

# THE STUDY OF SUBJECTIVE PRESSURE SENSATION EVALUATION OF FOUNDATION GARMENT

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## INTRODUCTION

Foundation garment is one of lingerie for body shaping such as corsets, girdles and waister-nippers. Women show high interests in the functional role of the foundation garments to shape the body more ideal by redistributing the body fat now. However, at the same time people often complain against the uncomfortable feeling caused by the excessive negative pressure generated by the foundation garments. Many studies have demonstrated that the pressure has negative physiological effects on the body[1-3], we also give a complete research between clothing pressure and physiological variables[4].

On the other hand, Subjective assessment is also very important for the assessment of clothing comfort, which is a complex synthesis of many kinds of psychological and physiological response, many studied have focused on the subjective wearing sensation[5-7]. But the subjective pressure sensation of foundation garment has not yet been clarified, therefore we developed a wearing experimental procedure and investigated the relationship between the overall subjective pressure sensation and different positions pressure sensation using factor analysis. This can give a suggestion for the design of these garments, such as the position of strong whale bone.

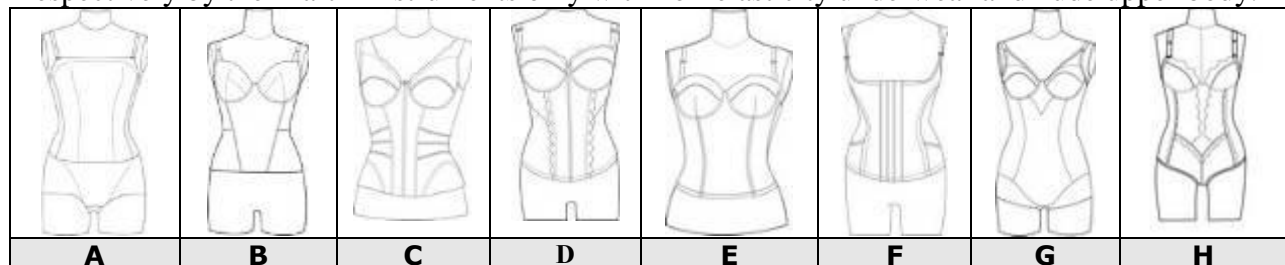
## METHODS

### Test samples and sizes

Some test sample was supported by the Beijing Aimer Lingerie Co., Ltd., there are eight corsets and eight girdles sample all together for the experimental, and all the foundation garment have different structures and more than 3 sizes, they are shown as Figure1. The size and materials used for foundation garment are shown in Table 1.

### Subjects

The subjects of this study were 18 healthy female graduates within the age range of 21-26 years old. They are all about 161cm with the standard deviation 4.17 chosen among 300 students. We sifted 42 female graduates at first and took their body measurements through 3d body scanner, and 15 students were finally invited as experiment samples for their body measurements and wearing habit. Details of physical constitutions are given in Table 2, which were gotten respectively by the Martin instruments only with non-elasticity underwear and nude upper body.



