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Sculpting Confidence: Pattern Alterations for Figure Variations to Enhance Fit of Women's Upper Body Contour Garments

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ABSTRACT

The sari blouse is a prime example of a female upper body contour garment worn in various South Asian countries, including Sri Lanka. However, many women are reluctant to wear it or are often dissatisfied with its fit. A well-fitted sari blouse enhances the overall appearance, adding value to this traditional attire. The fit of an upper body contour garment is directly affected by natural variations in female body shapes, even among individuals of the same body size. Unfortunately, many dressmakers fail to account for these body shape-related differences when crafting sari blouses, leading to widespread dissatisfaction among wearers. This study adopts a practice-led experimental approach to examine fit-related challenges caused by figure variations in standard-sized female bodies. Using a purposive sample of 30 participants, the research systematically identifies fitting issues through wearer trials and proposes seven key pattern alteration techniques as remedial solutions. These alterations focus on critical measurement points, including the shoulder line, side seams, armholes, center back, bust line, bra cut line, and center front, ensuring a more precise fit for upper body contour garments. While the findings offer valuable insights for apparel pattern designers, certain limitations must be considered. The study is based on a specific sample size and body measurements, which may not fully represent broader variations in body types. Additionally, the alterations were developed for a three-piece sari blouse, excluding variations in sleeve designs and fabric properties that could influence fit. Future research should explore the integration of 3D body scanning technologies and digital pattern-making methods to further refine fit accuracy and scalability in mass production. The results of this study contribute to improving the fit of sari blouses and similar upper body contour garments, ultimately enhancing wearer satisfaction and expanding opportunities for customized apparel solutions.

INTRODUCTION

Selecting the perfect fit is pivotal in clothing choices, influenced by various factors like body shape, fabric, design, and clothing purpose. A meticulously tailored garment not only adheres seamlessly to body contours but also ensures comfort for the wearer. It's crucial to acknowledge that even if ten women share the same size, a single dress will fit each differently, owing to their unique body shapes. This distinction extends to sari blouse wearers, exhibiting diverse body shapes and sizes. When contrasting basic fitted attire with contoured garments, the disparity lies in how they conform to the body. While basic fitted garments adhere primarily to outer body edges, contoured ones accommodate the body's curves and hollow spaces, like the bust area, resulting in a closer, more accurate fit. Historically, clothing served utilitarian purposes, but contemporary attire serves as a marker of social identity, aiding in class distinction, image projection, and overall aesthetic enhancement. Traditional cultural attire like the Sari and Osari hold significant value for Sri Lankan women, often worn in government offices, private companies, and weddings, accentuating cultural identity. The standard sari blouse, characterized by short sleeves, low front, and back necklines, and three front pieces with a bra cut line, offers support and shaping

for the upper body. Regardless of style, a well-fitted sari blouse boosts the wearer's confidence and comfort during social interactions. Consumer preferences favour custom-made over ready-made sari blouses among young women, citing reasons like the personalized fit and style preferences. Ultimately, well-fitted clothing contributes significantly to individuals' psychological and social well-being by ensuring ease of movement and maintaining a polished appearance. As in Sood and Pant (2016), young ladies prefer to wear custom-made blouses rather than ready-made sari blouses due to the following reasons:

Fit and Size

Custom-stitched blouses offer superior fit over ready-made ones, prone to size discrepancies.

Style Variety

Ready-made blouses offer limited styles, while custom stitching allows for a broader selection of designs.

Fabric and Stitching Quality

Custom blouses offer control over fabric and stitching, ensuring higher satisfaction compared to compromised quality in ready-made blouses.

Figure variations however compound fitting challenges, as

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women prioritize well-fitted attire. The lead researcher of this study, with seventeen years of hands-on experience in crafting custom sari blouses, highlights significant fitting difficulties for local tailors. They often struggle to accommodate diverse body shapes within standardized sizes, leading to dissatisfaction among sari blouse wearers. Thus, finding efficient techniques to resolve fitting dilemmas in the pattern-making process is crucial.

LITERATURE REVIEW

The Sari Blouse

The Sari or Osari symbolizes traditional attire for Sri Lankan women (Jayasooriya, Silva, & Wanigasundara, 2020), distinguished mainly by draping techniques. While Osari is unique to Sri Lanka, other styles are prevalent in India, Bhutan, Burma, and Malaysia (Varghese & Thilagavathi, 2012). The triple-cut sari blouse is favoured in Sri Lanka (Yapa & Silva, 2020), serving to support and shape the upper female body (Varghese & Thilagavathi, 2012). Additionally, it provides coverage and enhances the feminine silhouette (Yapa & Silva, 2020). Contour garments like the sari blouse have adapted to changing beauty standards (Gupta & Anand, 2016), yet fitting remains an issue, impacting wearers' satisfaction (Yapa & Silva, 2020). Well-fitted blouses not only enhance appearance but also boost confidence and comfort, influencing psychological and social well-being (Varghese & Thilagavathi, 2012).

