

## A Development of Bodice Pattern for Women Aged 18~24 Years<sup>+</sup>

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### Abstract

In this study, to develop a bodice pattern for women aged 18~24 years, statistical analysis was conducted using the body measurements from 2004 Size Korea and wearing test was conducted.

As a result, ease of the bust level to set a horizontal line was decided to be 4cm, that of front interscye line 0cm, and that of back interscye line 0.7~1cm. And the line which divides the horizontal baseline into halves set as the side line. The conversion formula for decision of the scye depth line in the pattern is  $B/6 + 3.3(\text{cm}) + \text{ease}(2.5\text{cm})$ , and if bust circumference is 91 or more, it should be 21cm, and if bust circumference is 76 or less, it should be 18.5cm.

The back neck line width is 7cm, front neck line width 6.5cm(back neck line width -0.5cm), and front neck depth 8cm(back neck line width +1cm). The shoulder slope was set as a slope of the hypotenuse of a right-angled triangle, which went out 15cm out of the shoulder point and went down 6cm, with  $\tan 21.7^\circ$ .

To develop a final research pattern, wearing test was performed on the primary research pattern for 21 women aged 18~24 years. As a result, the research pattern was evaluated to be significantly higher.

**Key Words** : Bodice pattern draft, Conversion formula, Ease of bust level,  
Front interscye line, Back interscye line

### I. Purpose of Study

Garments should be well fitted to the wearer's body shape, as well as functional and aesthetic.

To make such garments, scientific pattern draft should be established on the basis of the characteristics of body type and movement. In the mid-1950s, western garment patterns for

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women was introduced from Japan or America and in the early 1970s, a study on pattern based on the body shapes of Korean was begun. Between early 1970s and 1980s, the studies of new pattern drafts which were suited to the body types of Korean had been done, leading to the development of the basic patterns of garments such as bodice, sleeve, torso, skirt, pants, and jacket. In 1990s, studies rather on pattern according somatotype, age, and material than pattern for standard body type had been done. There has been increased interest in the body types like obese body type and bending body type beyond the standard body type in addition to diversified body type classification. Patterns for various age group such as middle-age, old-age, junior and children have been developed, as well<sup>1)2)</sup>.

However, there have been many changes in the recent body types of Korean women, compared to 1970s~1980s: in 1979 National Anthropometric Survey of Korea 1979 for women aged 20~24 years, height was  $155.5 \pm 5.3$ cm, bust circumference  $85.5 \pm 4.5$ cm, waist circumference  $67.9 \pm 4.1$ cm, hip circumference  $89.0 \pm 3.8$ cm, and weight  $52.7 \pm 5.4$ kg as mean values, while in 2004 Size Korea, height was  $160.7 \pm 4.9$ cm, bust circumference  $81.9 \pm 6.1$ cm, waist circumference  $67.1 \pm 5.8$ cm, hip circumference  $91.3 \pm 4.9$ cm, and weight  $53.5 \pm 7.1$ kg as mean values. Particularly, means of interscye, front and back mainly used at pattern making and converted using bust circumference, decreased compared to those in 1997; mean of front inetrscye was  $35.2 \pm 1.5$ cm and mean of back inetrscye  $37.1 \pm 1.8$ cm in 1997, while mean of front inetrscye was  $32.3 \pm 2.0$ cm and mean of back inetrscye  $36.5 \pm 2.3$ cm in 2004, which indicated the ratio of inetrscye, front and back to bust circumference became different. Accordingly, the existing pattern can hardly reflect the

characteristics of the current body type. So many parts of pattern have been corrected through test fitting in educational fields and industrial fields.

Therefore, existing pattern drafts for standard body type are required to be reexamined and a new pattern draft which applies the body measurements suited to the times is also required.

Based on this background, in this study, a new bodice pattern draft for standard body type was suggested and a wearing test was conducted using the data of body measurements from 2004 Size Korea for women aged 18~24 years.

