95% CI) between groups at 4 months.

Outcome	Group		Risk difference between groups
	Exp (n = 46)	Con (n = 50)	Exp relative to Con
Passed bra fit test	26 (56)	9 (18)	−0.39 (−0.54 to −0.19)
Passed level of breast support test	24 (52)	11 (22)	−0.30 (−0.47 to −0.11)

Exp = experimental group, Con = control group

Of interest, 25% of participants reported knowing that their bra did not fit, yet they still wore this bra during vigorous exercise. This result suggests that adolescent females do not perceive wearing an ill-fitting bra as problematic. Comments included 'This is the bra I wore to school and I came to training straight after school' and 'I wear my good bras for competition, not training'. Although poorly fitted bras in this young cohort were not associated with high levels of discomfort, in order to prevent the development of musculoskeletal disorders from insufficient breast support (Ryan 2000, BeLieu 1994, Kaye 1972, Wilson and Sellwood 1976, Maha 2000) and to promote physical activity (Lorentzen and Lawson 1987, Mason et al 1999, Gehlsen and Albohm 1980) education on bra fit is warranted. Since 75% of the participants reported never having been fitted for a bra professionally, bra education enabling them to fit themselves independently is particularly important. Physiotherapists are in an ideal position to provide education to adolescent females on the importance of wearing a well-designed, supportive and comfortable bra when participating in physical activity. They can prevent the development of poor bra wearing habits, which may impact negatively upon their health and lifestyle in later years.

An improvement in bra knowledge was sufficient to improve the ability to fit a correct bra independently with appropriate support for the level of physical activity and breast size. This improvement in bra fit may also be the result of removing the perceived barrier of embarrassment associated with the topic of breasts and bras. For many experimental participants, the booklet and its guide to bra purchase became a mother/daughter project, opening up the topic for discussion by easing embarrassment and self-consciousness. The improvement in bra fit and breast support suggests that a booklet such as this, designed to appeal to the target audience, could be used by physiotherapists to educate and improve the breast support knowledge and behaviour of their adolescent female patients. Incorporating bra fit and breast support education as part of physiotherapy intervention for musculoskeletal disorders associated with poor posture, or as part of sports coverage of female sporting teams and athletes, could improve outcomes and promote physical activity with its associated health benefits. However, further research investigating the effect of bra education on long-term reduction of musculoskeletal complaints is recommended. ■

eAddenda: Table 4, Appendix 1 available at JoP. physiotherapy.asn.au

Note: The breast education booklet that was developed as a part of this study is available from: Breast Research

Australia, Biomechanics Research Laboratory, School of Health Sciences, Faculty of Health and Behavioural Sciences, University of Wollongong, Wollongong, NSW 2522, Australia. www.uow.edu.au/bookshop

Ethics: The University of Wollongong Human Research Ethics Committee approved this study. All participants and their parents gave written informed consent before data collection began.

Competing interests: None declared.

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