Considerable Factors for Fitting

Clothing fit encompasses physical and psychological aspects, with accuracy crucial for comfort and satisfaction

(Kim, Sakaguchi, & Takatera, 2020). Achieving precise fit involves aligning the center line and side seams, ensuring accurate proportions, grain balance, and dart placement (Saeed, 2018). However, predicting fit solely based on body measurements is challenging (Ashdown & Dunne, 2006). Individual body differences significantly impact garment fit, even among individuals of the same size (Caruel & Bye, 2020). Tailors must consider this when creating well-fitted custom-made Sari blouses, as fit directly affects comfort and appearance. A well-fitted sari blouse exemplifies a contoured garment, enhancing appearance and comfort (Sood & Pant, 2016). Achieving better-fitted sari blouses requires careful fabric selection, accurate pattern development, and meticulous garment construction (Sood & Pant, 2017). Consumer dissatisfaction with ready-made sari blouses stems from fitting, sizing, style limitations, and poor quality (Sood & Pant, 2016). Custom-made blouses address these concerns, with fit being a crucial determinant of overall garment quality (Saeed, 2018). Well-fitted garments contribute to psychological and social well-being, enhancing comfort and confidence as many study reveal (Smathers & Horridge, 1978; Alexander *et al.*, 2005). To achieve systematic fitting without compromising other garments, understanding defects and providing remedies are essential (Saeed, 2018). Anand & Mehrotra (2016) highlight the distinction between contoured and basic fitted garments, emphasizing the need to modify patterns to accommodate body hollow spaces as in Figure 1. Achieving proper garment fit requires meticulous attention to detail and consideration of individual body differences, ensuring comfort, satisfaction, and overall garment quality.

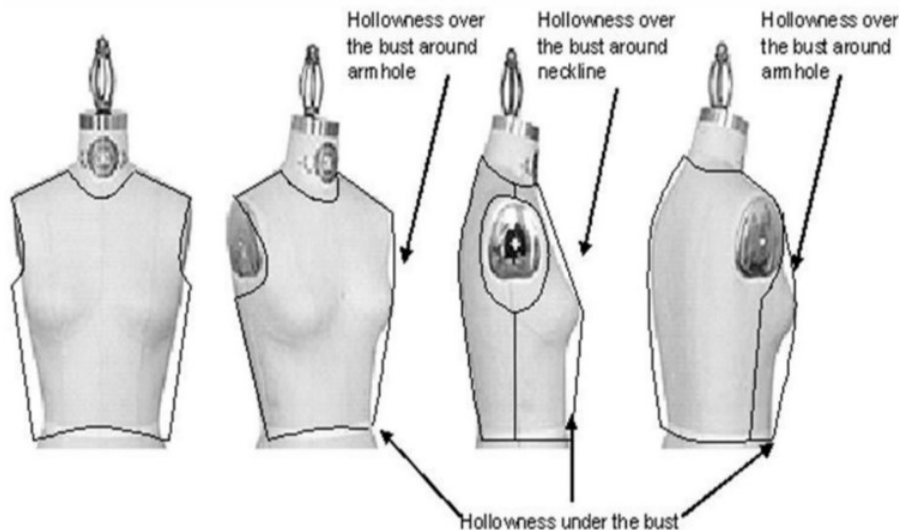


Figure 1: Hollowness around the bust (Anand & Mehrotra, 2016)

As illustrated above various critical areas influence garment fit, including hollow spaces around the bust and neckline, shoulder slope, and side seam contouring. 'Good fitting' entails a garment that conforms to the body without causing discomfort or wrinkles (Saeed, 2018). Well-fitted garments should have aligned seams, and properly positioned darts, and provide comfort and ease of movement (Sood & Pant,

2017). The garment should seamlessly integrate with the wearer, enhancing satisfaction and visual appeal (Varghese & Thilagavathi, 2012).

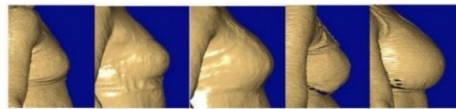
Sari blouses commonly encounter fitting issues such as tightness, shoulder slippage, and hemline rolling (Yapa & Silva, 2020). Shoulder slippage and tight armholes are particularly prevalent (Sood & Pant, 2017).

Achieving proper fit in this instance is crucial for an attractive appearance and quality, but it varies depending on individual body shapes (Saeed, 2018). However, overcoming fitting problems is challenging due to the diverse range of body shapes even within a given size (Yapa & Silva, 2020).

