



## Development of All-in-One Pattern Specialized for Obesity in Old Age

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**Abstract:** A diverse range of products are currently being sold; however, it is very difficult to purchase All-in-One patterns that reflect the body types of the elderly stage in the open market. This study is to develop specialized All-in-One patterns by assessing obese body types characteristics of the elderly social class. Five healthy women with typical obese body types in the elderly stage with busts, waists, and hips surpassing 100 cm were chose as test subjects. The three subjects for the wearing experiment are those with more than one year of experience wearing a bodysuit. A self-evaluation was made three times by looking in the mirror. The data from this study was processed to find averages and deviations; in addition, and a t-test was performed using the SPSS 24 statistical software. A total of 13 body parts were measured prior to and while wearing the specialized All-in-One patterns. Significant results were obtained from all 12 items. All-in-One for research appears to have produced a high level of satisfaction for subjects. This study can provide basic data on elevating the levels of satisfaction of the consumers in their elderly stages with special body types that deviate from standard body types at the time of wearing garments as well as for inner-wear companies to graft this market as a high-value-added niche market.

**Key words:** All-in-One patterns, obese body types, specialized All-in-One, silhouette, inner-wear

### 1. Introduction

Increases in the aged population is a global trend with particularly rapid increases in Korea. Physical and physiological changes in accordance with aging necessitate significant changes in the lives of people. It is the reality that the elderly social class is establishing itself as a generation equipped with economic and intellectual capabilities to the extent of being referred to as the golden generation. As such, the elderly social class is being highlighted as the generation to be recognized as the social group to lead the market in the consumption society and to bring about changes in future society. Accordingly, the garment industry is important as the industry to provide services that fulfill the requirements of elderly social class in our current era.

Women in the elderly social class have high levels of interest in their physical appearances, along with their concerns for health. Body types of women in their elderly stage have the characteristics of a thickening of the trunk section and a thinning of limbs. In particular, while the size of the abdomen increases due to obesity and protrusions, the size of the hip area decreases with the femoral

region connected to the hip joint becoming thinner due to decreases in muscle mass. The All-in-One among foundations is sold for the purpose of correcting the trunk silhouette. Although a diverse range of products are currently being sold, it is very difficult to purchase All-in-Ones that reflects the body types of the elderly stage in the open market. As such, they are being sold as customized products through specialized functional outlets. Specialied All-in-Ones have the advantage of providing physical balance while maximally covering individual body types. However, it is not possible to find research on All-in-Ones that reflect the body types of women in their elderly stages among preceding researches(Cho & Lee, 2008; Choi et al., 2013; Jeon & Sun, 2015; Jo et al., 1997; Jung & Na, 2016a; Kim & Kim, 2015; Lee, 2013; Na, 2017; Park & Na, 2018; Park & Jang, 2014; Shin & Lee, 2001; Sohn & Na, 2013) on inner-wear.

Therefore, this study is aimed at developing speicalized All-in-One patterns by assessing the characteristics of the obese body types of the elderly social class.

It is deemed that this study can be helpful by providing basic data on elevating the levels of satisfaction of the consumers in their elderly stages with special body types that deviate from standard body types at the time of wearing garments. In addition, as the consumption of elderly fashion to look younger is increasing(Yoon, 2008), this study will show the possibility for innerwear companies to graft this market as a niche market as a part of a highly-value-added industry.

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## 2. Method

### 2.1. Subjects and body sizes

The subjects are women in the elderly stage(61~65 years), and have the physical characteristics that prevent them from wearing existing, commercialized All-in-Ones. The subjects in this study is selected based upon a prior research which defines obesity as BMI 25 to 30(Lee, 2017; Yoon, 2008). Furthermore, five healthy women with typical obese body types in the elderly stage with the sizes of their busts, waists, and hips surpassing 100 cm were chose as the test subjects. Their basic body sizes are provided in Table 1.

### 2.2. MOIRE photo

Moire(MBS-100) photographs were taken to visually observe the characteristics of elderly obese body types and apply them to pattern design.

