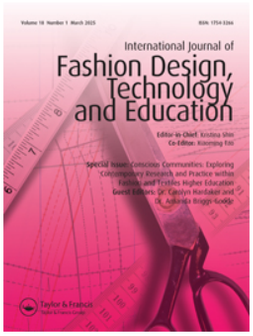

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Highlighting the need for change through an analysis of bra fit quality

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ABSTRACT

Poor bra fit is a global female health issue and is partially attributed to poor bra fit knowledge, with negative consequences combining physical, psychological, and social factors. This study determined women's ability to identify correct and incorrect bra fit as a direct measure of bra fit knowledge. Twenty-four female participants self-reported fit issues (subjective) and researchers carried out an assessment (objective) based on established professional bra-fitting criteria. All participants failed the objective assessment, with 77 bra fit issues identified in total. Large cups, the front band not being in contact with the sternum and loose straps were most frequently identified. Participants' subjective reports matched objective findings in only 51% of instances, highlighting the gross inability to identify correct and incorrect fit. Educational interventions to improve bra fit knowledge are warranted to enable correct size bra selection. Potential benefits may include improving bra fit, and physical, psychological, and social wellbeing.

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KEYWORDS
Bra fit; breast health; breast size; women's health; breast support

1. Introduction

The symptoms and negative factors associated with poor bra fit can be so severe that some women report an inability to participate in physical activity, (Burnett, White, & Scurr, 2015; Scurr et al., 2016) with others also seeking breast reduction surgery for alleviation of symptoms (Coltman, Steele, & McGhee, 2018; Greenbaum, Heslop, Morris, & Dunn, 2003; Ryan, 2000). For a bra to function according to its design, it must fit correctly, yet between 75 and 100% of women wear the wrong size bra daily, regardless of breast size (Coltman et al., 2018; Greenbaum et al., 2003; Haworth, May, Janssen, Selfe, & Chohan, 2022a; McGhee, Steele, & Munro, 2010; McGhee & Steele, 2010; Odebiyi et al., 2015; Page & Steele, 1999; Pechter, 1998). When a bra does not fit correctly due to one or more components of the bras, the level of breast support offered by the bra is affected as each individual component contributes to supporting the weight of the breasts (Coltman et al., 2018; Findikcioglu, Findikcioglu, Ozmen, & Guclu, 2007; Greenbaum et al., 2003). Persistent wearing of an ill-fitting bra has previously been associated with numerous negative health outcomes including physical and psychological factors (Figure 1) (Findikcioglu et al., 2007; Goulart, Detanico, Vasconcellos, Schütz, & Santos, 2013; McGhee & Steele, 2006, 2010, 2020; Spencer et al., 2020; Swami et al., 2015, 2020; Wood et al., 2008). Although incorrect bra fit is a global female health issue, the consequences are much greater for those women with larger breasts (Greenbaum et al., 2003; McGhee et al., 2010; McGhee & Steele, 2010, 2011; Wood et al., 2008).

The breasts may influence a woman's personal sense of attractiveness, femininity, and appearance anxiety (Spencer et al., 2020; Swami et al., 2015, 2020). Women often strive for the 'ideal' figure as portrayed by the media (Swami et al., 2020). These beauty ideals are often not realistically attainable, particularly for larger breasted women and therefore, detrimental outcomes may include; negative body image, development of poor relationships with food and/or physical activity, and reduced psychological wellbeing (Spencer et al., 2020; Swami et al., 2020). Embarrassment and low levels of self-esteem can have a significant impact on mental health and lead to negative clothes shopping experiences, and the breakdown of sexual relationships (Collins et al., 2002; Findikcioglu et al., 2007; Hadi, 2000; Scurr et al., 2014).