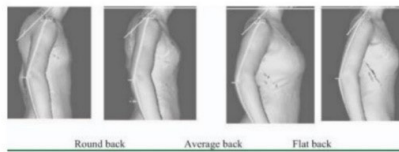
Figure Variations vs the Fit of Garment

The perfect fit in garments is influenced by factors like figure, fabric, design, and intended use (Saeed, 2018). Fit

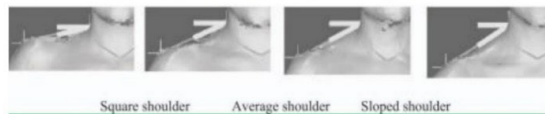
quality can be compromised by appearance, comfort, design, and fabric (Saeed, 2018). Incorrect measurements, fabric misalignment, and wearer perceptions can also lead to poor fitting (Yapa & Silva, 2020). Fit issues often stem from measurements of bust, waist, and hip girths as few studies highlight (Alexander *et al.*, 2005; Caruel & Bye, 2020). Additionally, body shape, including shoulder slope and bust prominence, significantly impacts the garment fit (Chen *et al.*, 2010). Figure 2 can provide clarity on this.



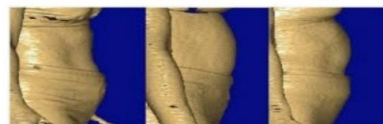
Bust Prominent (Caruel & Bye, 2020; Chen, LaBat, & Bye, 2010)



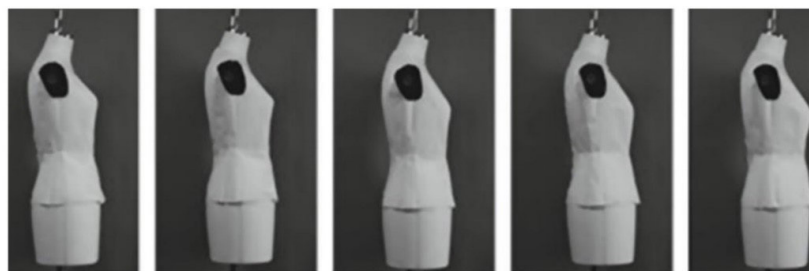
Back curvature (Caruel & Bye, 2020; Chen, LaBat, & Bye, 2010)



Shoulder Slope (Caruel & Bye, 2020; Chen, LaBat, & Bye, 2010)



Belly fat (Caruel & Bye, 2020)



Difference bust line positions (Kim, Sakaguchi, & Takatera, 2020)

Figure 2: Body shape variations

Shan *et al.* (2012) explored apparel fit, emphasizing its close ties to human anatomy and the challenges stemming from body contours. Achieving a seamless fit requires clothing to blend effortlessly with the body's natural shape, facilitating unrestricted movement and a

smooth appearance. Factors such as ease, line, grain, and balance collectively contribute to the desired fit, ensuring garments neither constrict nor wrinkle during wear. The various aspects that contribute to fitting issues encompass figure shapes, fabric types, garment designs, intended

purposes, wearer and observer perceptions, construction, ease of movement, and measurement accuracy. While numerous studies have explored the relationship between body shape and consumer satisfaction in ready-to-wear clothing (Chen *et al.*, 2010), gaps exist regarding fitting issues concerning body variations and wearer satisfaction, particularly in the context of sari blouses. Given that most individuals' body proportions deviate from standard sizing, standard sari blouses often lead to fitting challenges. However, research on the relationship between body variations and fitting remains scarce, necessitating a closer examination of fitting issues based on diverse body contours.

Anand and Mehrotra (2016) emphasize designing contour garments like sari blouses to accommodate the hollow areas created by the bust, highlighting the bust's prominence in achieving a proper fit. Bust, waist, and hip measurements play pivotal roles in classifying body forms and addressing fitting issues (Alexander *et al.*, 2005; Caruel & Bye, 2020), while fit preferences vary among individuals, highlighting the need for manufacturers to consider consumer perspectives.

Prominent bust, back curvature, shoulder slopes, and belly fat are key variations influencing a garment fit, guiding this study's focus on body measurements and sari blouse fitting issues. Chen *et al.* (2010) highlight the importance of body shape measurements for bra fit, with parameters like bust prominence and back curvature significantly impacting fit perceptions. While their research primarily focuses on bras, applicable parameters can inform sari blouse design, given the shared contour garment in nature.

Addressing sari blouse fitting issues related to body variations necessitates measuring the distance from the shoulder to the bust line, crucial for upper garment appearance (Kim *et al.*, 2020). Applying contouring principles around the bust prominence enhances fit, particularly around areas like the bust, armholes, and underbust (Figure 1). The fit and comfort of garments are intertwined, influenced by factors like activity, cultural norms, and environment, with comfort perceptions linked to both psychological and physiological responses.