## II. Methodology

To develop a bodice pattern for women aged 18~24 years, statistical analysis was conducted using the body measurements from 2004 Size Korea and wearing test was conducted. The major body sizes of women aged 18~24 years, which were used in the analysis, are as shown in <Table 1>.

### 1. Development of bodice pattern draft

#### 1) Baselines for bodice pattern

##### (1) Setting of ease by wearing test

In bodice pattern draft, primarily, it is important to decide the baselines of horizontal baseline, vertical baseline, side line, scye depth line, front interscye line, back interscye line as shown in <Figure 1>. Setting of these base lines is done by deciding the least ease given to the body. In this study, proper ease was set through wearing test of 6 patterns(ESMOD pattern, Secoli pattern, new Munwha pattern, A industry pattern,

<Table 1> Mean of measurements of women aged 18~24 years (n = 674)

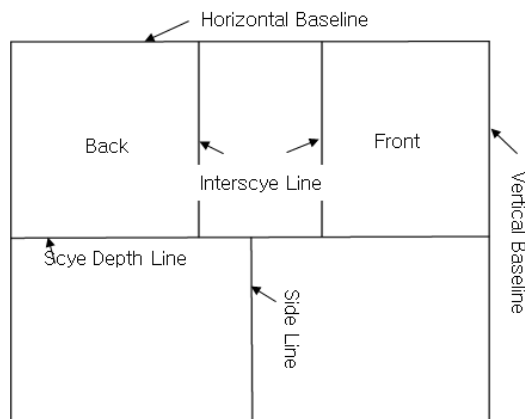
| Item                | SIZE KOREA Measurement | Item                       | SIZE KOREA Measurement |
|---------------------|------------------------|----------------------------|------------------------|
| stature             | 160.4 cm               | Bishoulder Length          | 39.6 cm                |
| Chest Circumference | 81.7 cm                | Back Interscye Length      | 34.2 cm                |
| Bust Circumference  | 82.3 cm                | Front Interscye Length     | 31.4 cm                |
| Waist Circumference | 67.3 cm                | Bust Point-Bust Point      | 17.2 cm                |
| Waist Back Length   | 38.1 cm                | Neck Point to Breast Point | 24.9 cm                |

Lee Seungryeol's pattern, and Lee Hyeongsook & Nam Yunja's pattern)<sup>3)4)5)6)</sup> that are being frequently used in educational fields and industries. The five items of wearing test were bust level (front, back), front interscye line, back interscye line, and position of side line, and nine experts took the wearing test. The wearing test was performed using the dress form which were the standard body shape of Korean women and developed by Yi Jeongim.<sup>7)</sup>

interscye line, back interscye line, and scye depth line through statistical analysis, regression analysis and paired t-test. Regression analysis was performed with bust circumference(B) as an independent variable.

2) Completion of bodice pattern

After the baseline for a bodice pattern was decided, conversion formulae on back neck width, front neck width, front neck depth, shoulder slope, bust point, underarm dart and front drop was studied. Since shoulder slope was not measured in 2004 Size Korea, the tangent value of the mean(21.7°) of shoulder angle measured in research of Min-jin Kim & Jeong-ran Lee was used to decide the shoulder slope pattern making method.



<Fig. 3> Baselines of bodice pattern

2. Wearing test of the developed pattern

The pattern was made by the developed bodice pattern draft for 21 female college students aged 18~24 years, and fitting of the pattern developed through wearing test was evaluated. The items of wearing test were 6 items of ease(bust level, front interscye line, back interscye line), shoulder slope, position of side line, and position of side neck point,The

(2) Extraction of a conversion formula by statistical analysis

To extract a conversion formula of front

bust circumference of those female college students who participated in the wearing test ranged 78~94cm, and the wearing test was performed by 3 experts.

### III. Results and Discussion

#### 1. Development of bodice pattern draft

##### 1) Baseline for bodice pattern

##### (1) Setting of ease by wearing test

Using evaluation value for ease and appearance of each part of 6 bodice patterns, one-way ANOVA and Duncan test were conducted and the results are shown in <Table 2>.