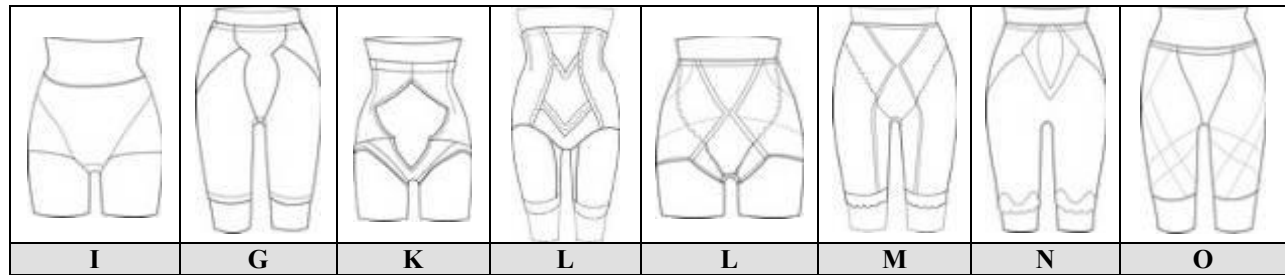


Fig. 1 Structures of the foundation garment

Table 1 Size and Material Used for Garment

| Sample ID | Knitted structure | Main fabric content (%) | Garment size    | Sample ID | Knitted structure | Main fabric content (%) | Garment size    |
|-----------|-------------------|-------------------------|-----------------|-----------|-------------------|-------------------------|-----------------|
| A         | Power-net         | Ny84% U 16%             | 70C 75B 80B     | E         | Power-net         | P40% Ny48% U12%         | 70B 75B 80B 80C |
| B         | Tricot            | Ny58% U 23% C19%        | 75B 75C 80B 85B | F         | Tricot            | Ny86% U 14%             | 70B 75B 80C     |
| C         | Tricot            | Ny87% U 13%             | 75B 75C 80B 85B | G         | Power-net         | Ny83% U 17%             | 70B 75B 80C     |
| D         | Power-net         | Ny10% U10%              | 70B 75B 80B 80C | H         | Tricot            | Ny90% U 10%             | 70B 75B 80C     |

U: polyurethane, Ny: polyamide, C: cotton P: polyester

Table 2 Physical Constitutions of Subjects

|                 | Min    | Max    | Mean   | Std. |
|-----------------|--------|--------|--------|------|
| Bust girth      | 81.50  | 96.70  | 85.99  | 4.57 |
| Underbust girth | 69.60  | 81.00  | 74.63  | 3.04 |
| Waist girth     | 64.50  | 84.50  | 71.23  | 4.96 |
| Abdomen girth   | 75.10  | 94.70  | 83.80  | 5.02 |
| Hip girth       | 86.10  | 109.30 | 94.89  | 5.89 |
| Height          | 154.90 | 171.00 | 161.30 | 4.17 |
| body weight     | 47.75  | 73.30  | 56.16  | 6.64 |
| BMI*            | 18.72  | 27.29  | 21.56  | 2.18 |

### Experimental method

The experiments were conducted in an artificial climate chamber where the temperature was controlled at  $27 \pm 1.4^\circ\text{C}$  and the relative humidity at  $32 \pm 2\%$ . To minimize the effects of menstrual cycles and circadian rhythm, the experiment was carried out during the early follicular phase of each woman, and several garments were tested at the same time for each woman on each day. In the experiment, we selected suited size clothing to the subjects according to their body measurements. Each subject entered the chamber 30 minutes or more so that she could become accustomed to the experimental environment. We asked subjects about pressure sensation at 15 positions on the torso and the shaping effect at several parts. The pressure sensation and the shaping effect are evaluated from -2-2 five-grade psychological scale, as shown in Figure 2.