Other Factors Affecting the Perfect Fit

While figure variations are considered the main variables in this study, other factors that contribute to fitting issues include the fabric type, the design of the garment, the purpose for which the garment is prepared, the perception of the wearer and observer, construction issues, and incorrect measurements. The term 'fit' can refer to either the style or the application of the garment. It can be influenced by current silhouette trends, specific garment types, design details, the accepted mode of dress for individuals or sectors of society, and the functional requirements of the dress as Watkins (2011) explains. According to Saeed (2018), heavy fabrics are not suitable for fitted garments, while flexible fabrics such as crepe and knit can be suitable for a snug fit. Additionally, the

use of stretch knits is crucial for achieving a good fit. According to Varghese and Thilagavathi (2012), fabric selection is an important initial step in the garment design process. It involves considering fabric characteristics, grain alignment, and proper seam placement, as these elements significantly impact the visual appearance of the final garment. When considering garment design, it can be either close-fitting or loose-fitting. Fitting issues mainly occur when there are irregularities in the shape of the figure and incorrect judgments in fabric design (Saeed, 2018). Yapa and Silva's (2020) study demonstrates how the characteristics of the fabric directly affect the visual appearance of the garment.

'Ease' in the context of clothing refers to the difference between the measurements of the body and the garment. It plays a crucial role in providing both comfort and the desired appearance, but if the garment is intended to fit properly. When properly applied, ease allows a garment to feel comfortable and flattering. However, it is essential to strike a balance, as an excessively loose or tight fit can compromise the garments' intended look and function (Saeed, 2018). Incorrect measurements and design issues can result in different amounts of ease being added. The snugness and ease of the clothing depend on personal preferences, attitudes, and the desired look of the consumer as concluded by Alexander *et al.* (2005).

Comfort is a crucial aspect of clothing. If a piece of clothing is appropriately sized, it can provide a comfortable experience while still maintaining a sense of fashion and style. This depends on the specific type of garment and the fabric used (Saeed, 2018). It can be challenging to accurately assess how well a garment will fit based solely on body measurements. Comfort is important because it enables easy movement of the body without any strain or restriction. A properly fitted garment should hang smoothly without any wrinkles. 'Balance' in the apparel terminology refers to the symmetry of the garment on the body, ensuring it hangs evenly on both sides. It also refers to the relationship between the garment and the body, as well as the relationship between different parts of the garment (Saeed, 2018). However, the evaluation of visual fit of a garment can be usually conducted by a panel of experts, as noted by Varghese and Thilagavathi (2012).

Pattern Alterations for Fitting Issues

Tailors utilize standard measurements like bust, waist, shoulder, height, and hip to craft patterns that ensure a snug and comfortable fit for their clients. During measurements, they also consider vital body details such as posture, shoulder shape, bust fullness, stomach protrusion, and any asymmetry (Cabrera & Meyers, 2003), shown in Figure 2. While traditional anthropometry, the study of human body proportions, relies on linear measurements, it falls short in effectively describing and classifying body shapes for pattern-making purposes. Thus, research on body variations' impact on pattern blocks is essential for improvement (Caruel & Bye, 2020). Creating a well-fitted garment from woven fabric

necessitates adjustments in three dimensions: length, girth, and depth. While achieving the right length and girth is relatively straightforward, the main challenge lies in achieving the appropriate depth. In woven fabric garments, depth is achieved through darts, which involve folding the fabric to add height and enable it to conform to the body's three-dimensional shape (Anand & Mehrotra, 2016). By deriving measurements and specifications from the human body, tailors create 2D patterns to cut fabric before sewing, a process known as pattern making or construction (Anand & Mehrotra, 2016). While darts are not employed in the toile in this study, they are adjusted as style lines to craft a triple-cut sari blouse. To attain a contoured fit, patterns must accommodate the hollow areas above, below, and between the bust mound and shoulder blade (Armstrong, 2009). Similarly, Anand & Mehrotra (2016) highlight the importance of modifying the basic pattern when crafting a contour garment for the upper body, considering the hollow areas around the bust

and shoulder blades.

MATERIALS AND METHODS

In Sri Lanka, the sari jacket is very famous for bridal dressing and is a highly important, eagerly anticipated attire during weddings. Over the past 17 years, the chief investigator of this study has actively been involved in creating custom-made bridal sari jacket. The customer feedback has revealed a common complaint about fitting issues with the sari blouses, indicating that local tailors face challenges in achieving the desired fit. Saeed (2018) also emphasizes the crucial role that fit plays in the overall impact of the garment. This section focuses on the materials, equipment, and methods - Study design, sampling, and data collection procedures alongside the practice-based approach used in this research study. Through a practice-based experimental approach, the study develops pattern alterations resulting from figure variations to enhance the fit of the saree blouse as indicated in Figure 3.

