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Breast Pain and Sports Bra Usage Reported by Chinese Women: Why Sports Bra Education Programs are Needed in China

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Abstract
This study aimed to evaluate breast pain and sports bra usage reported by Chinese women and to analyse whether they were affected by age, education, occupation, income or breast size. Four hundred and four Chinese women completed a questionnaire to determine their breast pain and its frequency as well as sports bra usage. Although more than 60% of Chinese women experienced breast pain during exercise, only 40% of them had ever worn a sports bra. The high percentage of participants who experienced breast pain and low percentage of sports bra usage confirmed the need to educate Chinese women on sports bra fit, design and reasons for wearing sports bras. Age, bra size and income level should be considered when implementing these educational programs.

Key words: *breast pain, sports bra usage, bra fit, bra size, education program.*

Introduction

Breast pain is a common complaint from women, particularly when they exercise. Forty to eighty-five per cent of women who are evaluated for breast symptoms complain of breast pain [1-3] and 70% of women have reported suffering from severe breast pain at some time during their lives [4]. Brown *et al*. [5] found that breast pain was reported by one third of the female runners surveyed from the 2012 London marathon. Breast pain has also been related to increased anxiety and depression [2]. Although the specific mechanisms causing breast pain are not clearly understood, excessive breast motion during exercise can lead to breast pain, which is sufficient to impede women from enjoying the health benefits associated with an active lifestyle [6].

Well-fitting and supportive bras have been proven to be an effective way to reduce exercise-induced breast pain or discomfort [6-8]. In fact, wearing a sports bra during exercise is more effective at reducing breast motion and related breast pain and discomfort than wearing a fashion bra. Sports bras are therefore recommended for females to wear during exercise [8-11]. Despite the importance of effective breast support, sports bras are not the most common choice of breast support during exercise for young women living in countries like Australia and the United Kingdom. For example, Bowles *et al*. [12] found that although the percentage of exercise-induced breast pain reported by young Australian women was 64%, the percentage of women wearing an encapsulating sports bra was only 41%. Due to the high proportion of women not wearing sports bras when they exercise, several researchers have suggested that education programs on the importance of wearing a well-fitted and supportive bra during exercise should be implemented [12-14]. Furthermore, a systematic study in a young Australian cohort showed that bra fit education leads to improved bra fit and sports bra usage [13]. Given that research has shown that 76% to 85% of women wear a wrong size bra [15, 16], it is evident that educational programs designed to highlight the importance of bra fit, as well as how to achieve correct fit, are warranted.

Although several studies have documented the exercise-induced breast pain reported by women living in the United States, the United Kingdom, and Australia, no literature was found investigating whether Asian women also experience breast pain when they exercise. Before education programs on bra fit and sports bra knowledge can be designed and implemented in a Chinese population, it is important to evaluate the current level of breast pain and sports bra usage among Chinese women. Although the effect of bra type and gait speed on breast and bra discomfort perceived by Chinese women was assessed though an experiment in a previous study [17], no research could be found investigating the level of breast pain and sports bra usage reported by the Chinese population. Understanding the population's specific needs will lead to an evidence-based and better targeted educational program that is likely to be effective in improving bra fit and sports bra usage and, in turn, reducing breast pain among Chinese women.

The aim of this research was to investigate breast pain and sports bra usage of Chinese women. If breast pain and bra discomfort reported by Chinese women are high and sports bra usage is low, the results of the study will be used as evidence to inform and support the implementation of education programs in China regarding the importance of both correct bra fit and wearing a supportive sports bra when exercising. It was hypothesised that the percentage of Chinese women who report exercise-induced breast pain or discomfort and the percentage of these women wearing sports bras would be similar to percentages reported by Caucasian women. Furthermore, it was hypothesised that breast pain and sports bra usage would be significantly affected by factors like age, educational background, occupation, income and breast size.

