Physical and Psychological Comfort Evaluation of Maternity Support Garments

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Abstract

About 50-70% pregnant women have experienced some form of low back pain (LBP). The use of a support belt is a common part of therapy for back pain associated with pregnancy. However, little research exists with regard to the factors that may influence acceptance and comfort in the use of maternity support garments, which may affect compliance with treatment. This wearer trial involves evaluation of the characteristics of various maternity support garments in an effort to investigate the factors that influence the acceptance and overall comfort of maternity support garments. Multiple regression analysis was performed to investigate which independent variables were predictive of acceptance and overall comfort scores in maternity support garment. The evidence suggests that overall comfort and ease to wear are perhaps the most significant factors for acceptance of maternity support garment and five factors that may largely contribute to the overall comfort are: abdominal comfort, ease of movement, design, heat transfer, and ease to wear. These findings will contribute to the formulation of design, fabrication, and garment construction criteria for future development of maternity support garment with the aim to promote quality of care to patients and compliance with garment treatment.

Keywords: Maternity support garment; Acceptance; Compliance; Comfort

1. Introduction

Low back pain (LBP) is the most common and significant musculoskeletal problem during pregnancy. About 50-70% pregnant women have experienced some form of LBP [1, 2, 3, 4, 5]. The pain can interfere with work, daily activities, and sleep [6, 7, 8, 9, 10, 11, 12, 13, 14, 15]. The use of a support belt is a common part of therapy for back pain associated with pregnancy [16, 17, 18, 19, 20, 21, 22, 23]. The application of a pelvic belt significantly decreased mobility of the sacroiliac joints in 25 women with pregnancy-related pelvic girdle pain, which was in line with the biomechanical predictions [24]. There are other hypotheses about the mechanical/biomechanical effects that support garment may generate including stabilization of the trunk, uplifting of the lower abdomen, raising the intra-abdominal pressure, and correction of the lumbar hyperlordosis [25]. Although the exact mechanism behind the use of support garment in pain relief is not yet known, women have experienced pain reduction with pelvic belt in combination with other therapies [16, 18, 20, 21, 22].

While maternity support garment treatment seems to be promising in the treatment of LBP during pregnancy, little research exists with regard to the factors which may influence acceptance and overall comfort in the use of maternity support garments. Several studies have found specific garment-related factors that affect garment satisfaction and compliance with pressure garment treatment such as comfort, ease of movement, ease of donning, appearance, color, fit, heat, skin problems arising from wearing garment [26, 27, 28, 29, 30, 31]. Given that garment treatment often involves active participation and adherence behavior of the patient, understanding these factors will have significant contributions to the formulation of preliminary guidelines in fabric selection and design criteria for future development of maternity support garments. Improved design and fabrication in maternity support garment would help enhance the quality of care provided to women and ultimately to promote compliance with garment treatment. This wearer trial involves evaluation of the characteristics of various maternity support garments in an effort to investigate the factors that influence the acceptance and overall comfort of maternity support garments. Wearer trial has the advantage of simulating the conditions similar to that experienced in 'normal' wear, results of which is not producible by laboratory testing [32].

Acknowledgments

This research is funded by the Competitive Earmarked Research Grant BQ779. We would like to thank Wacoal (Shanghai) R&D Company Ltd. for sponsoring maternity garment samples and Miss Aggie Chung for the drawings.

2. Method

2.1 Garment samples

Eight commercially-available maternity support garments are assessed in this study. There are four major categories including briefs, belt, cradle and torso support that are claimed to have supportive functions to the wearer's back. Details of each tested sample are described in Table 1. Within each category, there are different variations in the design or the materials used. As it is not feasible to trial wear all styles, experimental styles were selected according to the following criteria. Firstly, there is at least one style in each category. Secondly, the garment design seems to provide abdomen and/ or back support. Thirdly, different main materials are chosen. Fourthly, different style features are preferred.