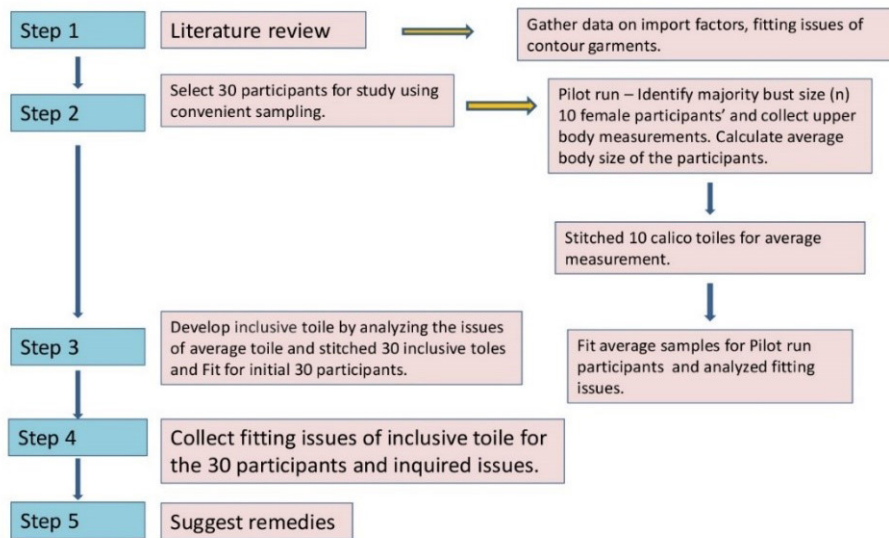


Figure 3: Research design for pattern alterations of upper body contour garment

Research Design

This study initially adopts a qualitative approach, utilizing data gathered from both primary and secondary sources. The self-sorting method, as described by Caruel and Bye (2020), was employed due to the COVID-19 pandemic's restrictions on direct contact, facilitating the recruitment of 30 purposively selected female participants. This sample size aligns with previous studies cited in literature. Approval for the study's design and practice was obtained from the University Ethics Committee (ERN/2023/014) at the University of Moratuwa, Sri Lanka.

During measurement collection, it was observed that the majority of participants fell within the bust size range of 91.5cm-94cm (36"-37"), comprising 37% of the total sample. For the pilot study, 10 participants within this range were purposively selected, targeting university students and staff aged between 23 and 45 years to control for age-related body variations and fitting

concerns. Pregnant or nursing women were excluded due to ethical concerns and frequent breast size changes.

The pilot study aimed to identify fitting issues, which were measured, recorded, and averaged. These average measurements informed the development of a toile (a trial version of the garment). The toile was then tested on a larger sample group of 30 individuals, and fitting issues were assessed based on both objective measurements and wearer feedback. Solutions were proposed based on observed fitting challenges across various body types.

While the practice-based experimental approach allowed for in-depth investigation of individual fit-related concerns, certain limitations must be acknowledged. The purposive sampling method and relatively small sample size limit the generalizability of the findings to broader populations. Additionally, the study primarily focuses on a three-piece sari blouse, excluding variations in sleeve designs, fabric types, and structural modifications that

may influence garment fit. Furthermore, the reliance on manual pattern alterations rather than digitalized methods may present challenges in standardizing these findings for mass production applications.

Materials and Equipment Used for Prototyping

The study employed standard tools and equipment commonly utilized in garment technology and pattern making. These tools included a tape measure, grading ruler, pattern papers, pens, pencils, erasers, scissors, and a set square, which were utilized to create block patterns. For constructing the toiles (prototype garments), calico fabric or grey cloth made of 100% cotton with minimal elasticity was utilized. Calico was selected due to its close resemblance to the cotton fabric typically used to sari blouses lining. Its purpose was to create a cost-effective prototype, facilitating the identification and resolution of any creases or wrinkles resulting from individual body shape variations. Using a standard toile allowed for the high lighting of specific body characteristics deviating from the average size (Cabrera & Meyers, 2003). Single needle lock stitch machines were employed for stitching the toiles.

Creating Patterns for the Average Person from Pilot Run

In the pilot study, we analysed the data from a sample of 10 individuals to establish average body measurements suitable for pattern development. Using the measurements obtained, we identified an average woman to represent the pilot-run sample. From the average woman's measurements, we derived key dimensions (as in figure 4), including waist, back and front waist, shoulder, bust, under bust, bust seam length, side seam, front and back width, armhole, shoulder to bust point, bust point to bra cut line, and front and back neck drop measurements. These measurements served as a reference for creating preliminary patterns for a medium-sized toile. However, due to study limitations, we could only design a three-piece sari blouse without sleeves. The front and back necklines were lower and rounded, with a bra cut line included. Consequently, only front and back pattern pieces were generated for the sari blouse. It's important to note that different sari blouse makers may use their unique pattern-making systems, so specific instructions for creating sari blouse patterns are not provided here. Nonetheless, we offer remedies for any construction issues that may affect the fit.

