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Experimental Study in Improving Functionality of Sport Bras

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Abstract: *Breast discomfort is a main reason to restrict women from participating in sports while the lack of motivation, time restriction and poor health are also barriers. The main functionality of a sport bra is to reduce bust bouncing during the sport activity. Though there are number of sports bra brands in the world, there is no method to reduce bust bouncing 100 percent. Mostly women with plus size breasts suffer from these issues and face many challenges in doing high impact sports. According to the literature, different breast shapes, breast positions, breast separations and upper breast fullness in same size category prevail among the women population making it highly complex in fitting a bra, specially sport bra, to these deviated breast forms. Stretch ability control, adjustability, encapsulation and product architecture are the main criterion in reducing bust bouncing in sport bra. Adjustability is, modifying supports to adjust the bra on different breast forms. In that case, women with different breast categories can wear these adjustable sport bras without any fitting issues. The objective of this study is to apply adjustability concept in developing sport bra in order to reduce bust bouncing in different breast forms.*

Key words: *Bust bouncing, Adjustability, Sports bra, Breast*

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I. Introduction

Breasts are mostly composed of fatty tissues and are supported mainly by skin and fragile ligaments called Coopers' ligaments. Therefore, during repetitive or high impact sports, the breasts bounce and pull on the ligaments forcing them to stretch. Once these ligaments have stretched ,the result is sagging breasts. Further, without correct support, breast pain and upper back and shoulder pain will result [1]. A survey from Herriot-Watt University showed that even breasts sized 34A need extra support during sport. Sports bra is a category of bras that provides additional support to female breast during physical exercises. Sports bras are vigorous than normal day-to-day bras; they allow the breasts to move in corporate with the trunk, not separately, thus reducing the chances of damage to the ligaments in the breast during high-impact exercises. A good sports bra should provide a sufficient support by restricting breast motion [1]. The main functionalities of sports bras are reducing bust bouncing, sweat controlling and providing comfortability to the bust area when doing sports.

Haycock (1978) recommended a criteria to evaluate the functions of a sports bra which includes good uplift to the breasts, limited motion of the breasts relative to the body, well-covered fasteners on both sides to prevent abrasion of the skin, wide and non elastic straps that do not slip off the shoulders, no riding up of the bra over the breasts by a wide cradle and absorptive, nonabrasive, and mostly non elastic materials [2].

Though there are number of sports bra brands in the current market, the products they offer do not completely fulfill the physical and fitness requirement of women athletes making women athletes face various difficulties during their workouts. Mainly identified problems are sternum issue, digging issue, sweating problems and bust bouncing. Sternum issue means the bra does not lie flat between the breasts which is mainly affected on plus size breasted women while digging issue is some of the bra edges are dig in to the skin. It feels uncomfortable specially when doing sports. Meanwhile sweating is the most common issue for sports bras as well as intimate bras. Though the main functionality of a sport bra is to reduce bust bouncing during the sport activity, there is no method to reduce bust bouncing 100percent. Sport women, specially women with plus size breasts, suffer various difficulties during their physical activities restricting them to perform to the best of their capacity.

The breast moves independently from the torso in a butterfly formation during running, with 50% of this movement occurring in a vertical direction, 25% in a forwards/backwards direction and 25% in a side to side direction [3]. Researchers have found that movement of a woman's breasts during exercise can range from 4cm during a walk to 15cm when running [3]. Women with large breasts can experience more than 10 cm of breast displacement during running. This multi-directional movement can cause breast pain, even 2cm of vertical breast displacement is sufficient to induce breast discomfort, according to a study of University of Portsmouth. A survey by the university's Research Group in Breast Health (RGBH) found that breasts were the fourth biggest barrier for women to exercise, after lack of motivation, time and poor health.