2.2 Subjects

Ethical approval was sought from The Hong Kong Polytechnic University and the Hospital Authority. Subjects who are able to communicate fluently with the researcher were included. Hong Kong Chinese pregnant women were invited to participate by convenience sampling from the Obstetric Clinics of Queen Mary Hospital.

2.3 Wearer Trial Procedure

To ensure the correct size of garment was used for each trial, the abdominal and hip girths of all subjects were measured and matching sizes were displayed accordingly. Before the trial, the assessment items were explained and the subjects can randomly choose the sequence of wearing the samples. Despite the above procedure, sometimes it is difficult for subjects to provide appropriate scores for the first sample. To minimize measurement bias, the subjects may adjust the scores accordingly anytime during the trial and they may wear the samples more than once. Standardized wearing instructions were provided by the same researcher. Pictures were placed in front of some garments to show how the garment is worn. All the subjects were asked to wear the garment samples in an air-conditioned room. A comfortable temperature was maintained at 20-24°C to ensure adequate warmth when getting undressed. Sufficient time and privacy were provided to allow the subjects to differentiate the comfort sensations of each garment. Each trial lasted for 45 minutes to an hour. To minimize recall bias, the subjects were asked to evaluate the garment one by one, and provide a score for each assessment item while wearing the sample.

2.4 Assessment and data analysis

There are a total of 25assessment items on the evaluation form. The items included design, appearance, color, garment invisible under clothing, ease to wear, ease to take off, convenience for toileting, material, handfeel, heat transfer, moisture transfer, perceived non-itchiness, not leaving a mark on the skin, abdomen comfort, back comfort, overall comfort, comfort sensations during body movement such as standing to sitting, sitting to standing, walking, bend over then stand up straight, crouch then stand up straight, twist waist, and overall ease of movement, overall acceptance and overall satisfaction. The scoring system was by "magnitude scaling" [33]. The subject selected two random numbers, one represents the "best" score and the other represents the "worst" score. The score given to each assessment item must be between the two preset numbers. The scores were normalized between 0 and 10 before data analyses. Multiple regression analysis was performed to investigate which independent variables were predictive of acceptance and overall comfort scores in maternity support garment. Magnitude scaling has the advantage of allowing individual measurement according to individual's range of perhaps a much wider dimension without affecting the aggregate properties of the measurement. Although this type of unlimited response scale may be insensitive to fluctuations along the scale [34], but the subjects are not forced to fit their ratings into a narrow pre-determined range of a conventional Likert scale [35].

3. Results

A total of 14 subjects were recruited for the wearer trial. Their mean age was 32.3 ± 4.2, ranging from 23 to 39 years old. Their mean gestation week was 30.2 ± 5.9, ranging from 21 to 36 weeks. Although there were only 14 subjects in this study, each subject assessed 8 maternity support garments, thus in effect the sample size was 14 x 8 = 112 subjects. Among those, 9 samples were not tested because the subjects felt fatigue or that garment was too difficult to wear. Thus, the final sample size was 93. Power analysis for multiple regression was calculated by using Cohen's table of power of the F-test for regression analysis at $\alpha = 0.05$ [36]. We chose to calculate the power by using the higher number of independent variables because as k increases, power decreases. Lambda was calculated for k=5, R^2=0.90, df_{res}=87, and N=93 using the equation: $\lambda = R^2/1\text{-}R^2*N$. Thus $\lambda = 0.80/1\text{-}0.80*93 = 372$. With reference to the table, this study has achieved 99% power, indicating a 1% probability of committing a Type II error.