### 2.3. Characteristics of the All-in-One design

The All-in-One for research is designed and manufactured by supplementing and fortifying the aforementioned seven correction points. At the time of designing a specialized bodysuit pattern, items selected by considering the body type correction and design included the following: ① Bra cup: It is made from a full-cup

design to fully accommodate the large, sagging breasts in the bra cup. The cup design is a full-cup type made of four pieces, including two pieces for the lower cup, one piece for the upper cup and wire a inserted into the side piece to firmly support the breast. ② Shoulder strap: Running type with a broad shoulder strap that can be connected to the bra cup to pull up the sagging breasts from the shoulder while minimizing localized pain in the shoulder. ③ Correction of the trunk: Lower Tamy for correction of the abdomen to the perineal point, and adding lining to the back portion with a power-net in an X shape to support force at the center of the back(support the waist with three layers of fabric including the outer layer for the section at the back of waist) ④ Maintain the hip-up and volume formation ⑤ Thigh: After having designed the folds in the thigh along the folds in the hip joint area of the perineal region in a straight line, and correcting the pulling phenomenon of the hip joint portion after wearing it. ⑥ Armhole line: Minimize the cupping to ensure that the flesh in the moving area does not move to the upper arm by maximizing the lateral aspects of the shoulder strap and bra cup ⑦ Other back cupping is made in a rounded, boat-type shape to minimize the quantity of cupping.

The correction effect and satisfaction of All-in-One for this research was found during the wearing experiment.

In addition, items presented in the preceding research(Na, 2017) are

**Table 1.** Body size of subjects

Item	Subject					Size Korea*
	S1	S2	S3	S4	S5	M(SD)
Chest circumference	113.3	110.0	108.0	105.2	103.6	91.2 (5.11)
Underbust circumference	99.8	96.0	96.7	95.2	92.7	83.3 (5.95)
Waist circumference	101.2	103.0	102.8	108.0	105.2	86.0 (7.91)
Omphalion circumference	110.4	106.0	104.0	101.0	107.2	88.9 (7.76)
Hip circumference	109.8	103.0	105.0	103.1	102.0	92.8 (5.13)
Thigh circumference	53.0	53.4	53.2	52.5	51.5	54.0 (3.87)

\*2015 7th

**Table 2.** Physical properties of research All-in-One

Fabric	Weight (g/m <sup>2</sup> )	Thickness (mm)	Density (piece/5cm)		Tensile strength(N)	Tensile elongation strain(%)	Restoration (%)	Fiber mixture rate(%)	
Shell	173.1	0.40	Wale	94.4	251.1	337.0	34.0	Nylon	77.1
			Course	122.2	226.5	272.5	94.0	Poly-urethane	22.9
Lining	152.1	0.40	Wale	74.8	174.4	381.5	74.0	Nylon	70.6
			Course	137.8	190.7	220.4	98.0	Poly-urethane	29.4
Lace	121.2	0.41	-	-	12.8	84.0	95.8	Nylon	88.1
			-	-	13.0	236.0	96.6	Poly-urethane	11.9
TR	80.0	0.3	-	-	-	-	-	Nylon	100.0
Tape	4.9	1.03	-	-	32.8	288.0	96.8	Nylon	78.2
			-	-	-	-	-	Poly-urethane	21.8

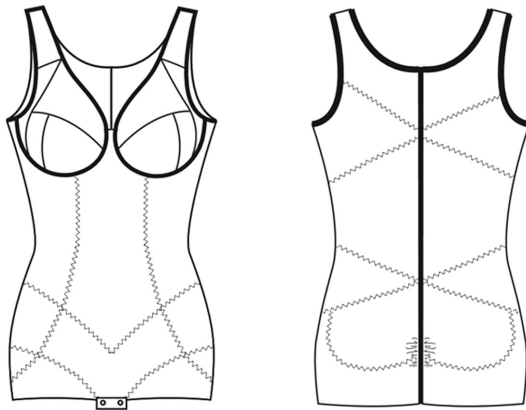


Fig. 1. The All-in-One for research.

used for the All-in-One length. The physical characteristics of All-in-One are shown on Table 2 and schematized as illustrated in Fig. 1.

### 2.3. Wearing experiment

A wearing experiment was executed in the sample production room of Company A. Five subjects for the wearing experiment are those with more than one year of experience in having worn a All-in-One. A self-evaluation(wearer) was made three times by looking at oneself in the mirror. Observer group was consisted of two innerwear designers and three fashion design major professors (including adjunct professor) and the test was repeated three times to gain the result value for wearing experiment. Evaluation of feel of wearing specialized All-in-One for research was made on two groups, namely, those wearing the wearer and the observer since there was no size among the existing products that the subject can wear. Reference(Jung & Na, 2016b; Park & Na, 2018) was to the preceding research for evaluation items, which was finally selected by seeking advice of two innerwear designers. Evaluation of the test items were categorized into five levels in accordance with the five-scale method including ‘Highly inappropriate = 1 point’, ‘Inappropriate

= 2 points’, ‘Average = 3 points’, ‘Appropriate = 4 points’ and ‘Highly appropriate = 5 points’. Subjects were asked to give corresponding points for each test items.