There are many challenges associated with achieving correct bra fit; a lack of standardisation, and varying

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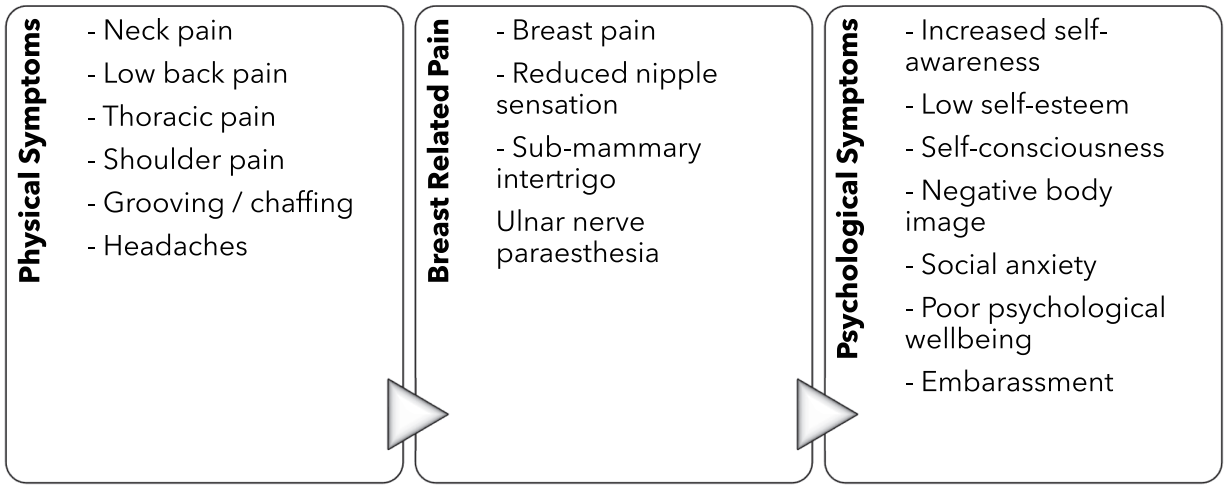

Figure 1. Previously reported symptoms related to poor bra fit (Findikcioglu et al., 2007; Goulart et al., 2013; Greenbaum et al., 2003; Haworth et al., 2022a; McGhee & Steele, 2006, 2010; Wood et al., 2008).

interpretations of the measurement process and sizing guidelines between manufacturers and retailers means that the ability to accurately communicate bra sizes is regularly compromised (Pei et al., 2019; White & Scurr, 2012). Varying breast size, shape and composition, the position the individual adopts during the measurement process, and respiratory state have also all been shown to affect the ability to effectively measure for bra size (Greenbaum et al., 2003; McGhee & Steele, 2006; Yu et al., 2006). For larger breasted women, the challenge becomes greater. As breast size increases, the ability to accurately measure circumferential measurements to determine bra size decreases due to varied soft tissue distribution around the chest area with the presence of both bulbous and ptotic tissue (Chen, Labat, & Bye, 2011). As larger breasted women also regularly present with elevated BMI's (Brown et al., 2012), the tape measure may migrate between skin tissue folds, making an accurate measurement unlikely (Pandarum et al., 2011). Furthermore, another factor that has shown to contribute to the high prevalence of poor bra fit is the structural design of the bra (Coltman et al., 2018).

The importance of achieving correct bra fit to support the breasts effectively is apparent and more efforts are required to enable more women to accomplish this. Addressing the factors that impede women from selecting a correctly fitting bra is imperative to overcoming these physical and psychological factors (Coltman et al., 2018).

The high incidence of poor bra fit amongst women has been partially attributed to a lack of knowledge amongst women as to what correct bra fit looks and feels like (Coltman et al., 2018; Greenbaum et al., 2003; McGhee et al., 2010; McGhee & Steele, 2010; White & Scurr, 2012). Correct bra fit is achieved when the component parts of the bra (band, cup, underwire, straps, and front band) 'fit' according to set professional bra fitting criteria (McGhee & Steele, 2010; White & Scurr, 2012). Professional bra fitters should ensure correct fitting of these specific components of the bra during a bra fitting (McGhee & Steele, 2010). For research purposes, McGhee and Steele translated these specific bra fit components into an objective measure of bra fit quality, named a bra fit assessment (McGhee & Steele, 2010).