In reducing bust bouncing issue of sport bra, there are four techniques to be applied, stretchability control, adjustability, encapsulation and product architecture. These techniques are experimented by apparel industry in order to achieve high performance sport bra. Strechability control is done by using high technical materials, silicon flock print, high build rubber print around bust area. Further, compression and encapsulation functionality is also used in reducing bust bouncing. Among the four techniques in reducing bust bouncing, adjustability is the best technique to be applied because it supports to adjust the bra on different breast forms. According to that, any woman among the same size category can be fitted the same bra with the help of adjustability feature.

1.1 Types of sports bras

Normally sports bras can be divided into two main categories as encapsulation and compression bras. Encapsulation bras support each breast separately while the compression bras flatten the breasts and evenly distribute their mass across the chest [4]. Further, bras with both encapsulate and compress the breasts are now available [5] [6] [7] .

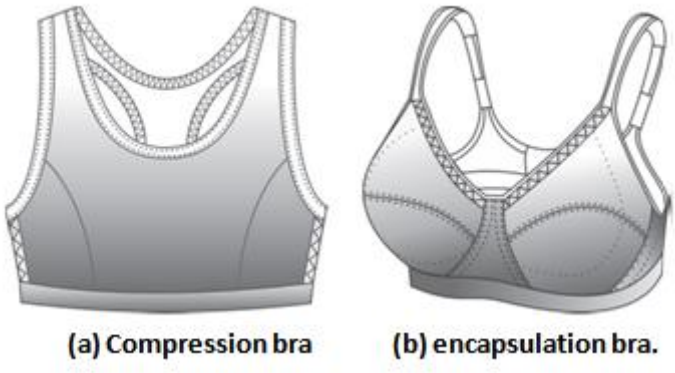

Fig 1.1 Categories of sports bras [8]

Sports bras need to be classified on different breast shapes, breast positions, breast separations and different upper breast fullness in the actual customer segment which is not realistic in the mass production systems of apparel industry. Therefore, in order to fulfill the customer requirements, the sports bras need to be improved using adjustability criterion which can make the bra fits different breast types mentioned above.

II. Methodology

In identifying the main problems of sport bras, questionnaire survey was done by selecting a sample of sports women. The feedbacks were analyzed and consumer requirements were identified. Experimental works were done in order to improve the sport bra which reduces bust bouncing by using both adjustability and encapsulation criteria. The construction of back panel was chosen in the intention of providing perfect, balanced, comfortable fit in while front panel was experimented procuring fundamental conditions like balance, comfortably fit in, and especially concerning about the stability. The straps and bra cradles were varied in the anticipation of achieving the major requirement, the stability of bust area while working out.

2.1 Sample No.1 : Sports bra with stabilized cradle and adjustable horizontal straps

Sports bra with stabilized cradle and adjustable horizontal straps has developed including two layered front with molded cups, two layered back, three layered bra strap with middle stabilizer panel. In this sample, neck and arm hole are secured with v fold over binding while bottom edge was covered with Y elastic bottom band. Stabilize cradle panel bonded on the inner front panel and both inner front panel and outer front panel was bonded together in the cradle part. From this construction, the stretchability of cradle part will be reduced. In order to make the bra adjustable, horizontal straps were inserted to inner front which can be adjusted from the side of the bra. Materials used for main panels are laser cut holes fabric, Spacer and Polyester.