### 2.4. Data processing and analysis method

Data obtained in this study was processed for computation of averages and deviations, and a t-test was performed using the SPSS 24 statistical software.

## 3. Results & discussion

### 3.1. Observation of characteristics of obese body types by means of moire photographs

As shown in Fig. 2 Moire photographs(MOIRE, MBS-100) are taken by producing a plaster body of Subject 1, wearing a brassier and panties in order to examine the characteristics of obese body types in the elderly stage. When the contours of moire are viewed from the front, protrusion of the lateral aspects of the abdomen and waist can be seen. Bra cup was designed as four-piece full cup to hold large and stretched breast. To make a correction effect on the protrusion of abdomen, power net is designed from the bottom of the bra to the front line of abdomen.

When viewed from a 45° angle, protrusions of the end points of the shoulder, rear movement area, and rear waistline of the 45° section can be confirmed. Moreover, it can be observed that the contour lines of the hips and the bottom portion of the back are aggregated toward the rear side. The physical characteristics for each area as discerned by moire photographs became important data for volume, reduction, and expansion at the time of pattern design.

### 3.2. Specialized All-in-One pattern design for research

All-in-One pattern for obesity body type, used for this research, was designed with the average measurement of the five subjects as shown in Fig. 3.

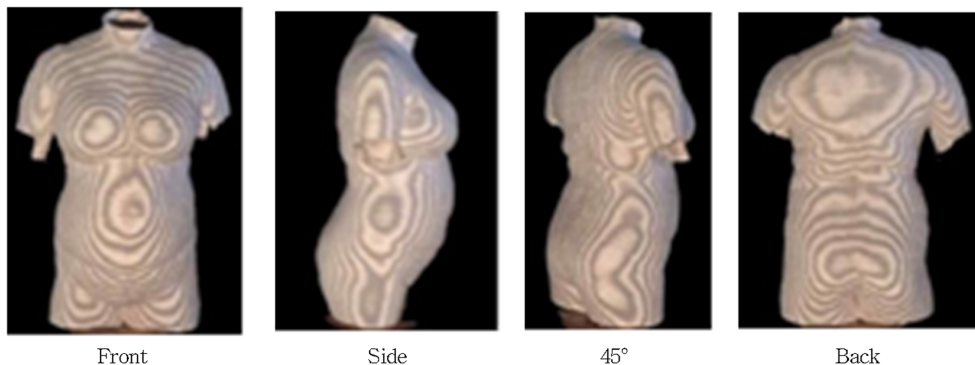


Fig. 2. Moire photographs.

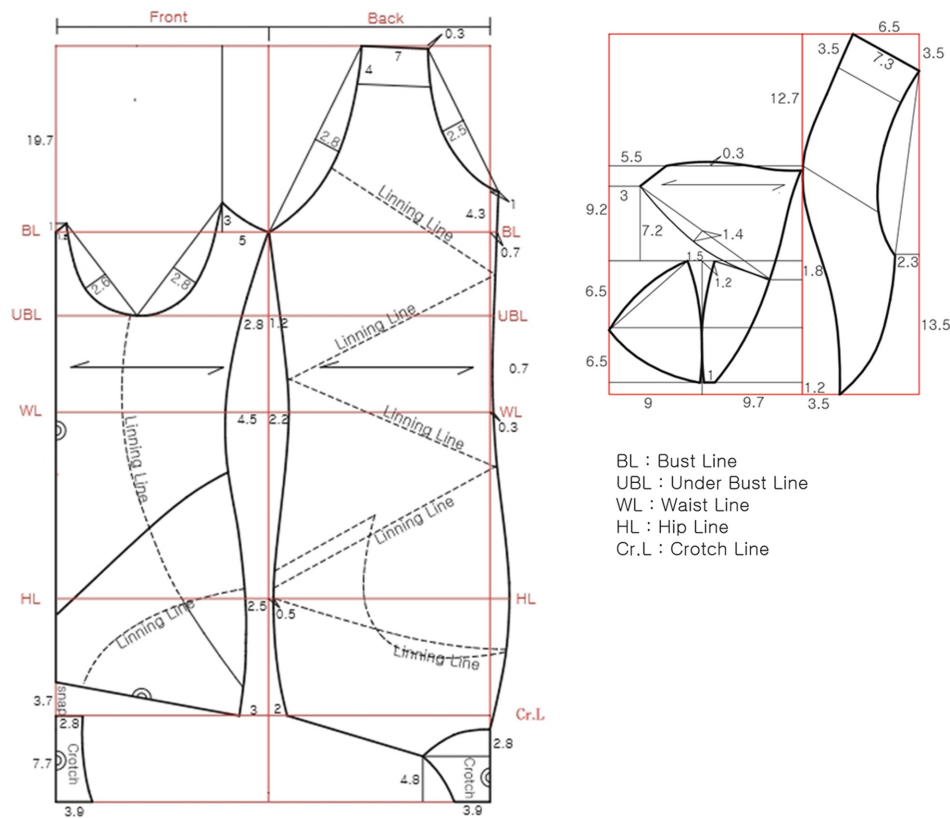


Fig. 3. Specialized All-in-One pattern design for research.