Figure 4 above indicates the block patterns before cutting the fabric to stitch the toile. The toile represents the initial prototype for an individual of average size in the pilot run. Which exemplifies a proper fit on an average-sized individual, adhering to the five standards for achieving a decent fit: ease, line, set of garments, balance, and grain (Saeed, 2018). The toile showcases a flawless appearance with no wrinkles, and appropriate ease, neither too tight nor too loose. Additionally, the same size number of 10 toiles were prepared for all pilot run participants (n=10).

Bust	93.31 cm
Under bust	75.14 cm
Shoulder to bust	25.85 cm
waist	76.85 cm



Figure 4: Average measurements, Front/back pattern pieces, and Toile of three-piece Sari blouse prepared for of average person (n=10)

Wearer Trial-Collection of Fit-Related Data through the Toile

It is essential to consider five criteria for achieving a good fit: ease, line, garment set, balance, and grain (Saeed, 2018). To ensure accurate contour reduction or enlargement, measurements should align with the natural body contour, employing techniques such as darts or fullness. Such adjustments may be necessary under the bust, around the armhole, around the neckline, and between the bust (Anand & Mehrotra, 2016), as well as for shoulder slope, back curvature, and hem (Chen *et al.*, 2010). All reductions can be marked by creating darts or tucks, while fullness or enlargement can be adjusted by slashing and adding fullness.

The following areas of the body were mainly identified as making fitting issues around:

1. Changes on shoulder
2. Changes on side seam
3. Changes around arm hole
4. Changes on center back
5. Changes on the bust line
6. Changes on bra cut line
7. Changes on center front

All the above issues are again separated into easily measured categories to organise and analyse.

Table 1: Summary of measurement issues

All measurements are centimeters											
Issue	Participant	PO (Average person)	P1	P2	P3	P4	PS	P6	P7	PS	ave
Side seam enlargement (Broadened)		0	1	7	5	5	+L2	+L2	+LS	0	07
Side seam length increment (hem)		0	1	2	1	0	1	2	2	15	1.2
CB Dart		0	1.4	2.4	1	0	2	1.5	2	1.4	1.3
CB height increment		0	3.9	6.5	5.7	1	5.5	7	6.5	5.2	4.6
Shoulder movement to back		0	0.7	0	1	0	15	1	0	0	0.5
AH dropped on SS		0	1	2	1.2	1.5	1.2	2	2	1.5	1.4
AH Dart in front		0	0	2	0	0	0	0	0	2.5	0.5
AH dart in back		0	2	2	0	1.8	0	2	0	0	0.9
CF enlargement top		0	0	0	0	0.5	0	0	0	0	0
to hem		0	0	0	0.5	2.4	1	1	2.4	0	0.8
Side seam movement To front on hem		0	2.4	1.7	2	2.4	2.4	2.4	2.4	2.4	2

After organizing the data of measurements as in Table 1, the mean value of the fitting issues was determined, and this mean value was utilized to develop a reasonable toile for other members in the sample group. This toile served as the inclusive toile for the study. This inclusive toile was fit for the remaining group members totalling 30 individuals. Given the safety precautions of the Corona virus pandemic during the study period, 30 separate inclusive toiles were stitched and fitted for the sample. We highlighted seven key amendments to do while developing inclusive toile as in below. The amendments are indicated through illustrations with relevant explanations.

Remedies for Fitting Issues through Pattern Alterations

Issue 1: Changes on Shoulder Excess Fabrics on Shoulder Line

When an individual with specific body proportions wears a regular-sized garment, it can lead to the accumulation of excess fabric along the shoulder line, as shown in Figure 5 (in caption blue) below. This occurrence is influenced by variations in the shoulder slope and bust prominence, which impacts the measurements from the shoulder to the bust. Kim *et al.* (2020) similarly noted that the position of the bust line can differ, even when the bust, waist, and hip sizes are similar. To comprehend these pattern



Figure 5: Excess fabric on shoulder and pattern correction (in caption blue), shoulder line deviation and pattern corrections (in caption red)

modifications better, visual illustrations are helpful. In Figure 5 (a and b), the AB line represents the portion that needs to be removed from the standard toile block pattern. This adjustment ensures that the front and back shoulders drop by the required measurement without affecting other parts of the blouse.