##### ① Horizontal baseline

The analysis of existing bodice pattern draft showed that the vertical baseline of bodice pattern was made based on the back length, the horizontal baseline was based on bust circumference and ease of bust circumference/2 set 2, 2.4, 4, 5, and 6cm. When front ease was 2~2.5cm and back ease was 1.5~1.7cm, and accordingly, whole ease was 4cm, the sensory evaluation of front and back ease in the bust level showed statistically significantly higher than that of the others. Since the Hyeong-sook Lee & Yun-ja Nam's pattern and new Munhwa pattern had each too much ease of 5 and 6cm and the ESMOD pattern and A industry pattern had each too little ease of 2 and 2.4cm, its appearance was evaluated to be poor.

<Table 2> Result of wearing test for decision of baseline

|                       |                                       |          | I         | II       | III      | IV       | V        | VI        | F-value   |
|-----------------------|---------------------------------------|----------|-----------|----------|----------|----------|----------|-----------|-----------|
| Bust level            | Front                                 | Ease(cm) | 2         | 2        | 2.5      | 1.5      | 3.6      | 2         | 18.518*** |
|                       |                                       | Mean     | 3.5<br>B  | 4.4<br>A | 4.3<br>A | 2.8<br>C | 1.9<br>D | 2.6<br>C  |           |
|                       | Back                                  | Ease(cm) | 0         | 2-0.3    | 1.5      | 0.9      | 2.3      | 3         | 21.023*** |
|                       |                                       | Mean     | 1.8<br>CD | 4.1<br>A | 3.3<br>B | 2.8<br>C | 1.6<br>D | 2.3<br>CD |           |
|                       | Overall                               | Ease(cm) | 2         | 4        | 4        | 2.4      | 6        | 5         |           |
|                       | Front interscye line                  | Ease(cm) | 0         | 1.0      | 1.8      | 0        | 1.5      | 1.3       | 4.628**   |
| Mean                  |                                       | 4.6<br>A | 3.9<br>B  | 3.6<br>B | 4.5<br>A | 3.9<br>B | 3.8<br>B |           |           |
| Back interscye line   | Ease(cm)                              | 0        | 0.7       | 1.0      | 0        | 0.8      | 1.0      | 36.348*** |           |
|                       | Mean                                  | 1.8<br>C | 4.8<br>A  | 4.3<br>A | 2.0<br>C | 2.8<br>B | 2.8<br>B |           |           |
| Position of side line | Difference between front and back(cm) | 0        | 0         | 1.0      | 0        | 2.0      | -1.0     | 12.053*** |           |
|                       | Mean                                  | 2.5<br>B | 3.8<br>A  | 2.4<br>B | 3.8<br>A | 2.1<br>B | 2.1<br>B |           |           |

\*\* p < 0.01 \*\*\* p < 0.001, Duncan test A>B>C

I : ESMOD pattern, II : Seung-ryeol Lee's pattern, III : Secoli pattern,

IV : A industry pattern, V : new Munhwa pattern, VI : Hyeong-sook Lee & Yun-ja Nam's pattern

② Front interscye line and back interscye line

Front interscye line had the highest evaluation value when there was no ease. The back interscye line is required to have a little ease since the rating of 0.7~1.0cm ease was statistically significantly higher than that of the others.

③ Setting the side line

Compared to the existing patterns, setting the side line is made into one of the following three methods: first, dividing the horizontal baseline into halves, second, dividing the horizontal baseline into halves and moving 0.5cm toward the center of the back, and in that case horizontal width of the front side is 1cm larger than that of the back side, third, moving a fixed dimension toward the front from the back interscye line or the other way.

The third method is appropriate in case of the body type having narrow width and protruded bust.

For position of the side line, it was highly evaluated when there was no difference between the front and the back, and it was underrated when there was difference more than 1cm. Also in-depth interview for the evaluator of wearing test showed that they evaluated high when the front was wider than the back about 0.4cm. Therefore, secondary wearing test was done in two cases that the side line was same in the front and back, and that it was 0.4cm wider in the front than the back. As a result, the rating was higher in the case that the side line was same in the front and back.