It was designed with a four-piece full cup to hold large, stretched breast in a bra cup. In particular, the size of the side cups was set wide to bring the breast near the armpit to the original breast site, and at the same time, the side cups were connected to the shoulder to boost the large, sagging breasts.

On the back of the body, the power net is designed to overlap on the left and right which makes a force to be exerted on the back. This has a correction effect to make the waist straight. The thigh part is designed to ease the tightening effect of a hip joint after wearing it, by designing straight line from the perineal region.

Table 3. Variation of body dimensions before and after All-In-One for research

(N = 5)

Body part	Bra+pany(nude)	For research	t-test
Chest circumference	120.0(1.464)	116.0(0.926)	8.944***
Underbust circumference	105.6(1.682)	100.0(0.926)	11.297***
Waist circumference	108.8(0.775)	106.0(0.926)	8.984***
Waist circumference (Omphalion)	123.0(1.732)	118.8(1.207)	7.705***
Hip circumference	122.8(1.656)	119.6(1.056)	6.310***
Thigh circumference	61.8(1.656)	60.0(0.926)	3.674**
Bust point-bust point	24.6(1.549)	23.2(0.775)	3.130**
Neck point to breast point	30.4(1.056)	28.2(0.775)	6.508***
Diameter of lower portion of the breast	10.4(1.056)	8.0(0.926)	6.620***
Internal length of the breast	16.2(0.775)	12.8(1.207)	9.181***
External length of the breast	18.0(0.655)	13.8(0.775)	16.036***
Suit length	38.6(0.507)	39.0(0.926)	-1.468
Waist to hip length	28.6(0.507)	26.0(0.655)	12.160***

\*\* p<.01, \*\*\* p≤.001

### 3.3. Effects on correction of appearance of Specialized All-in-One

In order to examine the physical changes in accordance with the wearing of the specialized All-in-One for research, each of the body parts in comparison to the state while wearing a brassier and panties are illustrated in Table 3. A total of 13 body parts were measured prior to and while wearing the specialized All-in One for research. Significant results were obtained from the 12 items. There were reductions in the chest, below breast, waist and abdomen by 4 cm, 5.6 cm, 2.8 cm and 4.2 cm, respectively, in comparison to the figures obtained when not wearing All-in-One. Moreover, the diameter of lower portion of the breast, internal length and external length were reduced by 2.4 cm, 3.4 cm and 4.2 cm, respectively, by making corrections with the 4-piece full cup.

### 3.4. Wearing experiment

A specialized All-in-One pattern for research was developed to correct the silhouette of obese older women, and the wearing experiment was carried out in the same category targeting to wearers and observers. The results are shown in Table 4. For obese older women, a bra cup was designed as a full cup with 4 pieces of wire inserted since their breasts are big but sagging and less elastic. When tested on the wearer among the seven items of the breast are five items(Q2,Q3,Q4,Q6,Q7) were rated higher than an average

value of 4.28. This result was better than the one in previous study of Na(2017). The difference between the wearer and the observer was. There were significant differences in the 10(Q2,Q4,Q7,Q8, Q9,Q10,Q13,Q14,Q15,Q16) items. Among the four shoulder area categories, Q8 was rated very high at 4.8. This was a similar result with the previous study(Park & Na, 2018) as the strap was a running-type. This can be interpreted as a result of the shoulder discomfort being released because research product is designed as a running shirt type and the side piece was set wide, which helped raise and cover the stretched breast.

In addition, Q9 were also higher at 4.0, while Q10 and Q11 were higher than the average. Among the five items of the body correction, Q12 and Q13 were rated very high with an average of each 4.40, 4.60. This is considered to have been well received since the lining of the power net is designed as X-type, which has a correction effect for the abdomen and backrests, while supporting the waist at the same time.