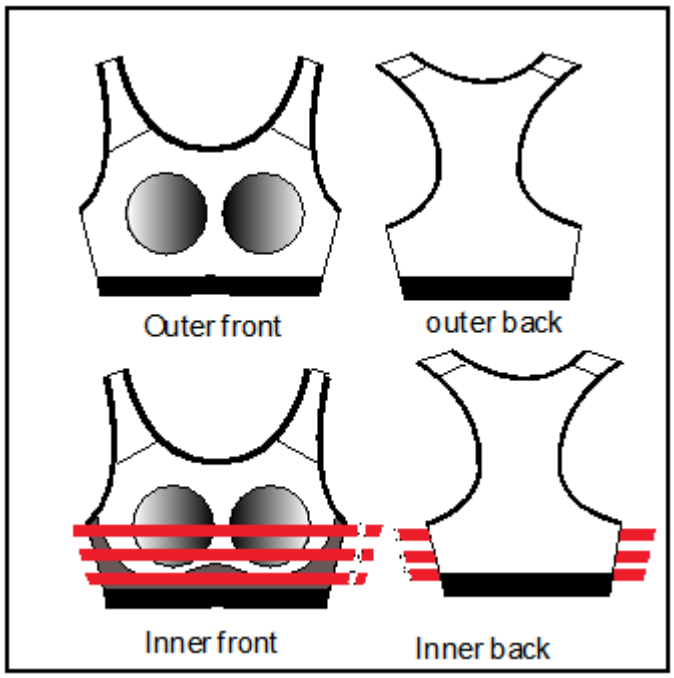

Fig 2.1 Technical Drawing of Sample No.01

2.2 Sample No.2: Sports bra with stabilized cradle and adjustable vertical straps

In this sample with stabilized cradle and adjustable vertical straps, the materials, constructions and patterns are similar to the Sample No. 01. Alteration was done for the front part inserting the adjustable vertical straps where it can be adjusted from the shoulder seam of the bra. The same materials were used as mentioned in sample No.1.

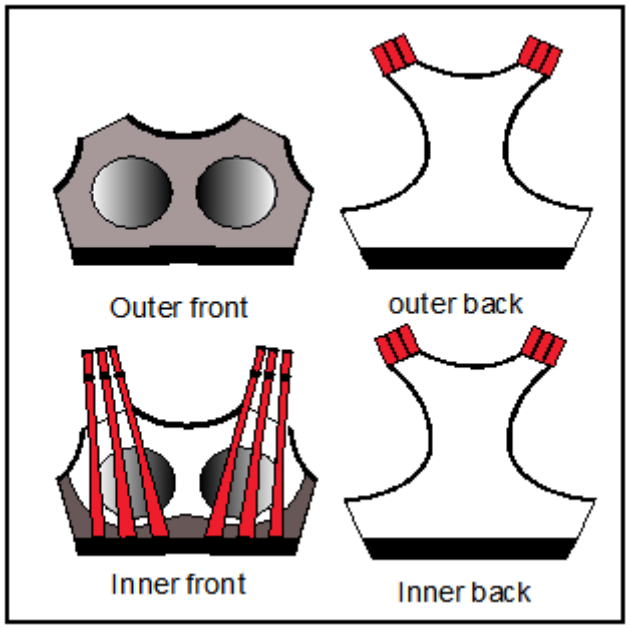

Fig 2.2 Technical Drawing of Sample No.02

2.3 Sample No.3: Sports bra with compression and encapsulation functionalities and adjustable vertical straps

This is a two layered bra which is having both compression and encapsulation functionalities. Inner layer was constructed by using form cup with adjustable straps through the channeling system. This straps can be adjusted for the different breast forms. Middle of the form cup attached to the adjuster which can be adjusted in the center area. Outer layer was constructed for the compression where power mesh layer providing

compression for the breast area. Middle of this part attached to the zipper fastener for the easy on and off. Outer straps are having three layers including stabilized panel. The back part was same having three layers as the previous samples. Materials used for main panels are power mesh, Form cup and Polyester.