Method

Survey development and implementation

A custom online survey consisting of 35 closed-ended questions was designed to investigate breast pain and sports bra usage reported by Chinese women, as well as their knowledge of bra fit and their bra purchasing habits. Each respondent's age, bra size, educational background, occupation, and monthly income were also recorded to evaluate the effect of these factors on breast pain and sports bra usage.

To establish content validity, the online survey was derived from relevant litera-

ture on breast pain and sports bra usage in non-Chinese populations [12, 18]. For readability in the target population, the survey was written in Chinese. A developmental version of the survey was reviewed by 10 Chinese students majoring in fashion engineering and 10 Chinese students in other majors, who provided suggestions to improve the clarity and readability of the final survey. These students were chosen because Chinese students majoring in fashion engineering could offer professional suggestions, and those in other majors could provide non-specialist suggestions.

Following the review, a final survey was published and responses collected online through the www.sojump.com website, which is one of the most common online survey websites in China. The survey was recommended by the website to its visitors randomly. Once posted the survey was available to be completed for four weeks. It was clearly stated at the start of the survey that all the responses collected were solely for academic research. Tacit consent was applied, such that by completing the survey, the participants gave their informed consent to participate in the study. This approach was used to ensure that every respondent provided consent, while having her confidentiality preserved.

The online survey employed skip logic, whereby participants were guided to relevant sections of the survey based on their response to a previous question. Because only surveys with complete responses were automatically collected, it was not possible to compute the response rate. The Internet Protocol (IP) address of each response was checked to ensure no duplicate responses. The survey was tested for reliability with Cronbach's Alpha coefficient of 0.731 in SPSS software (IBM Inc., Armonk, USA, Version 17.0), which accorded with the notion that conclusions can be accepted when Cronbach's Alpha coefficient was higher than 0.7 [19]. All procedures in this study were approved by Shanghai University of Engineering Science, Shanghai, China.

Survey content

Bra size

In this section, the respondents were asked: "Do you know your bra size?". If the answer was "Yes", the respondents were asked to provide their bra size using the Chinese bra sizing system.

Breast pain

Respondents were asked to classify the frequency they suffered breast pain or discomfort using three levels: never, at times and frequently. If participants reported that they suffered from breast pain or discomfort, they were asked to identify what they believed were the causes of this pain or discomfort. The causes were listed as menstruation, exercise, inappropriate bra or other causes, which were then specified by the participants.

Sports bra usage

In this section, participants were firstly required to rate the extent of their sports bra knowledge, defined as "very familiar", "familiar", "heard of the concept but unfamiliar" and "never heard of". Participants were then required to answer whether they ever wore a sports bra when they participated in physical activity or were currently wearing one. Participants who never used a sports bra were asked to choose the reasons why, which were listed as "no need to wear a sports bra", "never considered wearing a sports bra", "would like to wear a sports bra, but have not bought one yet", and "other reasons". Participants were required to answer when they thought a sports bra should be used, with the options being defined as "never", "during only intensive exercise", "during any level of exercise" and "during any level of exercise and in daily life".

Demography information

Participants provided their demographic information, including age, educational background, occupation and monthly income.

Statistical analysis

The automatically generated file containing all response information was downloaded and analysed using SPSS software (IBM Inc., Armonk, USA, Version 17.0). The demographic characteristics of the total sample of respondents (n = 404) were then characterised using a frequency analysis. Kruskal-Wallis Tests were used to investigate whether age, educational background, occupation or monthly income had a significant effect on whether participants reported a bra size, breast pain or sports bra usage. Mann-Whitney Tests were used to identify whether there were any significant differences among the various ages, educational backgrounds, occupations and monthly income levels. The significance level was set at 0.05.

Table 1. Number and percentage of respondents according to age, education, occupation and income category (n = 404).