As a result, ease of the bust level to set a horizontal line was decided to be 4cm, front interscye line 0cm, and back interscye line 0.7~1cm. And the line which divides the horizontal baseline into halves set as the side line. So front bodice width and back bodice

width were same.

(2) Extraction of a conversion formula by statistical analysis

① Decision of front interscye line and back interscye line

As a result of extraction of conversion formulas with bust circumference showed that front interscye line was  $B/6 + 2(\text{cm})$  and back interscye line  $B/6 + 3.4(\text{cm})$ .

The body measurements from 2004 Size Korea and converted values from conversion formulae of the existing patterns and the research pattern are shown in <Table 3>. Dimensional difference is shown to be large between the measured values and the converted values of existing patterns. This can be examined in the following. The conversion formula of existing patterns is obtained based on previous studies. So they doesn't reflect the fact that front interscye line and back interscye line decreased according to changes in body shape.

The conversion formula of final front interscye line and back interscye line was decided in consideration of ease determined in wearing test. The conversion formula of the front interscye line is  $B/6 + 2(\text{cm})$  and that of the back interscye line is  $B/6 + 3.4(\text{cm}) + \text{ease}$  (0.7~1cm).

② Decision of scye depth line

The conversion formula for the scye depth line is  $B/6 + 3.3(\text{cm})$ .

If converted values of bust circumference are applied to everyone, scye depth line is set to be excessively large in the body type with large bust circumference, leading to poor fitting of the armhole and sleeve cap curve line. Therefore in this study, the upper limit by the increased bust circumference was examined through statistical

<Table 3> Comparison of body measurement and conversion formulae for back and front interscye length (cm)

| Item                   | Pattern          | Conversion formula | Converted value | Measured value (2004 Size Korea) | Difference between Converted value and measured value |
|------------------------|------------------|--------------------|-----------------|----------------------------------|---|
| Back interscye length  | Existing pattern | $B/6 + 4.5$        | 18.2            | 17.1                             | 1.1   |
|                        |                  | $B/8 + 7.5$        | 17.5            |                                  | 0.4   |
|                        |                  | $C/6 + 4$          | 17.8            |                                  | 0.7   |
|                        | Research pattern | $B/6 + 3.4$        | 17.1            |                                  | 0.0   |
| Front interscye length | Existing pattern | $B/6 + 3$          | 16.7            | 15.7                             | 1.0   |
|                        |                  | $B/8 + 6$          | 16.5            |                                  | 0.8   |
|                        |                  | $C/6 + 3$          | 16.3            |                                  | 0.6   |
|                        | Research pattern | $B/6 + 2$          | 15.7            |                                  | 0.0   |

※ Bust circumference = 82.3cm Chest Circumference = 81.7cm in the conversion

<Table 4> The means and converted values of the scye depth line by sections of each bust circumference (cm)

| Bust circum. | n (person) | Mean | Converted values (except ease) | Bust circum. | n (person) | Mean | Converted values (except ease) |
|--------------|------------|------|--------------------------------|--------------|------------|------|--------------------------------|
| 73           | 46         | 16.2 | 15.5                           | 88           | 71         | 17.5 | 18.0                           |
| 76           | 91         | 16.7 | 16.0                           | 91           | 41         | 17.9 | 18.5                           |
| 79           | 140        | 16.6 | 16.5                           | 94           | 15         | 17.8 | 19.0                           |
| 82           | 138        | 17.1 | 17.0                           | 97           | 15         | 17.9 | 19.5                           |
| 85           | 113        | 17.2 | 17.5                           |              |            |      |                                |

analysis.

According to categorization of sizes, bust circumference was divided into 76, 79, 82, 85, 88, 91, and 94cm, the mean and converted values of the scye depth line are shown in <Table 4>. The mean of the scye depth line increased with the increase of bust circumference, and at the bust circumference 88 or higher sections, the mean of the scye depth line did not increase but in the conversion formula, it continued to increase.