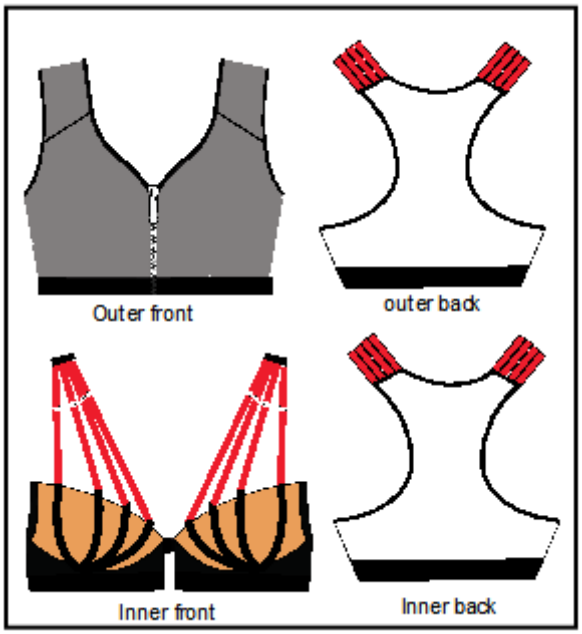

Fig 2.3 Technical Drawing of Sample No.03

III. Results & Discussion

From the questionnaire survey, mainly identified problems regarding sports bras are digging issue, sternum issue, sweating problem and bust bouncing problem. According to Fig 3.1 sweating issue is the main concern (58.6%) with sport bras while bust bouncing issue (44.8%) is also a concern for sport women.

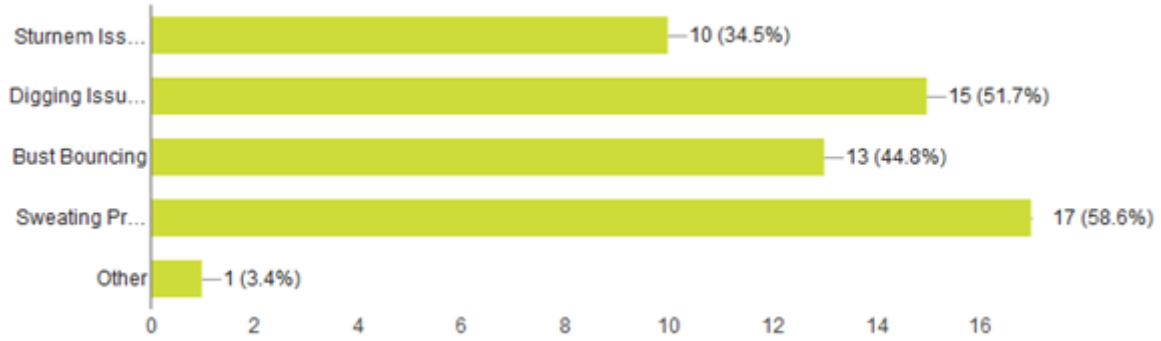

Fig 3.1 physical issues of sports bras

Further, it was revealed from the questionnaire survey that bust bouncing issue is more affected on running and jumping activities of sport women (Fig 3.2).

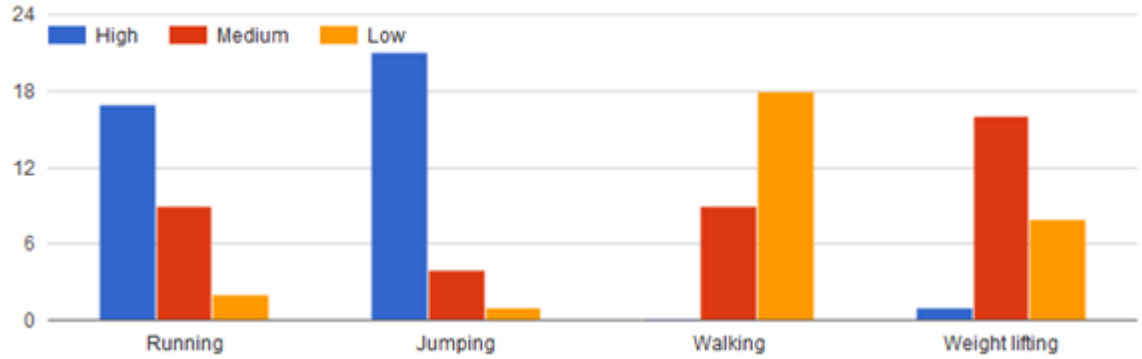

Fig 3.2 Levels of bust bouncing issue affected in each physical activities

Three samples were developed as explained in section 2.0 and model fit on was done in order to get the feedback.

