

Study on the analyze brassiere pattern by brand⁺

Park, You-Shin* · Choi, Young-Soon

Associate Professor, Dept. of Fashion Design & Textile, Seoil College*
Professor, Dept. of Fashion Design, Joong Bu University

Abstract

The purpose of this study is to develop the appropriate brassiere pattern for women. Total of 6 brands with same design and 75A, 80A size brassieres(total 12 brassieres) were compared and analyzed for pattern, cup size and patterns. SPSS 10.1 statistic process was used for data analysis.

The outcom of this study is summarized as follows.

Total length of brassiere by grade were performed smaller than the standard difference 5cm. For 1/2 front cover length, There were no significant differences between 75 and 80. The reason for lower line of wing is shorter than upper line of wing is because side support is cut side ways considering lower line of wing is sewn more toward front than upper line of wing.

Even it is same A cup size most cup related sizes become larger according to underbust comparing with cup capacity, they range from 146.67cc to 172.83cc for same A cups. Among same A cups with difference underbust there was average of 26.16cc differences. For relations of material, sewing technology and expansion rate, all 6 brands had zigzag type sewing for upper line tape. For every 0.3cm height, there were 17~21 stitches. When urethane mixture is similar expansion rate is higher while number of 1 inch zigzag are high. For elasticity, zigzag stitch expand side ways for more expansion.

Key Words : cup capacity, underbust, brassiere, pattern

I . Introduction

Among 11 trillion 234.3 billion won clothing market, inner-wear occupies 748.2 billion won and the recognition of inner-wear is enhanced

due to various consuming patterns of consumers and fashion trend of inner-wears. Brassiere among the inner-wears is even worn as outer-wear for its purposes, fashion trend and functionality. The important factors

⁺ This work was supported by the Seoil College Research Grant

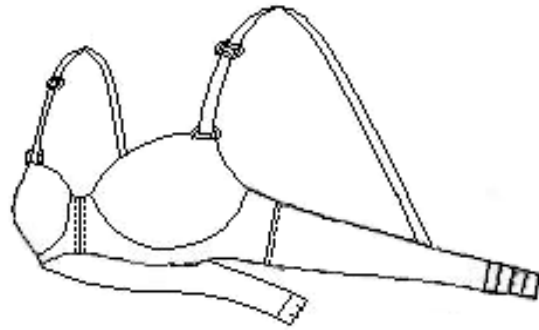
for purchasing brassiere are in sequence of size, design, color, price, others, material and brand¹⁾. Not like outer-wear focused on design and color, size is significantly important for brassiere. But standard from Korean Standard Association is not properly implanted in size of brassiere. So manufacturers are mixing new and old standard of size and different standard by brands result 23% of accuracy in size structure²⁾ and most consumers do not realize their own sizes accurately. There was not relation between increase of underbust and size of cup³⁾⁴⁾⁵⁾⁶⁾. Existing study of brassiere pattern are limited to experiment of cotton materials excluding currently produced polyester and urethane synthetic fibers. Therefore a study of currently sold in the market and products that consumers actually purchase is necessary. It is proposed to understand the female bra generally manufactured, to measure the pattern and cup capacity, to utilize as pattern data of development and to develop the most appropriate brassiere pattern, also to examine and compare domestic brassiere brands and basic brassiere patterns for study of domestic brassiere structure analysis.

II. Study method and contents

1. Objective of the study

This is the product for adults over 20 years old. Brassiere from department stores and wholesale marts were selected as first market research and 75A, 80A sizes were compared for the study. As a second analysis total of 6 brands with same design<Fig. 1> and 75A, 80A size brassieres (total 12 brassieres)were

compared and analyzed for pattern, cup size and sewing patterns.



<Fig. 1> Diagram of Bra Research

As most of domestic brassieres are manufactured with mold cups, objective of the study is selected as mold cup. For cup type, 2/3 cup among full cup, 2/3 cup and 1/2 cup was selected as it is the most commonly used. Hook eye was 3/6, wing type is upper, lower tape sewn. Also among upper, lower tape sewn brassieres, the most common 1cm width was selected. <table 1> shows in order to understand the characteristics of research products. In other word, it shows the width of tape on upper wing, plastic bone of side supporting part, cup shape and power net by brands. Power net is used for front cover that helps to keep breasts shape. Study period was from May 2nd 2006 to June 30th 2006 for brand research and sample purchases.