Therefore if the conversion formula is used as it is at the bust circumference 91 or higher sections, ease will be excessively increased. Accordingly, the scye depth line is required to be fixed at the bust circumference 91 or higher sections.

On the other hand, if bust circumference is 76 or less and the conversion formula is applied as it is, it is impossible to secure proper ease, therefore the scye depth line is required to be fixed even if bust circumference is 76 or less.

Usually, 2.5 cm ease is given to scye depth line, therefore a conversion formula for decision of the scye depth line in the pattern is  $B/6 + 3.3(\text{cm}) + \text{ease} (2.5\text{cm})$ , and if bust circumference is 91 or more, it should be 21cm, and if bust circumference is 76 or less, it should be 18.5cm.

(3) Correction of side line by body types

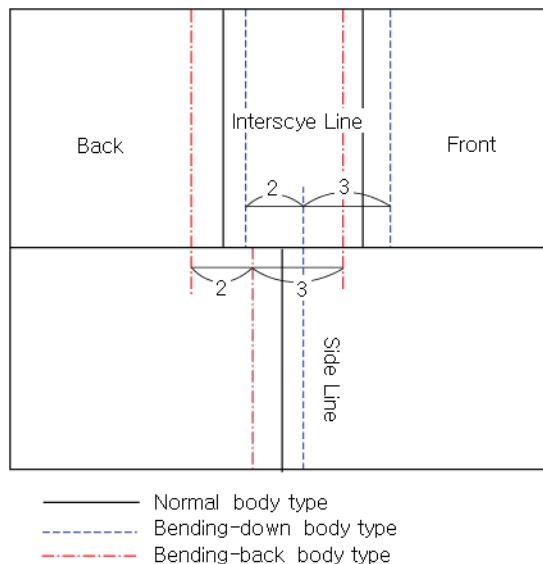
As a result of sensory evaluation by wearing test, same size of the front and back bodices was deemed appropriate. However, in case of bending-down body type or bending-back body type with broad back interscye line or front interscye line, if a side line is set in such a manner, the front and back armhole curve line are not properly drawn and the side lines are biased to the front or back at wearing. Therefore, in case of bending-down body shape or bending-back body shape, setting of a side line with front width line or back width line is deemed more proper.

A side line is set with the front and back interscye lines in the Britain and new Munhwa patterns, as well.

For decision of a side line, the analysis of a proportional expression between front interscye line and back interscye line was conducted. The result showed that the length between them was divided into 2:3 as seen in <Figure 2>.

For normal body type, no difference was found between (a) setting a side line as dividing distance between the back center line and the front center line into halves and (b) setting a side line as dividing distance between the interscye line, back and front into 2:3. However, paired comparison of a and b values by body type into bending-down body type or bending-back body type, showed that significant differences were found statistically.

Therefore in case of bending-down body type



<Figure 6> Setting of Side Line

or bending-back body type, setting a side line to a proportional expression(2:3) using interscye line, back and front is effective for better fitting.

2) Completion of bodice pattern

(1) Pattern draft in the neck

For back neck line width, a conversion formula is used in existing patterns, e.g.  $B/12$  or  $B/12+0.25$ ,  $B/20+2.9$ , etc. However, seen from the measurements of neck width/2f necke was no difference by sections of bust omroumference <Table 5>. Therefore it is not reasonable to change neck width by increase or forease of the bust omroumference, and it is proper to use the same size.able to chas of calculating back neck line width using  $B=82.3\text{cm}$ , which is the mean of bust omroumference, with the conversion formulae used in existing patterns were 6.9~7.1cm.aAnd the standard frviation of neck width was 0.48cm by the data of body measurements from 2004 Size Korea. Accordingly,

<Table 5> Mean of neck width/2 by sections of bust circumference (cm)

| Sections of bust circumference | Neck width/2 | Sections of bust circumference | Neck width/2 |
|--------------------------------|--------------|--------------------------------|--------------|
| 73                             | 5.8          | 85                             | 5.8          |
| 76                             | 5.6          | 88                             | 5.6          |
| 79                             | 5.7          | 91                             | 5.9          |
| 82                             | 5.7          | 94                             | 6.0          |

wearing test was performed by setting neck width/2 to  $7.0 \pm 0.5\text{cm}$  (6.5, 7.0 and 7.5cm) to decide the size of neck width. As a result, 7.0cm was evaluated to be statistically significant high.