Sample characteristics	Options	Number of respondents	Percentage, %
Age (years)	18-25	59	14.6
	26-35	266	65.8
	36-45	69	17.1
	>45	10	2.5
Educational background	Senior high school and under	14	3.5
	College or bachelor degree	358	88.6
	Postgraduate degree	32	7.9
Occupation	Foreign enterprise	64	15.8
	Private enterprise	145	35.9
	State-owned enterprise	103	25.5
	Self-employment	23	5.7
	Government agency	35	8.7
	Student	17	4.2
	Other	17	4.2
Monthly income (Yuan)	<1500	16	4.0
	1500-2500	41	10.1
	2500-3500	98	24.3
	3500-5000	117	29.0
	>5000	132	32.7

Results

Sample characteristics

Four hundred and four respondents completed the survey. Three hundred and sixty six respondents' IP addresses were distributed in 28 Chinese provinces, 18 (4%) of which were based in countries other than China, and the location of the remaining 20 (5%) could not be identified, who were likely to be Chinese women because they could access the www.sojump.com website and could read a survey written in Chinese. ***Table 1*** shows the age, educational background, occupa-

tion and monthly income of the respondents (n = 404), most of whom were aged between 26 - 35 years (65.8%) and had achieved a college or bachelor degree (88.6%). The three most common occupations reported by the respondents were private enterprise (35.9%), state-owned enterprise (25.5%) and foreign enterprise (15.8%). Most respondents (>60%) earned over 3500 Yuan per month, which is lower than the average wage (4290 Yuan per month) of employed persons in urban units in China [20].

Bra size

Of the 264 respondents (65.4%) who reported their bra sizes, 205 (50.7%) reported both their bra band and cup size, whereas 59 (14.6%) incorrectly reported their bra sizes, missing either the band size or cup size. One hundred and forty respondents (34.7%) reported "No" to the question "Do you know your own bra size?". Nineteen bra sizes were reported, with the band size ranging from 65 to 95 and cup size from A to F (Chinese bra sizing system). The most frequently reported cup sizes were B cup (61%), followed by A cup (26.3%), C cup (10.2%) and C+ cup (2.5%). The most common bra size reported by respondents was 75B (17.3%). Respondents who reported an A and B cup size were classified as women with small breasts (87.3%), and respondents who reported C and C+ cup size were classified as women with large breasts (12.7%) [10].

Age and occupation had no significant effect on whether respondents reported their bra size ($\chi^2 = 5.666$, $p = 0.129$; $\chi^2 = 3.205$, $p = 0.783$, respectively). However, monthly income and educational background significantly affected bra size reporting ($\chi^2 = 10.373$, $p = 0.035$; $\chi^2 = 9.745$, $p < 0.01$, respectively), where participants with a monthly income of 2500 - 3500 Yuan or with an educational background of senior high school and under were more likely not to report their bra sizes.

Breast pain

Two hundred and fifty-three respondents (62.6%) reported that they had experienced breast pain during exercise. Of this cohort, 248 respondents (61.4%) experienced breast pain at times and 5 (1.2%) frequently experienced breast pain. Of participants who had experienced breast pain, 97 respondents (24.0%) ascribed breast pain to menstruation, 140 (34.7%) to exercise and 155 (38.4%) to wearing an inappropriate bra. Age, educational background, occupation and monthly income had no significant effect on respondents who reported ever experiencing breast pain during exercise ($\chi^2 = 3.459$, $p = 0.326$; $\chi^2 = 2.413$, $p = 0.299$; $\chi^2 = 6.721$, $p = 0.347$; $\chi^2 = 5.533$, $p = 0.237$) or reasons for breast pain. Breast size was not significantly related to breast pain ($z = -1.091$, $p = 2.275$). However, this had a significant effect for participants reporting exercise as the cause of their breast pain ($z = -2.268$, $p = 0.023$), where more women with large breasts believed exercise was a reason for their breast pain than those with small breasts.