2. Study Method

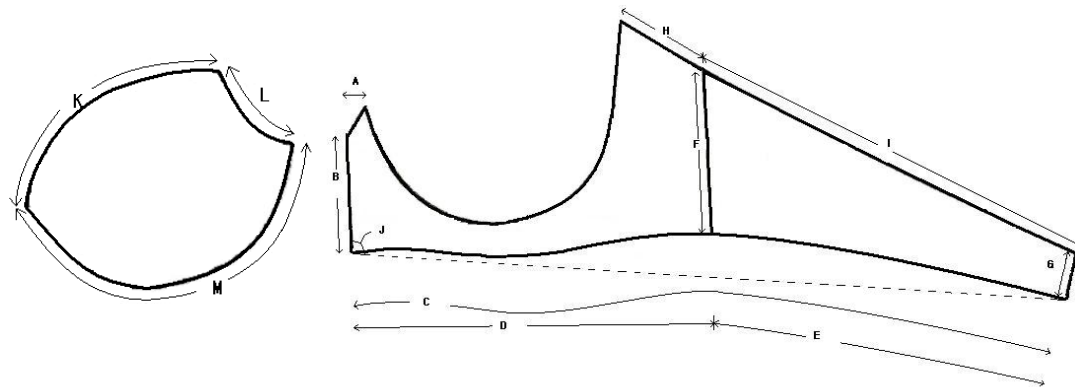
For measurement, length measurements are composed of 12 factors including total length, upper wing, lower wing, front upper line, side upper line, length of cup circumference, front cover length, upper front cover armhole, front

<Table 1> Property of Objective

Brand	A	B	C	D	E	F
Wing tape of upper line	1cm	1cm	1cm	1cm	1cm	1cm
Wing tape of under line	1cm	1cm	1cm	1cm	1cm	1cm
Cup shape	mold	mold	mold	mold	mold	mold
Side support	○	○	○		○	○
Place of power net	front panel	front panel	front panel	front panel	front panel	front panel

center width, front center height, wind angle, side support height. Cup capacity is calculated by the following steps. Cut the band tape by 2x5cm and paste them on the bra cup by three layers. Pour water after detaching it and

measure the amount of water again. Also sewing type, material elasticity were examined. Structure and part name of brassiere is shown on <Fig. 2>. Pile diagram is shaped when standard a line makes a right angle with central line of cup circumference<Fig. 3~4>.



<Fig. 2> Structure and part name of brassiere

A: 1/2 front center width ; straight length from front center line to cup, **B:** front center height ; front center line height, **C:** 1/2 length of brassiere; length from hook to first eye, **D:**1/2 front cover length ; lower part length from front center to side support, **E:** lower part wing length; bottom direction length of wing, **F:** side support height :front cover and wing connection line height, **G:** hook and eye width: rear adjustment width of wing, **H:** front cover upper armhole length : front cover upper armhole length, **I:** Wing upper line length; upper length of wing, **J:** wing angle; angle between wing bottom end to front center straight line and front center line, **K:** front upper line ; upper front length of cup, **L:** side upper line; side length of cup, **M:** cup circumference; circumference length of cup and front cover connection area.

3. Data Processing and Analysis Method

SPSS 10.1 statistic process was used for data analysis. Analysis of variance is used for 75A and 80A and t- test is performed for differences between 75A and 80A.

III. Results and Discussion

In order to examine grading size of each brand, same design 75A, 80A brassieres of each brands were compared. In case of foreign manufactured and imported brand, cup size is measured very large for same sized brassieres. Therefore import brands that do not consider body type of Korean women were eliminated.

In first experiment, there were many products from small and medium size businesses only indicating underbust size or with L, or M. For products when the sales person suggested A cup, the cup sizes varied a lot. According to cup size standard, difference between bust circumference and underbust circumference is 7.5cm and it is AA cup but it is indicated as underbust circumference 75cm and bust circumference 82.5cm. Among well known brands, it is indicated as B cup by old size indication type but in reality it is A cup. We were able to witness many differences on sizes and cup sizes by brand<table 2>.

1. Measurement analysis by sizes

From groups of 75 and 80, significant probabilities were shown and irregular sized products were manufactured by brands<table 3~7>.

1) Total length of brassiere

Total length of 75 and 80 were actually 61.73cm and 65.30cm. As a result total length differences is average of 3.9cm. The total length of 75A bra is generally 63.73cm but the total length of this research is 61cm which is shorter. This indicates pattern process is performed smaller than the standard difference 5cm⁷⁾. It can raise the clothes pressure. Therefore, it represents that manufacturers do not consider the biomechanics and have produces in the previous process.