Q15 The femoral silhouette was highly rated by wearer(4.2) and observer(4.6) because the general product was designed based on the folding line of the hip joint, but research product was designed as a straight type. A comparison between the wearer and the observer is shown in Fig. 4. The wearer evaluated Q2,Q8,Q13 higher than observer. These items are considered to have been rated higher by wearer than observer, since they are areas where wearers

**Table 4.** Sensory test by wearing the All-in-One for research (N=15)

No.	Appropriateness items	Wearer	Observer	t-value
		M(SD)	M(SD)	
Q1	Location of the cup	3.80(0.41)	3.80(0.41)	0.00
Q2	Breast support capability of the lower cup	4.60(0.50)	3.80(0.41)	4.73***
Q3	It appropriately gathers the breast medially.	4.00(0.65)	4.20(0.41)	-1.00
Q4	Contour of the breast	4.20(0.41)	4.60(0.50)	-2.37*
Q5	Extent of front cupping at the chest	3.80(0.41)	4.00(0.65)	-1.00
Q6	Correction ability of the side cup	4.60(0.50)	4.60(0.50)	0.00
Q7	Extent of wrapping around the breast section	4.00(0.00)	4.60(0.50)	-4.59***
Q8	Shoulder tension	4.80(0.41)	4.20(0.41)	-3.97***
Q9	Cupping below armpit	4.00(0.00)	4.40(0.50)	-3.06**
Q10	Rear armhole line	3.40(0.50)	4.20(0.41)	-4.73***
Q11	Cupping in the back	3.60(0.50)	3.80(0.41)	-1.18
Q12	Silhouette at the abdomen and waist is appropriate.	4.40(0.50)	4.60(0.50)	-1.08
Q13	Correction effect for the back of the waist	4.60(0.50)	4.00(0.00)	-4.59***
Q14	Correction of hip	3.60(0.50)	4.00(0.00)	-3.06**
Q15	Lateral silhouette	4.20(0.41)	4.60(0.50)	-2.37**
Q16	Overall silhouette	3.60(0.50)	4.80(0.41)	7.10***
	Average value	4.07(0.42)	4.22(0.45)	

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p \leq .001$

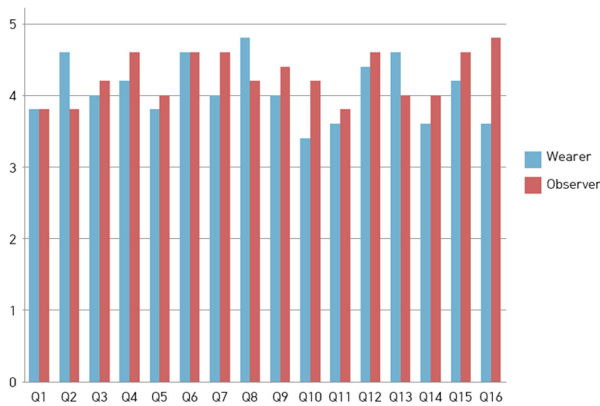


Fig. 4. Comparison of items between wearer and observer.

could feel the direct effect of wearing. On the other hand, Q9, Q10, Q16, which are armpits, back-to-back pits and overall silhouettes were rated higher by observers than wearers. These items are considered to be evaluated by visual observation.

The wearer evaluated Q2, Q7, Q13 higher than observer. These items are considered to have been rated higher by wearer than observer, since they are areas where wearers could feel the direct effect of wearing.

On the other hand, Q9, Q10, Q16, which are armpits, back-to-back pits and overall silhouettes were rated higher by observers than wearers. These items are considered to be evaluated by visual observation.

All-in-one designed in this study, well considering the elderly body type correction, four items showed outstanding performance ① Bra cup, ② Shoulder strap, ③ Correction of the trunk, ⑤ Thigh, other items ④ ⑥ ⑦ showed similar results with the previous study (Park & Na, 2018; Sohn & Na, 2013).

#### 4. Conclusion

As the results of having executed evaluations of the wearing of specialized All-in-One by developing a pattern for correction of the silhouettes of obese women in their elderly stage, the following conclusions were obtained.

In order to develop All-in-One pattern designed for elderly women Moire photography was used to observe the characteristics of body shape. The characteristics of the All-in-One design consists of ① Bra cup ② Shoulder strap ③ Correction of the trunk ④ Maintain the hip-up and volume formation ⑤ Thigh straight line design ⑥ Armhole line ⑦ Other back cupping minimization. The result of sensory test by wearing the All-in-One showed high results in breast (4.28), shoulder (4.8), and abdomen, back, thigh in average of 4.4.

By wearing the specialized All-in-One, developed for this study,

the levels of satisfaction increased as consumers were content with its effect on correcting the trunk silhouette. Furthermore, the newly designed pattern of All-in-One of this study has a potential to become an important reference to innerwear companies thus further research would be important. Further research will be focusing on functional innerwear designs and specialized pattern designs for various body types.

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