For front neck line width, the same size as back neck line width is used in most existing patterns, however, as a result of wearing test, lifting appeared in front of the neck, therefore it was set to 0.5cm less than the back neck line width. Also, for front neck depth, 1cm was added to back neck line width.

The sizes decided on the basis of the wearing test are back neck line width 7cm, front neck line width 6.5cm (back neck line width -0.5cm), and front neck depth 8cm (back neck line width +1cm).

#### (2) Pattern draft in shoulder slope

Since shoulder angle was not measured in 2004 Size Korea, shoulder slope was obtained by using the shoulder angle measured in research of Min-jin Kim & Jeong-ran Lee. The mean of shoulder angle was  $21.7^\circ$ . The shoulder slope obtained was set as a slope of the hypotenuse of a right-angled triangle, which went out 15cm out of the shoulder point and went down 6cm, with  $\tan 21.7^\circ$ .

The bodice pattern draft obtained through the above analysis is as shown in <Figure 3>.

#### 3) Wearing test

To develop a final research pattern, wearing test was performed on the primary research pattern for 3 women aged 18~24 years. Body sizes of the 3 subjects are as shown in <Table 6>.

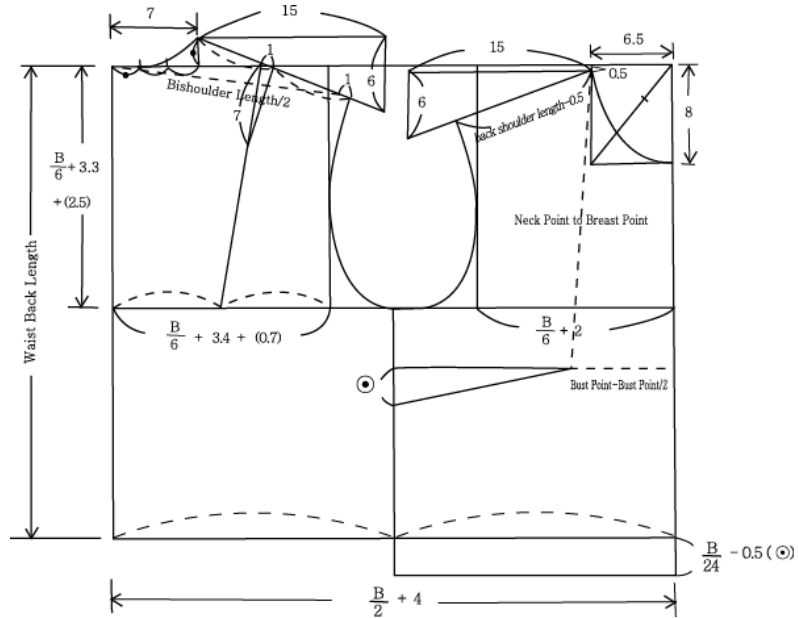
The results of wearing test are shown in <Table 7>. Among 6 experimental patterns, the research pattern and Seung-ryeol Lee's pattern were highly evaluated in most items.

Both the patterns were evaluated to be highest in the items of ease of the bust circumference and back interscye, position of the shoulder point, and whole appearance of the back, however, the research pattern was highly evaluated but the Seung-ryeol Lee's pattern was relatively underrated in ease of the front interscye. Also, the research pattern was evaluated to be significantly higher compared to the Seung-ryeol Lee's pattern in whole appearance of the front.