2) Upper and Lower wing line, Front cover length

For front cover length, most of products have power net attached inside for unelasticity. For 1/2 front cover length, the average is 13.63cm and 14.00cm for 75 and 80. There were no significant differences. Minimum and maximum length were similar resulting total length adjusted on wing area. Upper wing lines were 16.42cm and 17.78cm for 75 and 80. Difference between the size is 1.36cm. Lower wing lines were 15.73cm and 17.15cm for 75 and 80. Difference between the size is 1.42cm. The reason for lower line of wing is shorter than upper line of wing is because side support is cut side ways considering lower line of wing is sewn more toward front than upper line of wing. Furthermore, there is no distinct difference because consumers demand pushing their breasts up.

3) Front upper line and Side upper line of cup, Cup circumference

Front upper line of cup were 14.52(15.27)cm

<Table 2> Value of measurement of each brand(cm)

Value of measurement	Brand		A	B	C	D	E	F	Mean	SD	Minimum	Maximum	subtraction	t-test
	75	80												
Total length(cm)	75	80	61.8	63.2	59.6	59.8	63.4	62.6	61.73	1.67	59.60	63.40	3.9	-97.2***
	75	80	66.2	67.8	63.2	63.4	65.0	66.2	65.30	1.79	63.20	67.80		
Upper wing line(cm)	75	80	16.9	16.7	16.7	15.3	17	15.9	16.42	.67	15.30	17.00	1.36	-19.4***
	75	80	18.7	17.8	18.2	16.5	18	17.5	17.78	.75	16.50	18.70		
Lower wing line(cm)	75	80	16.1	15.3	16.3	14.7	17.2	14.8	15.73	.97	14.70	17.20	1.42	-28.5***
	75	80	17.6	16.8	17.8	16.1	18	16.6	17.15	.76	16.10	18.00		
Front cover upper armhole length(cm)	75	80	3.5	3.8	2.2	3.5	3.2	3.5	3.28	.56	2.20	3.80	0	0.00
	75	80	3.7	3.6	1.9	3.4	3.8	3.3	3.28	.70	1.90	3.80		
front panel length (cm)	75	80	13.3	14.8	12.0	13.7	13.0	15.0	13.63	1.13	12.00	15.00	.35	-76.9***
	75	80	14.0	15.6	12.3	14.0	13.0	15.0	14.00	1.22	12.30	15.60		
Front upper line of cup(cm)	75	80	13.3	13	13.1	14.0	16.7	17.0	14.52	1.84	13.00	17.00	.75	-10.6***
	75	80	14.3	13.5	14.1	14.5	17.2	18.0	15.27	1.86	13.50	18.00		
Side upper line of cup(cm)	75	80	5.3	4.6	5.1	5.0	6.3	7.0	5.55	.91	4.60	7.00	.26	-58.1***
	75	80	5.3	4.3	5.6	5.8	6.3	7.6	5.82	1.10	4.30	7.60		
Cup circumference(cm)	75	80	18.8	20.2	18.0	18.2	17.4	19.6	18.70	1.02	17.40	20.20	1.15	-48.0***
	75	80	20.0	21.6	19	19	19	20.5	19.85	1.07	19.00	21.60		
Front center height(cm)	75	80	4.0	5	4.7	3.7	3.7	3.4	4.08	.63	3.40	5.00	.54	-93.0***
	75	80	4.8	5.5	5.2	4.2	4.3	3.7	4.62	.67	3.70	5.50		
Front center width(cm)	75	80	0.9	0.9	2.2	0.8	2	0.9	1.28	.64	.80	2.20	.07	-12.4***
	75	80	1	0.9	2.4	0.8	2	1	1.35	.67	.80	2.40		
Side support height(cm)	75	80	6.6	7.4	6.5	6.6	6.8	7.9	6.97	.56	6.50	7.90	.43	-75.6***
	75	80	7.3	7.4	7.5	6.6	7.4	8.2	7.40	.51	6.60	8.20		
Wing angle(°)	75	80	112	95	104	114	109	94	104.67	8.57	94.00	114.00	.25	-33.71***
	75	80	111.5	97	100	115	112	94	104.92	8.96	94.00	115.00		
Cup capacity(cc)	75	80	144	118	108	118	140	150	146.67	33.82	118.00	210.00	26.16	-36.39***
	75	80	175	130	138	152	160	195	172.83	33.62	130.00	225.00		

for 75 and 80. Difference between the size is 0.75cm. Side upper line of cup were 5.55 (5.82)cm for 75 and 80. Difference between the size is 0.26cm. Cup circumference were 18.70(19.85)cm for 75 and 80. Difference is 1.15cm. Even it is same A cup size most cup related sizes become larger according to underbust comparing with cup capacity, they

range from 146.67cc to 172.83cc (26.16cc differences) for same A cups. Grading process would be preferred because it has different underbust, and cup capacity can be raised by underbust despite of the same size of cup. Cup should be manufactured by referred size regardless of underbust.