Shoulder Forward to Front or Back

Due to variations in shoulder-to-bust measurements, the shoulder line tends to deviate. As a result, the entire jacket or blouse rotates towards the front side, which may cause the back side to lift as well. To address this issue, it is necessary to modify the patterns while ensuring that the shoulder line remains in the correct position. By measuring from the toile, from the front shoulder to the back (as shown in Figure 5 in caption red), the shoulder line can be adjusted from point ‘a’ to point ‘b’. Additionally, an equal amount should be cut from the back shoulder line.

Issue 2: Changes on the Side Seam

Too Large or Tight on the Side Seam

When fitting a specific body shape, the average toile often appears excessively large on the side seam as depicted in Figure 6(in caption blue). This problem can occur either at the top or bottom of the side seam. To fix this, the fit-on toile needs to be pinned along the side seam to eliminate the excess fabric. It is crucial to ensure that these adjustments do not affect other areas of the garment. Ensuring that the criteria for the perfect fit mentioned in the literature review are met is crucial throughout this process.



Too Large or Tight on the Side Seam (above)



Side Seam Deviation (above)

Figure 6: Side seam reduction and pattern corrections (in caption blue), Side seam deviation and back armhole dart (in caption red)

To reduce the side seam, start by measuring the amount indicated in the toile, following a similar approach as shown in Figure 6 (in caption blue). Subsequently, subtract this measured amount from the patterns. When making alterations to the front, ensure that the side seams are aligned and proceed to redraw the side seam as indicated by AB line in Figure 6 (in caption blue). Apply the same alteration to both the back pattern and the front pattern (as seen in Figure 6 in caption blue).

Side Seam Deviation

Due to differences in waist measurements between the front and back, there is a deviation in the SS (Side Seam) line. In Figure 6 (in caption red), one of the pictures depicts the presence of an SS line in the toile. This can be corrected by drawing a red line like AC. Similarly, to ensure correctness on the back pattern, a new SS line should be drawn, such as DE in Figure 6 (in caption red). The front should also be adjusted accordingly for the front SS-line AB.

Issue 3: Changes around the armhole

Dart on Front Armhole



Front Armhole Darts (above)

Excess fabric on the side seam (above)

Figure 7: Front Armhole Darts/A-Before and B- after pinning and pattern correction (in caption blue), Excess fabric on the side seam of the armhole removed by AB line (in caption red)

Darts are created on the armhole to fit different bust shapes, which creates a space around the armhole (Anand & Mehrotra, 2016). Pinning and marking them is necessary to make these darts on the standard toile , and then accurately transfer them to the pattern in the correct position. It is worth noting that darts may not

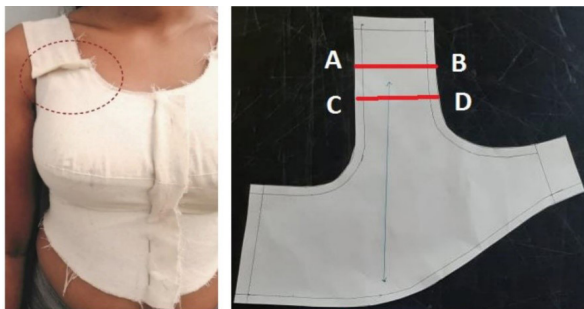
always point towards the bust point as some darts may be placed towards the neckline, as shown in Figure 7 (in caption blue).

After wearing the standard toile, it is essential to ensure that it fits properly. If there are wrinkles, like the ones shown inside A in Figure 7 (in caption blue), use a pin to create a dart (or possibly a tuck or pleat) similar to aide B. To avoid sewing a dart on the blouse and to keep it neat, the dart can be eliminated from the pattern. Start by marking the measurement of the dart on the pattern piece at the correct spot. The end point of the dart should align with the neckline or bust line. Then, it is essential to only cut the seam allowances up to the end point of the dart. This step helps to flatten the pattern. Next, fold the darts and redraw the armhole line as shown in Figure 7 (in caption blue).

Bunching around the Armpit

To ensure a proper fit, the armhole should be adjusted based on the side seam measurement. To remove excess fabric from the armhole, draw a line AB along the back armhole as shown in Figure 7 (in caption red). The amount that the side seam (SS) is dropped should be equal to the amount marked on the toile during the fitting process. This adjustment should also be applied to the front armhole.

Pleat above Bust



Excess fabric above bust



back armhole dart (above)

Figure 8: Excess fabric above bust and pattern corrections (in caption blue), back armhole dart (in caption red)

Due to the hollowness above the bust and the presence of excess fabric as in Figure 8 (in caption blue), it causes a dart or pleat to form above the bust and around the armhole (Anand & Mehrotra, 2016). To eliminate this excess fabric, mark lines AB and CD on the pattern can be closed with the correct amount of pleat.