The current evidence base demonstrates that women have a poor ability to independently choose a well-fitting bra (McGhee & Steele, 2010), regardless of age and breast size (Coltman et al., 2018; McGhee et al., 2010; Spencer & Briffa, 2013). An investigation of bra fit amongst young adolescent females reported that 11% ($n = 5$) of participants passed the bra fit assessment following the professional bra fitting criteria prior to delivery of an education intervention (McGhee et al., 2010; McGhee & Steele, 2010). However, specific detail as to which of the bra fit components were most prevalent was not presented (McGhee et al., 2010). Provision of an education booklet as an intervention to improve bra fit knowledge, provided information relating to the components of a correctly-fitted and supportive bra. Bra fit assessment pass rates improved at a 4-month follow up, with 56% ($n = 26$) of participants presenting wearing a correctly fitted bra (McGhee et al., 2010). This small study highlights the potential benefit of educational materials to improve knowledge relating to what correct bra fit looks and feels like, but these findings are not representative of the adult population as young female athletes were recruited with cup size range A-DD. It does however, emphasise the lack of knowledge girls have relating to bra fit and its

importance, particularly during the most critical stages of breast development (Bowles, Steele, & Munro, 2008; McGhee et al., 2010).

Bra fit knowledge has also previously been reported to be poor amongst older women, with Spencer and Briffa (2013) highlighting the high prevalence of poor bra fit amongst post-menopausal women. Ninety three percent of women were found to be wearing the wrong size bra, with 57% wearing a size that was too small and 36% wearing a size that was too big. Whilst no detail was provided as to which component of the bra size was incorrect (band or cup), the inability of another subgroup of women to accurately select correct bra size was highlighted.

It has previously been shown that self-measurement and selection methods of bra fitting reduce the likelihood of achieving correct fit (McGhee & Steele, 2010). The rising popularity of online clothes shopping over the last decade means that women are becoming reliant on self-measurement and selection as the opportunity of a professional bra fit is removed with an online purchase (Greenbaum et al., 2003). In a previous study (McGhee & Steele, 2010) investigating the effect of different bra measurement and sizing approaches, one hundred women (mean age 43.5 ± 13.2 years, bra cup size range A-G) were measured for bra size using four different approaches; professional bra fitting criteria (McGhee et al., 2010; McGhee & Steele, 2010), self-selection, where the participants tried on several bras until they were happy with the fit, the traditional measurement method (Greenbaum et al., 2003) and the breast hemi-circumference measurement method (Pechter, 1998). When using the self-selection technique, which was the most common approach to bra fitting amongst participants, the most prevalent bra fit issues were small cups (43%), an incorrectly-shaped underwire (40%), and an over-sized band (29%). These bra fit issues contrast with another study (Greenbaum et al., 2003), where most women presented wearing a tight underband and over-sized cups. This may be due to the different participants recruited to each study as one group was recruited from mammaplasty referrals with larger breasts (C-J) (Greenbaum et al., 2003) whilst the others were asymptomatic, with relatively smaller breast sizes (A-G) (McGhee & Steele, 2010).

Determining bra fit knowledge through assessment of a woman's ability to identify the presence or absence of bra fit issues is not something that has previously been researched before. Therefore, the objective of the present study was to determine the ability of women to identify the presence or absence of bra fit issues as a measure of bra fit knowledge. It was hypothesised that poor bra fit would be prevalent amongst participants and participants would be unable to accurately report the absence/presence of their own bra fit issues. This new information will help to identify whether women know what common bra fit issues look and feel like, whilst also highlighting whether there is a need for more education relating bra fitting and achieving correct bra fit, with an overall objective of reducing poor bra fit amongst women.

2. Methods

2.1. Participants

The data presented in this study is a subset of data from a larger, preliminary pre-clinical study (Haworth et al., 2022) and with this in mind, the study sample size was determined based upon primary outcome measures from the larger study. The sample size required for the pre-clinical study matched a clinical sample of participants (Haworth, May, Janssen, Selfe, & Chohan, 2023); the sample size was determined based upon a previous study to use a Numerical Pain Rating Scale amongst individuals with chronic back pain, to measure responsiveness to a conservative treatment intervention (Chohan, Payne, Selfe, & Richards, 2013) – a change of 1.4±1.3 scale points referred to symptomatic improvement. A sample size calculation from this data determined that a minimum of 19 participants were needed to detect a significant difference of 1.4±1.3 at the 5% significance level with 90% power.

The University Ethics Committee approved this study (STEMH241). Data were collected in accordance with the WMA Declaration of Helsinki (World Medical Association, 2013) and written informed consent was provided by all participants. Data were collected between Oct 2016 and July 2017.