4) Front center width and Front center height

Front center height were 4.08(4.62)cm, 80A is higher 0.54cm than 75A. Front center width were 1.28(1.35)cm, 0.07cm, difference between the size is 0.07cm. For front center height, if its too high, it may cause tightness and if its too low, it will reduce role of maintaining breast location. 4.08cm is the most common height. For front center width, it is wider when the size of breast is small for regular human body⁸⁾ but breasts need to be gathered for silhouette purposes it does not correspond with body measurement.

5) Wing angle

Wing angle were 104.67(104.92)° for 75 and 80. It shows similarly from existing study.⁹⁾ Minimum values for 75, 80 are both 94°. Wing end to front center degree is close to 90° resulting linear shape of brassiere not considering pattern for dimensional body shape. Maximum values of 75, 80 are 114(115)°<Fig. 2~3>.

6) Cup capacity

There were regular proportional relationship as 210~270cc are A cup, 317~435cc are B cup, 450~500cc are C cup¹⁰⁾. But the maximum cup capacity in this study was 144(175)cc and minimum capacity was 108(130)cc averaging 137.63(162.5)cc. In other words, even same underbreast, maximum of 36cc(75), 45cc(80) were shown. Among same A cups with difference underbreast there was average of 26.16cc differences. The cup capacity should also not be changed by underbreast and the grading process should be introduced because it is increased and decreased by only the size of cup.

2. Material, Sewing technology and Expansion rate

For relations of material, sewing technology and expansion rate, all 6 brands had zigzag type sewing for upper line tape. For every 0.3cm height, there were 17~21 stitches. For lower line tape, three stitch, zigzag were used. Most of the materials were mixture of polyester

<Table 3> Comparison of 75A brassieres

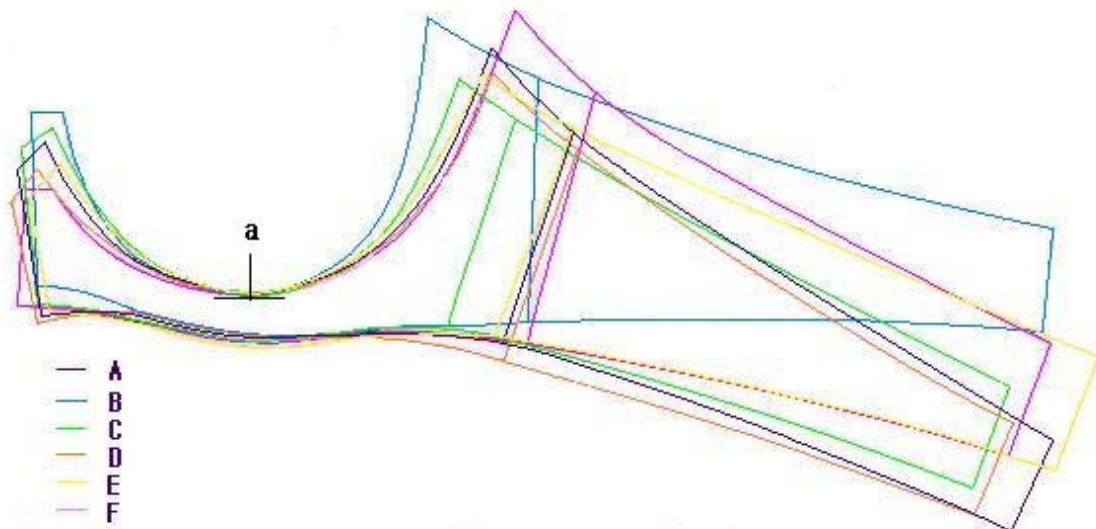
75A	SS	d.f	MS	F	SP
Between groups	147217.597	13	11324.431	117.323	.000
Within group	6756.670	70	96.524		
Total	153974.267	83			