In the multiple regression analysis, the data in Table 2 show two independent variables are significant predictors of acceptance score for maternity support garment: overall comfort and ease to wear. The probability of F associated with the regression (ANOVA) demonstrates a significant model for the acceptability data (F = 135.9, p = 0.000). The adjusted R^2 is 0.751 which represents a chance-corrected value for R^2 (R^2 = 0.867) indicates a strong prediction model that explained 75% of the variance. The equation that is predictive of the acceptability score using the most significant multiple regression model is $\hat{Y} = 0.021 + 0.687$ (overall comfort score) + 0.268 (ease to wear score). The evidence shows that five independent variables are significant predictors of overall comfort score in maternity support garment: abdominal comfort, ease of movement, design, heat transfer, and ease to wear (Table 3). The probability of F associated with the regression (ANOVA) demonstrates a significant model for the overall comfort (F = 80.486, p = 0.000). The adjusted R^2 is 0.812 which represents a chance-corrected value for R^2 (R^2 = 0.907) indicates a strong prediction model that explained 81% of the variance. The equation that is predictive of the overall comfort score using the most significant multiple regression model is $\hat{Y} = -0.011 + 0.428$ (abdominal comfort score) + 0.215 (ease of movement) + 0.131 (heat transfer) + 0.124 (ease to wear score) + 0.120 (design).

Table 2 Multiple stepwise regression analysis of predictive factors for acceptance of maternity support garment

Independent factors	Beta weights	P value
Overall comfort	0.675	0.000
Ease to wear	0.269	0.000

Table 3 Multiple stepwise regression analysis of predictive factors for overall comfort of maternity support garment

Independent factors	Beta weights	P value
Abdominal comfort	.508	.000
Ease of movement	.209	.001
Design	.152	.010
Ease to wear	.144	.015
Heat transfer	.138	.010

4. Discussion

The aim of this study was to investigate the factors that influence the acceptance and overall comfort of maternity support garment. On the evidence of the findings in Table 2, it suggests that overall comfort and ease to wear are perhaps the most significant factors for acceptance of maternity support garment. In other words, pregnant women tend not to accept maternity support garments that are uncomfortable and difficult to wear, which will probably result in non-compliance with garment treatment. The findings suggest that the overall comfort of maternity support garment is largely contributed by five factors: abdominal comfort, ease of movement, design, heat transfer, and ease to wear (Table 3). These findings have expanded our understanding in the factors that may influence the use of maternity support garment. These identified factors would for the most part contribute towards the formulation of preliminary guidelines in the fabrication and design criteria for the future development of maternity support garments. Garment designers and makers should follow these guidelines to ensure the overall comfort of wearers. Support garments with improved design and fabrication could help to improve quality of care and enhance compliance with garment treatment.

As might be expected, the findings are largely consistent with previous research in other garment treatments where factors that affect the adherence behavior and patient satisfaction are identified [26, 28, 30, 31, 37]. Williams et al. (1998), similar to this study, have found that comfort, ease of movement, ease of donning and color were the factors for overall satisfaction with pressure garment treatment in burns patients. O'Hare et al. (1997) reported that comfort and fit help to promote compliance with wearing compression garment to treat venous disorders. Myers et al. (1995) and Chan (2000) also found that comfort was very/the most important characteristic for hip protective garment in elderly patients and when purchasing maternity clothes [31]. It indicates to a great extent that comfort plays one of the key roles in acceptance and compliance with garment treatment. The data also suggests that pregnant women seem to accept the use of and feel comfortable with maternity support garment based on the criterion that it is easy to wear. This finding is perhaps not surprisingly as women may experience reduced range of motion and motion control due to increased trunk mass and dimensions [38]. The restriction of motion and postural instability may make tasks involving forward bending movement more difficult to perform.

In theory, garment comfort is a combination of thermophysiological comfort, which is related to the heat generated by the wearer is in equilibrium with the bodily heat transported through the garment into the environment; comfort through movement, which is the ease in movement when wearing the garment and it is affected by the cut pattern and garment assembly; and sensory/tactile comfort, which relates to the mechanical softness, its lack of friction, prickle and irritation and the feelings that arise from skin contact with fabrics [32, 39]. The findings are broadly in line with the theory of physical comfort. This study has found that abdominal comfort perhaps plays the most important role in overall comfort, which is specific to maternity support garment. The importance of abdominal comfort in the use of maternity support garment may reflect the women's concern for the baby's health and growth during pregnancy [40]. Several women in this study has voiced a concern that in their previous experience, their babies seemed to be 'kicking' more than usual when maternity belt was worn over a longer period, and that excessive pressure may affect the fetal growth. It may also stem from the women's perception of garment effectiveness is inevitably linked to the abdominal panel as it is an essential feature in maternity support garment to achieve the optimal support that it intends to provide for back pain relief. Perceived effectiveness of garment treatment is also an important factor for adherence behavior [28].