Experimented Sample No. 01

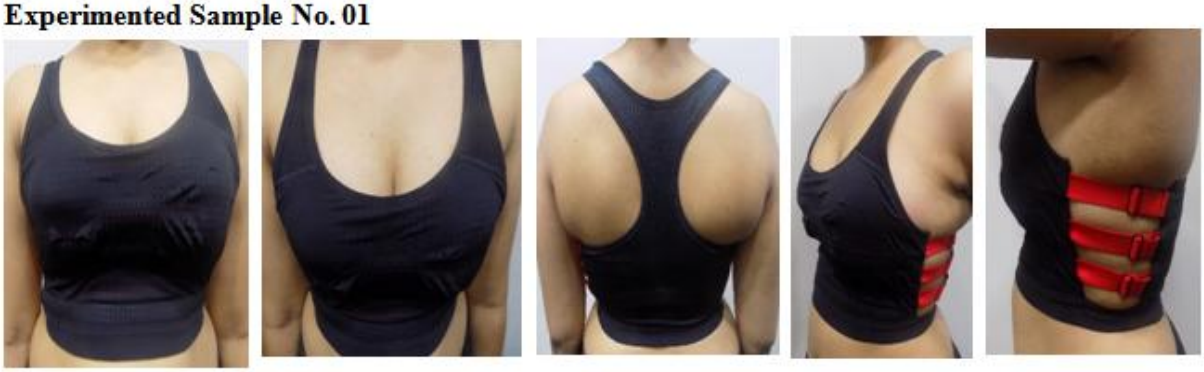

Fig3.3 Double layer molded bra with stabilized cradle and horizontal adjustable straps

Experimented Sample No. 02

Fig 3.4 Double layer molded bra with stabilized cradle and vertical adjustable straps

Experimented Sample No. 03

Fig 3.5. Double layer bra with adjustable form cup and center front adjuster

Sample No 01 has horizontal adjustability while sample No 02 has vertical adjustability. Sample No 03 has both way adjustability vertically and horizontally while it has good encapsulation too.

3.1 Analysis of the wearer feedbacks

Feedback on samples were collected from three sport women who fitted on the three samples and several activities such as running, jumping were done in order to check the performance.

According to the wearers' feedbacks, sample No 01 has fairly good support, good adjustability, fairly enough bust capacity and good garment fit. However, comfortability of the bra is not satisfactory. Accordingly, Sample No. 02 ranked as a good in above properties while comfortability is also fairly good. Sample No. 03 has excellent support, very good adjustability, enough bust capacity and good garment fit while comfortability of the garment is very good. When the physical activities such as running, jumping, up & down movements and shoulder movements were done, sample No.03 was graded as the best one with excellent support and zero bust bouncing for the wearers. According to above analysis sample No.03 is the most suitable sports bra for above mentioned activities for sport women.

IV. Conclusion

The main functionality of a sport bra is to reduce bust bouncing during the sport activity. However, up to date there is no method to reduce bust bouncing 100%. Mostly women with plus size breasts suffer from these issues and face many challenges in doing high impact sports. Though different bra sizes available, due to different breast shapes, breast positions, breast separations and upper breast fullness, bra fitting problems are still prevailing.

In reducing bust bouncing of sports bra, adjustability is the most suitable technique because it allows adjusting the bra on different breast forms too. Further, the other techniques such as, stretchability control, encapsulation and product architecture can be combined with adjustability in reducing bust bouncing of sport bras.

From the experimented bra samples, double layer bra with adjustable form cups and center front adjuster is ranked as the best sport bra with minimum bust bouncing and high comfortability by sport women who fitted on the sample bras and performed physical activities.

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