Individuals recruited to the study were healthy female adults with a breast cup size D+, who had been free from back pain in the 3 months prior. A strict screening process (Greenhalgh & Selfe, 2010) was implemented to identify and exclude anybody with potential indicators of serious pathology. Pregnant and breastfeeding women, or anyone with a history of breast surgery were excluded from the study (McGhee et al., 2013; McGhee & Steele, 2006, 2010).

2.2. Study design and protocol

As previously mentioned, the data presented in this study is a subset of data from a larger, preliminary pre-clinical study (Haworth et al., 2022). The repeated measures study included two data collection sessions, separated by a four-week intervention period (Figure 2). During the first data collection session, baseline

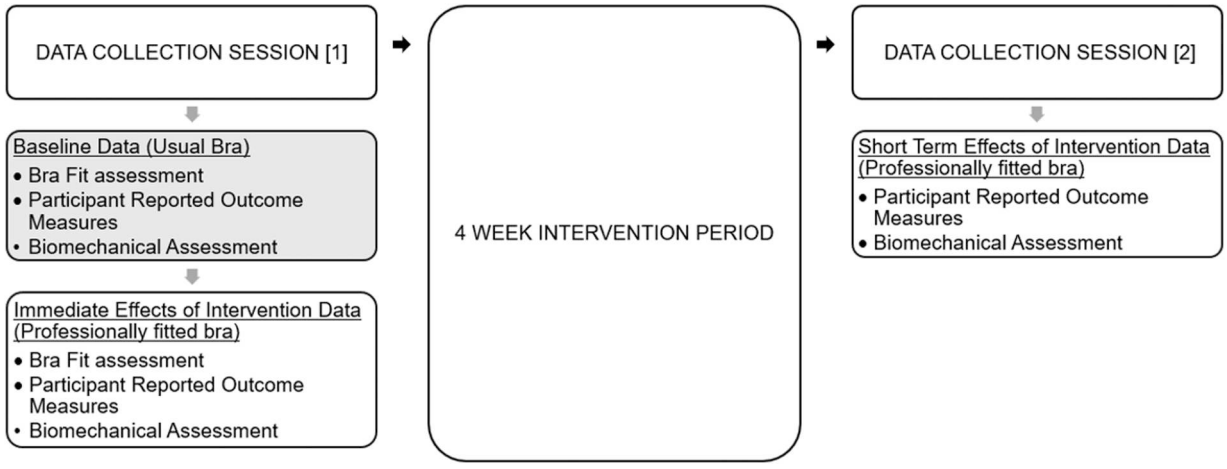

Figure 2. Full study design. The data from this analysis was collected during data collection session [1], indicated by the highlighted box.

data were collected with participants wearing their own usual bra, and then in a brand new, professionally fitted bra which had been purchased for the purpose of the study, to assess the immediate effects of the professionally fitted bra. Participants replaced their usual bra with the professionally fitted bra for a four-week intervention period. At the second data collection session, data was collected in the professionally fitted bra again to understand the short-term intervention effects. The full dataset includes bra fit assessment data, participant reported outcome measures relating to self-reported bra fit issues, and kinematic data which was collected using a 3D marker-based motion capture system to calculate breast spinal kinematics during standing, sitting, and jumping tasks. The data included in this publication were collected during the first of two one-hour data collection sessions with participants wearing their own usual bras. A full protocol is described elsewhere (Haworth et al., 2022).

Participants were recruited in a voluntary manner using advertisement posters placed around the university campus and posted on social media. Data were collected with participants wearing their own usual bra. The usual bra was defined as a non-sports bra that participants regularly wore daily. Data included participant characteristics (age, height, weight, BMI), bra size, an objective bra fit assessment (McGhee et al., 2010; McGhee & Steele, 2010) and self-reported bra fit issues (Brown, White, Brasher, & Scurr, 2014a).

2.3. Outcome measures

2.3.1. Bra fit assessment

An objective bra fit assessment (McGhee et al., 2010; McGhee & Steele, 2010) was carried out by two researchers to evaluate the bra fit quality of participants' own usual bras. Prior to data collection, training was provided by an experienced bra fitter. Two researchers completed each objective bra fit assessment to improve robustness of the data. This assessment incorporated components of the professional bra fitting criteria (Table 1), which considered the fitting of the bra's underband, cups and straps. The presence of one or more bra fit issue which could not be eliminated through strap or hook adjustment indicated incorrect fit, and a failed assessment. The objective bra fit assessment has been used previously in related research to determine the fitting quality of a bra (McGhee et al., 2010; McGhee & Steele, 2010).