The findings relating to ease of movement and heat transfer are largely corroborated by those reported in Williams et al. (1998) and Johnson et al. (1994) [26, 30]. It was reported that discomfort and activity limitations in pressure garment are the most significantly associated with non-adherence behavior in patients with burns, and that perceived body temperature in the garment was the primary contributor that limits garment compliance [26]. In other words, patients tend to remove garment when it became too hot and uncomfortable and if it interfered with function. The importance of heat transfer when wearing maternity support garment is likely to be attributed by a greater demand for thermophysiological comfort in pregnant women. This is perhaps due to an increase in perspiration [41] and blood flow to the skin during pregnancy [42] because of peripheral vasodilatation and increased sweat gland activity, especially after the 3rd month of gestation, which help to dissipate the excess heat to regulate the core temperature of pregnant women [43]. The blood volume increases by 30% to 50%, and as much as 70% by 36th week of gestation is essential to meet circulatory and nutritional demands of maternal and fetal growth [42].

The need for ease in physical movement and perhaps mobility when using maternity support garment may be explained by the increase in work participation as census data reveal that women and men have broadly similar work force participation rates among those with higher education [44]. Thus, women who work would need to maintain their normal daily activities even if they become pregnant. Although sensory/tactile comfort may also play a role in the overall comfort, the significance was not shown in this study. The importance of sensory/tactile comfort would be related to as pregnant women tend to have an increased skin sensitivity and that pruritis (itchiness) is the main dermatological symptom in pregnancy [45]. The lack of significance in tactile/sensory comfort as a factor that influences the overall comfort may be due to the garments tested in this study sample. The majority of the samples are made from soft and smooth fabric thus the impact of this variable presumably may not be reflected in the results. Future study with a larger sample of garments with various materials may reveal different findings.

An interesting finding revealed that design of the garment may predict overall comfort for the wearers. This observation seems to suggest that the design apparently may play a role in the psychological comfort. This finding is somewhat supported by a study which showed that 70% of women considered style is the most/ very important factor when buying maternity clothes [31]. In the same study, 63% of the respondents were dissatisfied with the styles of maternity clothes that were commercially available, and among those 73% preferred more fashionable style than the existing outdated and classic style [31]. The results are also comparable to previous studies in which pregnant women were found to dislike wearing garments that appear odd, or 'medical' [46] and 'frumpy' [47]. The importance of aesthetic design in

maternity support garment may stem from women's negative perceptions and feelings towards one's bodily changes during pregnancy. Some women may use negative terminology to describe their pregnant bodies as 'fat' 'ugly', 'frumpy', 'bloated', 'weird' and referred to being less attractive [47, 48]. One possible explanation to account for the association between design and comfort is that aesthetics in the design of garment may improve the women's perception of a better appearance, which in turn may promote body satisfaction and may lead to a more positive affect and psychological comfort. However, it is important to note that the experience of bodily changes during pregnancy is more complex than the polarized variables of satisfaction or dissatisfaction [47].

There appears to be a linkage between the aesthetics and color of clothing with an individual's affect. A study reported that a negative affect of unhappiness or distressed was found when women were wearing clothes that they did not like or appear good, or that looked old-fashioned [47]. The same study showed that, on the contrary, women had a positive affect of happiness when they found clothes that fit and were happy wearing. Patients wearing pressure garment experienced negative affect of embarrassment and self-consciousness if the garment had poor appearance and construction [49]. The negative feelings may also be exacerbated by wearing of pressure garments that are conspicuous and not readily concealed beneath normal clothing [29]. This linkage may be mediated by psychosocial variables. Another study found that the perceptions of color pressure garments (such as pink and blue) were more positive than the traditional beige garments in a large sample of 1259 subjects [50]. They suggested that beige colored pressure garments have negative connotations (of illness/disability) and can serve as reinforcers of unattractiveness leading to lowered self-esteem and social acceptance, and on the other hand, color ones could lead to social acceptance which may increase the patient's self-esteem [50].