Sports bra usage

Two hundred respondents (38.1%) reported being "familiar with" sports bras, and 46 (11.4%) reported being "very familiar with" them. However, 204 respondents (45.5%) reported that they had "heard of the concept but being unfamiliar" with sports bras, and 20 respondents (5.0%) reported they had "never heard of" a sports bra. Age, occupation and monthly income significantly affected the extent of familiarity with sports bras ($\chi^2 = 13.04$, $p < 0.01$; $\chi^2 = 14.378$, $p = 0.01$; $\chi^2 = 10.947$, $p = 0.027$). That is, respondents aged 26-35 years were more familiar with sports bras than those aged 18 - 25 years ($z = -3.600$, $p < 0.01$). Respondents working in foreign companies were more familiar with sports bras than those working in a private company or state-owned company, as well as students and those in other occupations ($z = -2.192$, $p = 0.028$; $z = -1.979$, $p = 0.048$; $z = -2.521$, $p = 0.012$; $z = -3.174$, $p < 0.01$). Respondents working in a private company or state-owned company were more familiar with sports bras than those in other occupations ($z = -2.098$, $p = 0.036$; $z = -2.221$, $p = 0.026$). Respondents with a monthly income of more than 5000 Yuan were more familiar with sports bras than other income groups.

Only 39.85% of respondents had ever worn a sports bra. Age, monthly income and breast size significantly affected sports bra usage ($\chi^2 = 12.504$, $p < 0.01$; $\chi^2 = 15.245$, $p < 0.01$; $z = -2.244$, $p = 0.025$). In each age group, less than half of the respondents had ever worn a sports bra. This was especially true for those aged 18-25 years (25.5%) and 36-45 years (29.0%), where the percentage was derived from each specified age group. Respondents aged 26-35 years (45.9%) and 40+ years (40.0%) wore a sports bra more frequently than those aged 18-25 (25.4%) or 36-45 years (29.0%) ($z = -2.872$, $p < 0.01$; $z = -2.524$, $p = 0.012$, respectively). Respondents with a high monthly income of more than 5000 Yuan (53%) were more likely to have ever worn a sports bra as compared with their low monthly income counterparts (< 36% for any monthly income level less than or equal to 5000 Yuan). The most common reason for why respondents had not worn a sports bra was that they had "never considered wearing a sports bra" (53.1%), or that they "would like to wear a sports bra, but have not bought one yet" (34.2%). Only 12.4% of respondents (30) reported they had "no need to wear a sports bra". Reasons for not wearing a sports bra according to age, educational background, occupation, monthly income and breast size are shown in ***Table 2***.

Breast pain had a significant effect on sports bra usage ($\chi^2 = 6.022$, $p = 0.049$), whereby respondents who experienced breast pain at times were more likely to wear a sports bra than respondents who never experienced breast pain ($z = -2.275$, $p = 0.023$). However, up to 40% of the respondents who frequently experienced breast pain never wore a sports bra, and more than half of the respondents who suffered from breast discomfort or pain at times never wore a sports bra.

Discussion

This is the first study to evaluate breast pain and sports bra usage reported by Chinese women and to identify how they were affected by factors such as age, education, occupation, income and breast size. The results revealed that although more than 60% of Chinese women experienced breast pain during exercise, only 40% of them had ever worn a sports bra, with the most common reason for not wearing a sports bra being not considering wearing one. The implications of these important findings, with implications for educational programs, are discussed below.

Bra size

Thirty-four per cent of respondents in the present study reported "No" to

Table 2. *Number and within-group percentage of respondents according to reasons for not using a sports bra (n=243).*