2.3.2. Self-reported bra fit issues

Based on criteria from the professional bra fitting criteria, and adapted from a previous breast health survey (Brown et al., 2014a), participants were asked to

Table 1. Components of the bra fit assessment (McGhee et al., 2010; McGhee & Steele, 2010).

Band	**Too tight:** flesh bulging over top of the band; subjective discomfort 'feels too tight'
	Too loose: band lifts when arms are moved above head, posterior band not level with inframammary fold
Cup	**Too big:** wrinkles in cup fabric
	Too small: breast tissue bulging above, below or at the sides
Underwire	**Incorrect shape:** underwire sitting on breast tissue laterally (under armpit) or anterior midline; subjective complaint of discomfort
Straps	**Too tight:** digging in; subjective complaint of discomfort; carrying too much of the weight of the breasts
	Too loose: sliding down off shoulder with no ability to adjust the length
Front band	Not all in contact with the sternum
Bra fit rating	**Pass**: no errors or if hooks or straps can be adjusted to achieve correct fit
	Fail: any other ticks

subjectively report the frequency of which they experienced common bra fit issues using a 5-point Likert scale; never (0), rarely (1), sometimes (2), very often (3), always (4) (Brown, White, Brasher, & Scurr, 2014b; Burbage & Cameron, 2017). Participants were also asked to quantify to what extent their bra meets their needs on a Numerical Rating Scale from 0 'not at all' to 10 'completely'.

2.4. Data processing and analysis

Responses to the objective bra fit assessment were coded as follows: bra fit issue identified '1' and bra fit issue not identified '0', with overall result of pass '1' or fail '0'. The frequency of bra fit issues were reported as both a number (n) and a percentage (%) of total possible instances. Responses from the self-reported bra fit issues were coded: bra fit issue reported '1' (any point on the Likert scale except Never), and bra fit issue not reported '0' (Never).

2.5. Statistical analysis

To determine whether subjective responses predicted objective analyses of bra fit, binary logistic regression analyses were adopted. Odds ratios were also calculated as the probability of an objective event occurring with respect to a subjective one.

Two-way Pearson chi-square tests of independence were used to undertake bivariate cross-tabulation comparisons, specifically to test differences in participants' ability to evaluate bra fit components when splitting them by individual characteristics. This method of analysis explored how characteristics might influence an individual's ability to determine the absence or presence of bra fit issues. Participants were dichotomised by age using standard median split to create a 'younger' and 'older' group. BMI values were divided according to published grouping thresholds (World Health Organisation, 2000) to create 'healthy' (<18.5), 'overweight' (18.5–24.9) and 'obese' (>24.9) categories. Band size was split to create 3 groups; '<34' (below the modal size), '34' (modal size) and '>34' (above the modal size) and cup size was divided pragmatically into three categories: 'DD', 'E & F', 'G, H & HH'. A correct evaluation indicated that both the subjective and objective evaluations were in agreement, and an incorrect evaluation indicated that the subjective and objective evaluations were not in agreement. Statistical significance was set at the $p<0.05$ level throughout.

3. Results

Twenty-four participants were recruited. Their characteristics are presented in Table 2.

The most frequently worn bra size amongst participants was 32DD (cup size range D – H, band size range 30–42). All participants ($n = 24$) wore an underwired bra that adopted the alphabet sizing approach. When asked how much their bra met their needs, participants responded with a mean score of 6.5 ± 1.4 out of ten. All (100%) participants failed the objective bra fit assessment. There were a total of 144 bra fit components included within this analysis: 24 participants with 6 bra fit components per participant. A total of 77 bra fit issues (53%) were identified amongst all bras (average 3.2 per bra, range 1–5), with all but one bra failing with multiple fitting issues. The most common bra fit issues were cups that were too large (63%, $n = 15$), the front band not being in contact with the sternum (58%, $n = 14$) and straps that were too loose (50%, $n = 12$).