### 2. Wearing test of the developed final research pattern

To look into individual appropriateness of the developed final research pattern, wearing test was performed for 21 female college students aged 18~24 years. The examination of 6 items of ease (bust level, front interscye, back interscye), shoulder slope, position of side line,





<Figure 3> Bodice Pattern Draft

<Table 6> Body measurements of 3 subjects (cm)

| Items              | Body measurements |           |           |
|--------------------|-------------------|-----------|-----------|
|                    | subject A         | subject B | subject C |
| Bust circumference | 81.8              | 82.1      | 82.5      |
| Waist back length  | 38                | 38.3      | 38        |
| Shoulder angle     | 21°               | 21°       | 20°       |

<Table 7> Results of the wearing test for appearance (n=15)

|                            | I         | II         | III       | IV        | V         | VI        | F-value    |
|----------------------------|-----------|------------|-----------|-----------|-----------|-----------|------------|
| Ease of bust level         | 2.27<br>C | 4.33<br>A  | 3.93<br>B | 1.67<br>D | 2.27<br>C | 4.60<br>A | 86.007***  |
| Ease of front interscye    | 4.27<br>B | 3.73<br>C  | 3.20<br>D | 3.73<br>C | 3.73<br>C | 4.73<br>A | 20.705***  |
| Ease of back interscye     | 1.73<br>D | 4.73<br>A  | 4.27<br>B | 2.73<br>C | 2.73<br>C | 4.73<br>A | 78.021***  |
| Position of scye depth     | 3.73<br>B | 4.20<br>AB | 2.73<br>D | 4.07<br>B | 3.27<br>C | 4.60<br>A | 18.194***  |
| Position of shoulder point | 1.33<br>D | 4.33<br>A  | 3.13<br>B | 2.13<br>C | 2.27<br>C | 4.67<br>A | 89.202***  |
| Front silhouette           | 2.00<br>D | 3.40<br>B  | 3.27<br>B | 1.73<br>D | 2.40<br>C | 4.33<br>A | 74.498***  |
| Back silhouette            | 1.20<br>D | 4.13<br>A  | 3.20<br>B | 1.40<br>D | 2.13<br>C | 4.33<br>A | 152.968*** |

\*\* p < 0.01 \*\*\* p < 0.001, Duncan test A>B>C

I : ESMOD pattern, II : Seung-ryeol Lee's pattern, III : Secoli pattern,

IV : A industry pattern, V : new Munwha pattern, VI : Hyeong-sook Lee & Yun-ja Nam's pattern

and position of side neck point with the pattern made by the developed research bodice pattern draft showed that 4 subjects whose shoulder angle was 24° or more and 2 subjects whose shoulder angle was 16° or less required correction of the shoulder slope. Correction was not required in the items except shoulder slope, thus individual fitting of the developed research bodice pattern draft was found to be improved.

### III. Conclusion

In this study, to develop a bodice pattern for women aged 18~24 years, statistical analysis was conducted using the body measurements from 2004 Size Korea and wearing test was conducted.

As a result, ease of the bust level to set a horizontal line was decided to be 4cm, front interscye line 0cm, and back interscye line 0.7~1cm. And the line which divides the horizontal baseline into halves set as the side line. So front bodice width and back bodice width were same. The conversion formula of final front interscye line and back interscye line was decided in consideration of ease determined in wearing test. The conversion formula for decision of the scye depth line in the pattern is  $B/6 + 3.3(\text{cm}) + \text{ease} (2.5\text{cm})$ , and if bust circumference is 91 or more, it should be 21cm, and if bust circumference is 76 or less, it should be 18.5cm.

The back neck line width is 7cm, front neck line width 6.5cm(back neck line width -0.5cm), and front neck depth 8cm(back neck line width +1cm). The shoulder slope obtained was set as a slope of the hypotenuse of a right- of ad tri of a, which went out 15cm out of the shoulder point and went down 6cm, with

tan21.7°.

To develop a final research pattern, wearing test was performed on the primary research pattern for 3 women aged 18~24 years. As a result, the research pattern was evaluated to be significantly higher.

With these, this study attempts to provide fundamental data for industrial fields requiring fitting, e.g. uniform, as well as educational fields requiring customized pattern for each individual.

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