Back Armhole Dart

In Figure 8 (in caption red), the back armhole dart of ACB should be closed, and then the armhole line, shoulder line, and neckline should be altered by redrawing. While closing the dart, try to maintain the projection of the shoulder area towards the origin. Instead of using the DE line draw the FG line. When drawing the FG line, ensure that point F is placed on the shoulder line, either before folding the dart or by considering any deviations in the shoulder line.

Issue 4 – Changes on Centre Back Center Back Dart



Figure 9: Different back darts and pattern correction

Due to variations in back curvatures, a center-back dart is necessary. This back curvature cannot be accurately measured using a measuring tape alone, and a body scanner is required. Therefore, this method is crucial for accurately assessing body measurements and addressing fitting issues of a contour garment without relying solely on tape measurements. After fitting the toile onto the body, pins are used to mark the dart, as shown in Figure 9. This dart marking is then transferred onto the pattern paper at the back of the center as shown in Figure 9. The AB line represents the new center back line, which should be perpendicular to the hem at point B and perpendicular to the neckline at point A. Adjustments to the hemline shape and the center back height may be made accordingly.

Issue 5 – Changes on the Bust Line Bust Line Dart

Due to variations in the shape and size of the bust, darts are necessary along the bust line. Some people only make darts at the center front (CF), but they should be made along the bust line as shown in Illustration10a. The alteration can be done as shown in Illustration10a patterns. Draw lines AB and A'B' up to the bust point (BP), which represents point B and B'.

From there, continue with the standard bust line up to the side seam (SS). The length of the bust line should be equal in both pattern pieces.

Illustration 10bis another type of bust variation. This variation involves a complete reduction in the prominence of the bust. It does not involve any deductions in the SS length or CF length but rather focuses on reducing the volume of the bust starting from the mount of the bust. This alteration is illustrated in Illustration10b patterns, where the LM line should be equal to the L'M' line for symmetry.



Figure 10: Different types of bust line changes and pattern corrections

Issue 6 – Changes on Bra Cut Line Bra Cut Line Deviation

Due to variations in the measurement from the bust to the underbust (which indicates the height of the bust), there may be deviations in the bra cut line. To ensure a

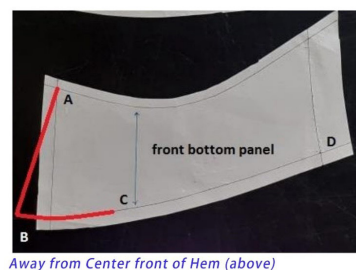
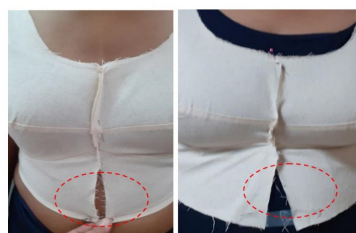


Figure 11: Bra Cut Line Deviation and pattern corrections (in caption red), Away from Center front of Hem and pattern corrections (in caption blue)

perfect fit, that should be altered as shown in Figure 11 (in caption red). After cutting away the middle panel, the bra cut line on the front bottom panel should be raised immediately. The lengths of the bra cut lines AB and A'B' should be equal.

Issue7- Changes on Centre Front Too Tight of CF on Hem

Due to excess belly fat, there is insufficient space on the waist to close both sides of the front panels. To address this issue, it is recommended to increase the waist measurement along the hemline as depicted in Figure 11 (in caption blue).

CONCLUSION

The sari blouse plays a pivotal role as a contour garment complementing the sari, embodying social status, personal identity, and aesthetic appeal in many South Asian countries. Beyond functionality, a properly fitted sari blouse enhances comfort, confidence, and psychological well-being, fostering positive social interactions. This study highlights the impact of body shape variations and garment construction on the fit of upper body contour garments. By emphasizing seven key measurement points, it proposes effective pattern alteration methods to streamline the fitting process and enhance garment satisfaction for wearers.

While the findings provide valuable insights into apparel pattern designers, certain limitations should be acknowledged. The study was conducted with a relatively small sample size of 30 participants, which may not fully capture the diversity of body variations across different populations. Additionally, the study primarily focused on pattern alterations for a standard three-piece sari blouse, excluding variations in sleeve designs and fabric properties that could influence fit. Future research should explore these aspects and investigate the application of digital body scanning and 3D pattern-making technologies to refine fit accuracy further.

Implementing these pattern alteration techniques in real-world garment production poses some challenges, particularly in mass production settings where standardized sizing is prioritized. The feasibility of integrating these customization methods into commercial manufacturing and ready-to-wear garment production warrants further exploration. Collaboration between designers, tailors, and technology-driven solutions may help bridge this gap, ensuring a balance between personalization and scalability. By addressing these challenges and expanding research in this area, the industry can move toward more inclusive and well-fitted upper body contour garments that cater to a broader range of body variations, ultimately enhancing wearer satisfaction and garment performance.

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