Variables	Options	Reasons for not using a sports bra				
		No need, %	No consideration, %	Plan to but not yet, %	Other reasons, %	Total, %
Age (years)	18 - 25	3 (6.8)	26 (59.1)	14 (31.8)	1 (2.3)	44 (100)
	26 - 35	20 (13.9)	77 (53.5)	47 (32.6)	0 (0)	144 (100)
	36 - 45	7 (14.3)	24 (49.0)	18 (36.7)	0 (0)	49 (100)
	> 45	0 (0)	2 (33.3)	4 (66.7)	0 (0)	6 (100)
Educational background	Senior high school and under	0 (0)	6 (66.7)	3 (33.3)	0 (0)	9 (100)
	College or bachelor degree	25 (11.7)	115 (53.7)	73 (34.1)	1 (0.5)	214 (100)
	Postgraduate degree	5 (25.0)	8 (40.0)	7 (35.0)	0 (0)	20 (100)
Occupation	Foreign enterprise	2 (6.9)	19 (65.5)	8 (27.6)	0 (0)	29 (100)
	Private enterprise	11 (12.8)	46 (53.5)	29 (33.7)	0 (0)	86 (100)
	State-owned enterprise	8 (12.9)	30 (48.4)	23 (37.1)	1 (1.6)	62 (100)
	Self employment	4 (25.0)	9 (56.3)	3 (18.8)	0 (0)	16 (100)
	Government agency	0 (0)	14 (56.0)	11 (44.0)	0 (0)	25 (100)
	Student	1 (8.3)	7 (58.3)	4 (33.3)	0 (0)	12 (100)
	Other	4 (30.8)	4 (30.8)	5 (38.5)	0 (0)	13 (100)
Monthly income (Yuan)	< 1500	2 (18.2)	6 (54.5)	3 (27.3)	0 (0)	11 (100)
	1500 - 2500	3 (10.0)	18 (60.0)	9 (30.0)	0 (0)	30 (100)
	2500 - 3500	5 (7.7)	36 (55.4)	23 (35.4)	1 (1.5)	65 (100)
	3500 - 5000	10 (13.3)	39 (52.0)	26 (34.7)	0 (0)	75 (100)
	> 5000	10 (16.1)	30 (48.4)	22 (35.5)	0 (0)	62 (100)
Breast size	Small breasts	16 (15.4)	58 (55.8)	29 (27.9)	1 (1.0)	104 (100)
	Large breasts	1 (11.1)	5 (55.6)	3 (33.3)	0 (0)	9 (100)
	Not reported	13 (10.0)	66 (50.8)	51 (39.2)	0 (0)	130 (100)

the question: "Do you know your own bra size", which was much higher than the percentage of respondents (1%) who had not reported their bra size in previous research [12]. This finding suggests that Chinese women are less familiar with their bra size than Australian women. Only 65.4% of respondents in this research reported their bra sizes, and 14.7% reported a wrong band size or reported only the band or cup size. These results indicate that the Chinese women surveyed in this study had poor knowledge regarding their bra size, which reinforces the need to educate Chinese women on bra fit knowledge. Only 12.7% of the 205 respondents who provided a complete bra size were categorised as having large breasts, which was much less than the 56% reported in previous research on an Australian population [12], suggesting that the respondents in this study had smaller breasts than their Australian counterparts. Recent research also found that incorrect bra fit at the front band, underwire and strap components significantly differed between breast sizes, implying this is an important factor for bra fit evaluation [21].

Educational background and monthly income had a significant effect on whether a respondent reported a complete (band and cup) bra size. Respondents with lower education levels were less likely to report their bra sizes compared to respondents with higher education levels. Respondents with a moderate monthly income (2500 - 3500 Yuan) were least likely to report their bra sizes when compared to their counterparts at other income levels. These findings suggest that women with lower education and income levels should be the initial focus when developing educational material regarding bra fit knowledge.

Breast pain

Sixty-three per cent of respondents indicated that they suffered from breast pain or discomfort at times or frequently, which is comparable with the 64% of participants suffering breast pain reported by Bowles, Steele, and Munro [12], although higher than the 56% reported by Gehlsen and Stoner [22]. It is interesting that although the respondents in the present study generally had smaller breast sizes than the aforementioned research, a similar percentage of respondents reported breast pain. A large percentage of respondents ascribed their breast pain to more than one reason, with 38.3% of whom ascribing breast pain to menstruation, less than the 45% reported by Bowles *et al*. [12]. More of these respondents (61.3%) ascribed breast pain to inappropriate breast support and 54.9% to exercise, suggesting that better breast support could alleviate breast pain or discomfort in Chinese women when they are exercising. With regards to the relationship between breast pain and exercise, decreasing exercise intensity or hours of participating in exercise is not a feasible suggestion, due to the multitude of health benefits associated with exercise [23-29]. Rather, given that well-fitting sports bras can decrease breast pain and discomfort during exercise [7-8], improving breast support provides a much more appropriate solution to reducing breast pain.