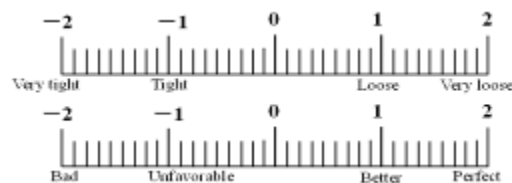


Fig. 2 Psychological scale for pressure sensation and shaping effect evaluation

## RESULTS

### Pressure sensation evaluation and shape beauty assessment with the time

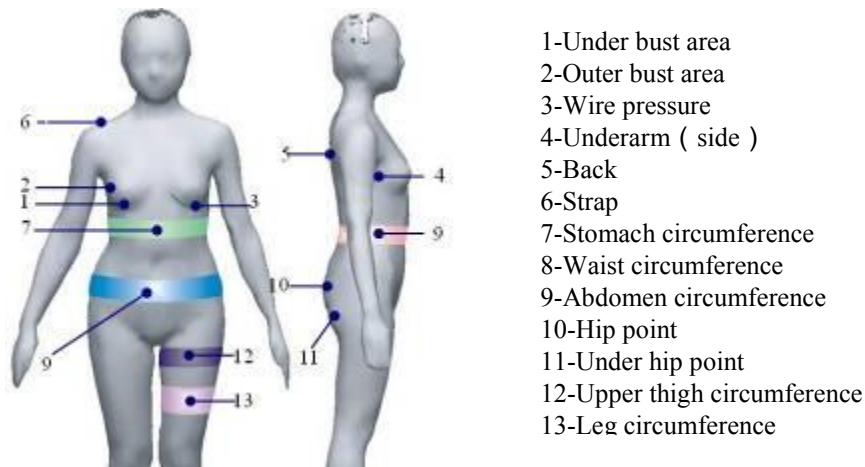


Fig. 2 the position of pressure sensation evaluation

In the subjective experimental, we designed an experimental for the pressure sensation and shape beauty evaluation from short time and long time conditions. The position of subject evaluation was 13 parts on the body shown as Fig. 2. Each subject entered the chamber 30 minutes or more before the start of the experimental so that she could become accustomed to the environment, and then take on the experimental foundation garment. The short time evaluation was tested after taking clothing 30 minutes, and the long time evaluation was tested after 4 hours, the subjects can leave chamber during the long time test and back again at the fixed time.

The pressure sensation evaluation was changed with time during the experimental, as shown in Fig. 3. In the short time test, the pressure sensation evaluations were most in the -2-0, because we selected suited size to the subjects, the foundation garment inevitably give negative pressure to the body, but at the back, under hip point, and leg circumference positions, the pressure sensation is small. After subjects with the clothing after 4 hours, we found most pressure evaluations were lower, because they were accustomed to the negative pressure at most parts of the body, especially at the bust area, most female feel little pressure because they feel bra pressure in the daily life. But at the stomach circumference, subjects felt more strong pressure than in short time test. At the leg circumference of girdle, subjects felt loose after a long time.

The shape beauty assessments were also surveyed in the experimental. The beauty assessments of most parts were changed during the long time test, but the waist, abdomen and hip shape evaluation was lower than during short time test, because subjects accustomed to the pressure and elasticity of clothing material will release a little ease.

### **The analysis between the whole pressure sensation and the body parts of corsets**

We designed an experimental for investigating the whole pressure sensation and the body parts. The whole subjective pressure sensation and 15 parts of the body with different corsets were asked. We obtained factor matrices using KMO& Bartlett's Test and principal factor solutions, which constitute the proportion of the test variance ascribed to the action of the common factors. Using factor analysis, three factors were extracted from fifteen components. After rotating the factor axes the structure of the test relations was more clearly indicated. The results of factor matrices rotated by the Varimax method are shown in Tab.3, the three factors obtained were sufficient to describe the data. The side waist, front waist, back waist, side area at the bust line (below the armpits), side area at stomach circumference could be explained by common factor (Factor I), named *the Factor of pressure sensation at waist position*. the Factor II named *the Factor of pressure sensation at bustwire and back position* is constituted by the outer bust, side bust, middle position between bust points, wire pressure, and back. The Factor III named *the*

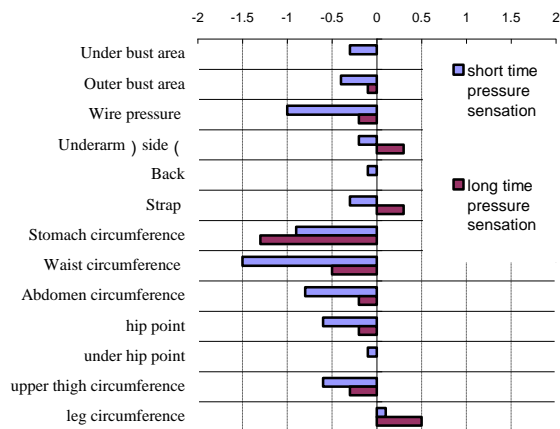


Fig. 3 the pressure sensation assessment changed with time

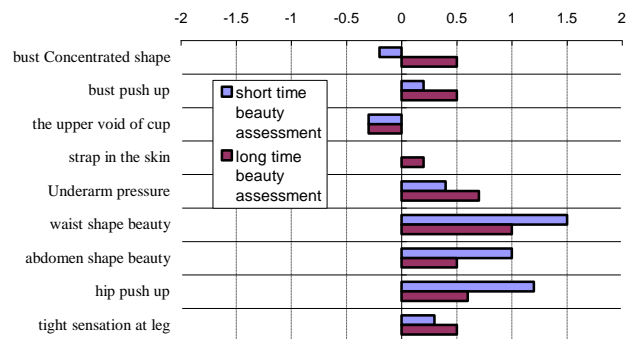


Fig. 4 the beauty assessment changed with time

**Factor of pressure sensation at near waist position** is constituted by the outer bust, side bust, middle position between bust points, wire pressure, and back.