When comparing between subjective and objective findings, agreement was only achieved in 51% ($n = 74$) of instances. The binary logistical regression tests demonstrated that subjective responses did not agree with objective analyses of bra fit for all components assessed ($p < 0.482$) (Table 3). Of the 77 bra fit issues that were identified objectively, 62% ($n = 48$) were also reported by participants subjectively. Of the 67 (47%) bra fit components that were considered a good fit in the objective bra fit assessment, only 26 (39%) instances were also reported by participants, indicating that participants perceived there to be more bra fit issues than actual.

Of the nine incidences of incorrect underwire shape that were identified objectively, 100% were also reported subjectively. Similarly, of the six incidences where a small cup was identified objectively, 100% were also reported subjectively. The ability of participants to identify the presence of a large cup was much less, with only 53% ($n = 8$) of those that were identified objectively being reported subjectively. Four instances of a large cup were overlooked by participants.

There were 56 occurrences where a bra fit issue was not identified objectively yet was still reported subjectively. This was most observed for a small cup ($n = 13$)

Table 2. Participant ($n = 24$) characteristics.

Measurement	Mean (SD)	Range
Age (years)	30.9 (9.7)	20–51
Height (m)	1.7 (0.008)	1.50–1.80
Weight (kg)	77.5 (19.8)	47.30–122.80
BMI (kg/m^2)	28.2 (6.3)	18.95–42.49
Bra Size: Band	34*	30–42
Cup	D*	D – H
Bra meets needs** (/10)	6.5 (1.4)	4–8

* Modal size, ** 0 'Not at all' – 10 'Completely'.

Table 3. Subjective responses and objective assessment of bra fit quality.

			Subjective Response			
			Not Reported	Reported	Sig.	Odds Ratio
Objective Bra Fit Assessment	Straps Too Tight	Not Identified	6	11	0.751	1.3
		Identified	2	5		
	Underwire Incorrect Shape	Not Identified	3	12	0.999	403868710.7*
		Identified	0	9		
	Tight Band	Not Identified	4	9	0.482	2.0
		Identified	2	9		
	Small Cup	Not Identified	5	13	0.999	621336478.0*
		Identified	0	6		
	Large Cup	Not Identified	5	4	0.674	1.4
		Identified	7	8		
	Front Band Not In Contact With Sternum	Not Identified	3	7	0.634	1.6
		Identified	3	11		

Note: Significance set at $p<0.05$.
Green indicates agreement between subjective and objective data
Red indicates disagreement between subjective and objective data
*Very high odds ratios are accounted for due to the heavy weighting of participants in the 'reported subjectively' category.

($p = 0.999$). These results further suggest an over-reporting of bra fit issues, highlighting that participants may be unable to distinguish between the absence and presence of specific bra fit issues. Overall, the binary logistical statistical tests demonstrate the gross inability of participants to identify the absence / presence of bra fit issues.

Two-way Pearson's chi-square tests (Table 4) identified two instances where an individual characteristic influenced participants' ability to detect the absence or presence of a bra fit component. Two-thirds of participants in the younger group correctly evaluated the presence or absence of tight straps, compared to 25% in the older group ($p = 0.041$). One hundred percent of participants with a cup size E or F were unable to determine the presence or absence of a tight band, whilst 80% of participants with a smaller cup, and 71.4% of participants with a larger cup were able to correctly evaluate this bra fit component ($p = 0.003$). No further significant findings were observed when comparing between participants with different individual characteristics.

4. Discussion

The potential benefits of addressing the barriers to achieving correct bra fit for women are multifaceted: maximising the potential of any bra to provide effective breast support, improving psychological wellbeing and painful symptoms, and increasing female sports participation rates. Whilst efforts have been made to address technical design challenges related to breast support garments, work is also required to improve bra fit knowledge and awareness amongst women to enable improved selection of the correct size bra. The results from this study suggest that bra fit knowledge is poor amongst women. The bras that the women were wearing did not completely meet their needs, yet they continued wearing them daily. Participants demonstrated a poor ability to accurately distinguish between the presence or absence of specific bra fit issues, with only 42% of instances matching when comparing between subjective and objective results.

Participants were better able to identify specific bra fit issues; they were best able to identify the absence or presence of an incorrectly shaped underwire, and small cups. Whilst bra fit knowledge has not previously been measured through the ability to identify specific bra fit issues, this study demonstrates that perhaps specific components of the bra cause more difficulty than others. When analysing whether individuals with specific characteristics were better at determining bra fit, there were no distinguishable findings or conclusions from which future targeted interventions could be built upon, although this type of analysis within a larger sample size may yield more substantial findings.