5. Conclusion

This study found two factors that may influence the acceptance of maternity support garment are overall comfort and ease to wear and five factors that perhaps contribute towards the overall comfort are abdominal comfort, ease of movement, design, heat transfer, and ease to wear. These findings will contribute to the formulation of design, fabrication, and garment construction criteria for future development of maternity support garment with the aim to promote quality of care to patients and compliance with garment treatment.

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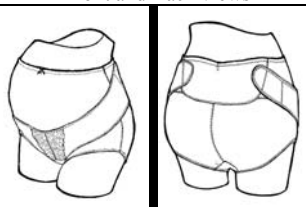
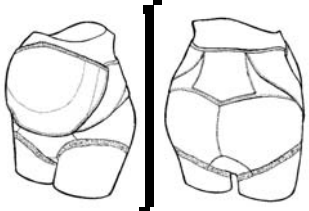
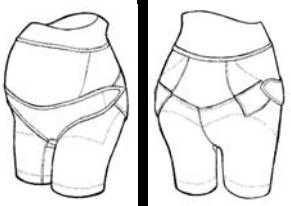
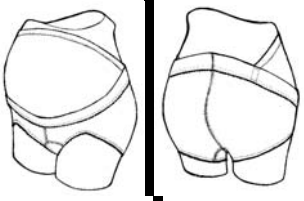
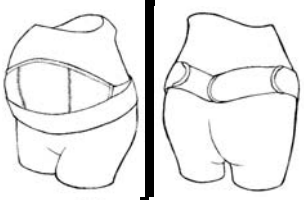
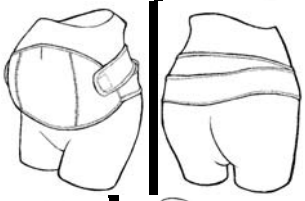
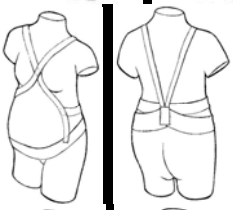
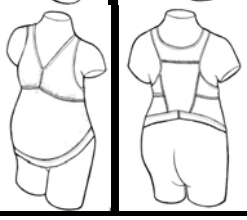
Table 1 showing a brief description of maternity support garments in wearer trial

Category	Garment style	Front and Back views	Abdomen Support	Back support	Fibre contents
Brief	A		4-inch front panel supports lower abdomen, extends and fastens at back	Rectangular reinforcement at centre back	60.5% Nylon 30% Viscose 9.5% Spandex
Brief	B		Large bowl-shape stretchable panel covers the whole belly	Pentagon reinforcement at centre back	Nylon Cotton (% not specified in the product)
Brief (with legs)	C		3-inch front panel supports lower abdomen & fastens at side	Wide trapezoid reinforcement for the back	Polyurethane Nylon (% not specified in the product)
Brief	D		Large soft panel covers the whole belly with $1\frac{1}{2}$ -inch elastic band at the lower abdomen	The $1\frac{1}{2}$ -inch elastic band extends to the back	70% cotton 30% elastane
Belt	E		Thick wide cushion oval-shape front portion	$2\frac{7}{8}$ -inch wide strap wrap around back waist	Polyester Cotton (% not specified in the product)
Belt	F		Soft & large oval shape fleece front portion	3-inch Sling intersect at the back and fasten at front	45% nylon 15% polyester 15% spandex 17.5% cotton 7.5% rayon
Cradle	G		3-inch elastic band supports the lower abdomen	$1\frac{1}{4}$ -inch elastic strap over shoulders and across torso	64% polyester 23% spandex 9% cotton 4% nylon
Torso support	H		A vest with 2-inch rigid fabric panel at lower abdomen	Hexagonal panel at the back	82% nylon 18% spandex