Tab.4 shows the correlation coefficients between the Whole pressure sensation and the parts of the body, we find that the Whole pressure sensation has significant correlation with Factor I and Factor III. So we concluded that the whole pressure sensation has a significant correlation with the pressure at waist position and near waist position. Liner regression analysis showed that variables for the pressure sensation at waist position ( $X_1$ ) and the pressure sensation at near waist position ( $X_3$ ) are good predictors for the whole pressure sensation assessment ( $Y$ ), as shown in Tab.5. Regression equation is  $Y = -0.807 + 0.499 X_1 + 0.187 X_3$ .

Table 3 Rotated Component Matrix

|  | Component |       |            |
|--|-----------|-------|------------|
|  | 1         | 2     | 3          |
| Side waist(at waistline)                       | .904      | .097  | .360       |
| Front waist                                    | .840      | .283  | .407       |
| Back waist                                     | .834      | .130  | .459       |
| Side area at the bust line (below the armpits) | .755      | .580  | -.115      |
| Side area at stomach circumference             | .658      | .152  | .578       |
| Outer bust                                     | .108      | .912  | -.010      |
| Side bust                                      | .301      | .904  | -8.747E-05 |
| Middle area between bust points                | .099      | .877  | .316       |
| Wire pressure                                  | .124      | .875  | .302       |
| Back   | .319      | .629  | .459       |
| Front area at abdomen circumference            | .100      | -.034 | .924       |
| Back area at stomach circumference             | .500      | .319  | .708       |
| Front area at stomach circumference            | .525      | .281  | .696       |
| Side area at abdomen circumference             | .515      | .202  | .690       |
| Back area at abdomen circumference             | .464      | .361  | .690       |

## CONCLUSIONS

In this study, the whole wearing comfort of pressure sensation and different parts of body were researched, the main conclusion shown as follows.

Table 4 Correlation coefficients Between the Whole Pressure Sensation and the Part of the Body

|                              | the Whole Pressure Sensation | Factor I     | Factor II | Factor III |
|------------------------------|------------------------------|--------------|-----------|------------|
| the Whole Pressure Sensation | 1                            | .783(*<br>*) | .088      | .480(**)   |
| Factor I                     | .783(**)                     | 1            | .000      | .000       |
| Factor II                    | .088                         | .000         | 1         | .000       |
| actor III                    | .480(**)                     | .000         | .000      | 1          |

Correlation is significant at the 0.01 level (2-tailed).

Table 5 Coefficients Analysis

| Model |            | Unstandardized Coefficients |            | Standardized Coefficients | t       |
|-------|------------|-----------------------------|------------|---------------------------|---------|
|       |            | B                           | Std. Error | Beta                      |         |
| 1     | (Constant) | -.792                       | .038       |                           | -20.712 |
|       | Factor I   | .519                        | .039       | .907                      | 13.316  |
| 2     | (Constant) | -.807                       | .029       |                           | -28.178 |
|       | Factor I   | .499                        | .029       | .873                      | 17.055  |
|       | Factor III | .187                        | .033       | .286                      | 5.594   |

1. The wearing pressure sensation and the beauty assessment can be changed with time.
2. The whole wearing comfort of pressure sensation has a significant correlation with the 15 parts of the body pressure sensation.
3. The 15 parts of the body pressure sensation can be described by three factors, they are *the Factor of pressure sensation at waist position* (Factor I), *the Factor of pressure sensation at bustwire and back position* (Factor II), and *the Factor of pressure sensation at near waist position* (Factor III).
4. From the correlation coefficients and step regression analysis, we can conclude the whole wearing comfort of pressure sensation has a significant correlation with two factors of the three, we can give the Regression equation is  $Y = -0.807 + 0.499 X_1 + 0.187 X_3$ . This showed that the whole pressure sensation assessment (Y) has significant correlation with variables for the pressure sensation at waist position ( $X_1$ ) and the pressure sensation at near waist position ( $X_3$ ). This can give suggestions for the design of garments, such as the position of strong whale bone.

#### ACKNOWLEDGMENT

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