A lack of knowledge may be directly related to the poor agreement between subjective and objective findings in this study. Perhaps poor knowledge may be attributed to the lack of conversation and education around the importance of bra fit and breast health amongst the female population (McGhee et al., 2010). Although the national curriculum stipulates that biological aspects of puberty must be taught to schoolchildren, there is no requirement to teach other aspects of breast health education such as bra fitting and the importance of getting it right (Brown et al., 2017). In a survey of secondary school children, there were frequent reports of concerns amongst larger breasted schoolchildren relating to; 'breast bounce during exercise', (69%) 'how breasts may look when they are 50', (55%) 'sagging breasts' (52%) and 'finding bras that fit' (51%) (Brown et al., 2017), further stressing the need for breast specific education relating to bra fit and bra function. Amongst larger breasted females in particular,

Table 4. Two-way Pearsons Chi-Square tests to evaluate how individual characteristic influenced participants' ability to detect the absence or presence of a bra fit component.

		Straps Too tight		Underwire Incorrect shape		Tight Band		Small Cup		Large Cup		Front band not in contact with sternum	
		Correct Evaluation	Incorrect Evaluation	Correct Evaluation	Incorrect Evaluation	Correct Evaluation	Incorrect Evaluation	Correct Evaluation	Incorrect Evaluation	Correct Evaluation	Incorrect Evaluation	Correct Evaluation	Incorrect Evaluation
Age	Younger (n = 12)	8 (66.7%)	4 (33.3%)	6 (50%)	6 (50%)	7 (58.3%)	5 (41.7%)	7 (58.3%)	5 (41.7%)	8 (66.7%)	4 (33.3%)	8 (66.7%)	4 (33.3%)
	Older (n = 12)	3 (25%)	9 (75%)	6 (50%)	6 (50%)	6 (50%)	6 (50%)	4 (33.3%)	8 (66.7%)	5 (41.7%)	7 (58.3%)	6 (50%)	6 (50%)
	Pearson's Chi-Square	0.041		1.00		0.682		0.219		0.219		0.408	
BMI	Healthy (n = 7)	3 (42.9%)	4 (57.1%)	3 (42.9%)	4 (57.1%)	3 (42.9%)	4 (57.1%)	5 (71.4%)	2 (28.6)	3 (42.9%)	4 (57.1%)	5 (71.4%)	2 (28.6)
	Overweight (n = 10)	4 (40%)	6 (60%)	4 (40%)	6 (60%)	6 (60%)	4 (40%)	3 (30%)	7 (70%)	6 (60%)	4 (40%)	5 (50%)	5 (50%)
	Obesity (n = 7)	4 (57.1%)	3 (42.9%)	5 (71.4%)	2 (28.6%)	4 (57.1%)	3 (42.9%)	3 (42.9%)	4 (57.1%)	4 (57.1%)	3 (42.9%)	4 (57.1%)	3 (42.9%)
	Pearson's Chi-Square	0.77		0.401		0.77		0.237		0.77		0.676	
Band Size	< 34 (n = 6)	2 (33.3%)	4 (66.7%)	2 (33.3)	4 (66.7%)	3 (50%)	4 (50%)	4 (66.7%)	2 (33.3%)	2 (33.3%)	4 (66.7%)	5 (83.3%)	1 (16.7%)
	34 (n = 10)	5 (50%)	5 (50%)	5 (50%)	5 (50%)	5 (50%)	5 (50%)	4 (40%)	6 (60%)	6 (60%)	4 (40%)	5 (50%)	5 (50%)
	>34 (n = 8)	4 (50%)	4 (50%)	5 (62.5%)	3 (37.5%)	5 (62.5%)	3 (37.5%)	3 (37.5%)	5 (62.5%)	5 (62.5%)	3 (37.5%)	4 (50%)	4 (50%)
	Pearson's Chi-Square	0.777		0.558		0.845		0.494		0.494		0.358	
Cup Size	DD (n = 10)	4 (40%)	6 (60%)	5 (50%)	5 (50%)	8 (80%)	2 (20%)	4 (40%)	6 (60%)	5 (50%)	5 (50%)	4 (40%)	6 (60%)
	E, F (n = 7)	4 (57.1%)	3 (42.9%)	4 (57.1%)	3 (42.9%)	0 (0%)	7 (100%)	5 (71.4%)	2 (28.6%)	4 (571%)	3 (42.9%)	5 (71.4%)	2 (28.6)
	G, H, HH (n = 7)	3 (42.9%)	4 (57.1%)	3 (42.9%)	4 (57.1%)	5 (71.4%)	2 (28.6%)	2 (28.6%)	5 (71.4%)	4 (57.1%)	3 (42.9%)	5 (71.4%)	2 (28.6%)
	Pearson's Chi-Square	0.770		0.866		0.003		0.244		0.942		0.306	