Sports bra usage

About half of respondents had heard of, but were unfamiliar with, the concept of a sports bra, and about 5% had never heard of a sports bra. The degree of familiarity with sports bras differed significantly between different ages, occupations and income levels, suggesting that these three factors should be taken into consideration when implementing sports bra knowledge programs in China.

Almost 40% of respondents had ever worn a sports bra, 23% lower than the percentage of those who ever experienced breast pain, which was in agreement with our first hypothesis. The percentage of respondents who had ever worn a sports bra was almost half of the percentage of 71% indicated by Bowles *et al*. [12]. The low percentage of sports bra usage in the present study indicated that the Chinese respondents did not frequently use sports bras. This confirms the need to educate women, including Chinese women, on the importance of wearing a well-fitted and supportive

bra during exercise and on the effect of sports bras on reducing exercise-induced breast pain.

Age, breast size and monthly income had a significant effect on sports bra usage, which was consistent with previous research [12]. Respondents with large breasts were more likely to wear sports bras than those with small breasts, again consistent with previous literature [12]. Respondents aged 26-35 years were less likely to wear a sports bra than those in the 18-25 and 36-45 years age groups. Compared with their low monthly income counterparts, a larger percentage of respondents with high monthly incomes had ever worn a sports bra, which may simply be because they were more able to afford one.

Fifty-three per cent of respondents who had never used a sports bra (n = 129) indicated that they had not considered wearing one, which was much greater than the 15% reported by Bowles *et al.* [12]. Only 12.4% of respondents (n = 30) reported that they did not need to wear a sports bra, which was substantially lower than the 27% of participants who reported they did not need to wear a sports bra in the research of Bowles *et al*. [12]. These results suggest that Chinese women are currently much less likely to use a sports bra than Australian women. However, a large percentage of Chinese women did not use a sports bra because they had not considered wearing one rather than because they did not want/need to wear one. This reinforces the need for an education program regarding the importance of wearing a well-fitting and supportive sports bra during exercise.

Breast pain had a significant effect on sports bra usage, where respondents who experienced breast discomfort at times were more likely to wear a sports bra than those who never experienced breast pain. However, 52% of respondents (n = 72) who believed exercise was a cause of breast pain never wore a sports bra. This percentage also indicated that not all respondents realised the benefits of wearing a sports bra for reducing breast motion and related breast pain or discomfort during exercise.

Strengths and limitations

The primary limitation of this study is that the visitor characteristics of the survey website are likely to affect the respondent group. The percentage of young respondents (26 - 35 years old) and those who had achieved a degree (college or bachelor) is higher than we expected. The percentage of respondents who had a lower monthly income is also very high. This will limit the sector of the Chinese population to which the study findings can be applied. The questions of the survey were closed-ended, which may have limited the answers of respondents. Adding open-ended questions to future surveys is recommended to gain unanticipated information. Despite these limitations, this is the first study to investigate breast pain and sports bra usage among Chinese women, which helps understand the needs of this large sector of the world's population.

Conclusions

The results of this study, particularly with respect to the reporting of bra size, have confirmed the need to educate Chinese women on how to choose a well-fitting bra. The data collected in this paper can be used to confirm the education program content and characters of the education population targeted. Women with lower education and income levels should be the focus when developing the educational materials on bra fit knowledge. Furthermore, the low percentage of sports bra usage and high percentage of breast pain reported in this cohort of Chinese women reinforces the need to implement education programs regarding the importance of wearing a supportive sports bra during exercise targeted at Chinese women. Age, bra size and income level should be considered when designing and implementing such education programs, as these three factors affect the sports bra usage of Chinese women.

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