psychological factors may play a role in preventing correct bra fit. Larger breasted women often experience episodes of poor psychological wellbeing, low self-esteem and feelings of embarrassment, and therefore methods of educating this group of women may be challenging and may be met with some resistance.

A lack of knowledge in breast health and bra fit has previously been demonstrated and breast related factors are the fourth most reported barrier to participation in physical activity (Burnett et al., 2015; Scurr et al., 2016). Although a traditional bra is usually worn during activities of daily living, and not physical activity, it is equally as important to educate and enable women to achieve correct bra fit relative to function. Achieving this may contribute towards removing barriers to physical activity, which can have multiple positive effects: improving self-esteem, lifting mood and other addressing previously reported negative health implications such as weight and appearance dissatisfaction (Bowles et al., 2008; Swami et al., 2020). In a study investigating sports bra use and breast support in the London 2012 marathon, nearly three-quarters of participants subjectively rated their own breast health and bra fit awareness as average or below-average, which reinforces the need to educate women about bra fit (Brown et al., 2014a).

Upon reflection, this study is not without its limitations. An important factor which was not considered within this study, was the age of the bra, which has previously been acknowledged as an influencing factor for bra fit quality (Pechter, 1998). Frequency of bra replacement influences the supportive capabilities of a bra (Isokariari, 2018). Although a bra may fit at the time of purchase, wearing and laundering may cause deterioration of its shape and structure (Isokariari, 2018; Pechter, 1998). Had the age of the bras been recorded, this could have been considered as a potentially influencing factor. Furthermore, the specific design of each bra (e.g. balconette, full cup, crop top, etc.) and its impact on bra fit quality was not considered, although all bras worn did have an underwire. In future studies, comparisons between different designs of bras may inform the extent to which different designs influence bra fit breast support.

A larger sample size would have been beneficial to improve generalisability of results and would be recommended for any future studies that adopt a similar methodology to asses bra fit knowledge. Whilst the bra fit assessment included within this study is not a validated measure, it has been used in other previous breast and bra related research studies (McGhee et al., 2010; McGhee & Steele, 2010), and is the only current measurement tool of its kind to assess the quality of bra fit. Furthermore, although the inter-tester reliability of the bra fit assessment was not analysed statistically, there was 100% agreement between researchers during data collection with no conflicts to overcome. Two researchers completed each bra fit assessment to reduce the risk of personal opinion and subjective judgement affecting the objective bra fit assessment results, and the level of agreement confirms the value of the training prior to data collection and the availability of photographic examples of each bra fit issue for reference throughout the assessment.

It would also have been interesting to assess how other specific characteristics may have influenced the results of this study. For example, exploring whether education level, or ethnicity correlates with measures of bra fit quality could reveal important trends, and provide a deeper understanding of the factors influencing subjective and objective fit evaluations. Future studies could benefit from including these characteristics as part of their demographics.

A final limitation of this study is that the subjective perceptions were recorded on a Likert scale, reporting the frequency in which the individual had experienced the specific bra fit issue, whereas the objective assessment was a simple pass or fail at a specific moment in time. Future studies may benefit from using the same scoring system regardless of whether the assessment is objective or subjective.

5. Conclusion

The results from this study demonstrated the poor ability of women to identify bra fit issues, which may provide reason as to why the bras only partially met participants' needs in terms of comfort and support, and why the prevalence of poor bra fit amongst women is so high. More effort is required to educate women and girls about the importance of bra fitting for health and wellbeing. Future work should focus on interventions to increase bra fit knowledge, and breast health awareness with an aim to improve bra fit quality, as well as determining whether specific individual characteristics influence an individual's ability to achieve correct bra fit.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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