* p≤0.5 ** p≤ 0.01 *** p≤0.001

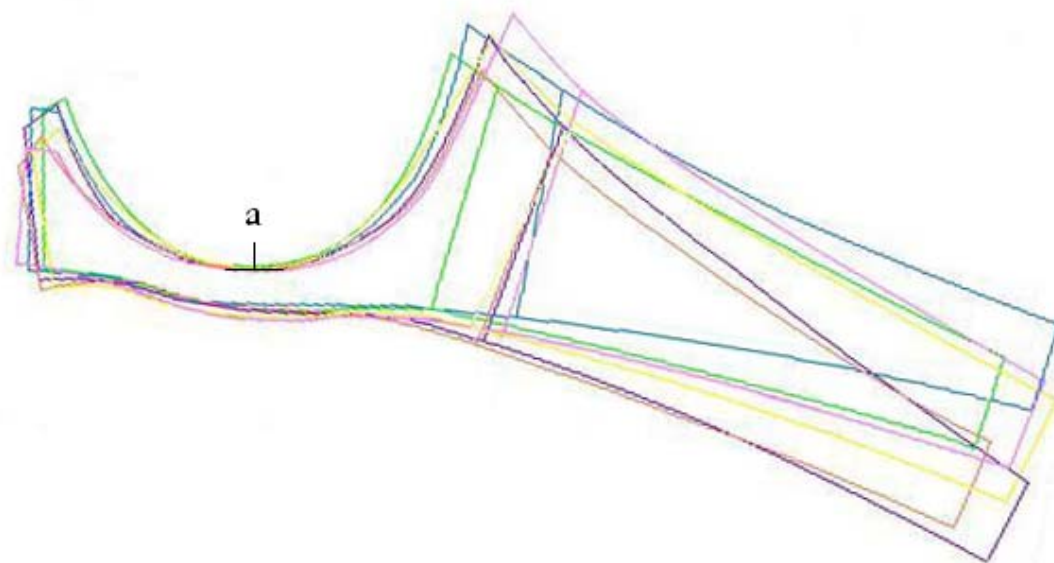
<Table 4> Comparison of 80A brassieres

	SS	d.f	MS	F	SP
Between groups	187246.485	13	14403.576	149.832	.000
Within group	6729.207	70	96.132		
Total	193975.691	83			

* p≤0.5 ** p≤ 0.01 *** p≤0.001



<Fig. 3> polymerized figure of 75A brassieres



<Fig. 4> polymerized figure of 80A brassieres

and urethane. The mixing rate of elastic fabric is at least 8.5% and 18% at maximum. When urethane mixture is similar expansion rate is

higher while number of 1 inch zigzag are high. For elasticity, zigzag stitch expand side ways for more expansion<table 5>.

<Table 5> Characteristics of subjects

Brand \ Item	Upper wing line (mm/ㄱH)	Lower wing line (mm/ㄱH)	Fabric(%)	Ratio of extension(%)
A	zigzag(3/18)	three stich(7/9)	polyester90, urethane 10	23
B	zigzag(3/17)	zigzag(3/18)	polyester, urethane	28
C	zigzag(3/21)	zigzag(3/18)	polyester46, urethane 8.5, nylon 45.5	20
D	zigzag(3/18)	zigzag(3/18)	polyester90, urethane 10	32
E	zigzag(3/20)	zigzag(3/19)	polyester90, urethane 10,etc.	45
F	zigzag(3/19)	three stich(7/8)	polyester90%, nylon 10,etc.	13

IV. Conclusion

Total length of 75 and 80 were actually 61.73cm and 65.30cm. That results were performed smaller than the standard difference 5cm.

For 1/2 front cover length, the average is 13.63cm and 14.00cm for 75 and 80. There were no significant differences. Upper wing lines were 16.42cm and 17.78cm for 75 and 80. The reason for lower line of wing is shorter than upper line of wing is because side support is cut side ways considering lower line of wing is sewn more toward front than upper line of wing.

Even it is same A cup size most cup related sizes become larger according to underbust comparing with cup capacity, they range from 146.67cc to 172.83cc (26.16cc differences) for same A cups.

Front center height were 4.08(4.62)cm, 80A is higher 0.54cm than 75A. Front center width were 1.28(1.35)cm, 0.07cm, difference between the size is 0.07cm. For front center height, if

its too high, it may cause tightness and if its too low, it will reduce role of maintaining breast location. 4.08cm is the most common height.

Wing angle were 104.67(104.92)° for 75 and 80. Minimum values for 75, 80 are both 94°. Wing end to front center degree is close to 90° resulting linear shape of brassiere not considering pattern for dimensional body shape.

There were regular proportional relationship as 210~270cc are A cup, 317~435cc are B cup, 450~500cc are C cup. But the maximum cup capacity in this study was 144(175)cc and minimum capacity was 108(130)cc averaging 137.63(162.5)cc. In other words, even same underbust, maximum of 36cc(75), 45cc(80) were shown. Among same A cups with difference underbust there was average of 26.16cc differences.

For relations of material, sewing technology and expansion rate, all 6 brands had zigzag type sewing for upper line tape. For every 0.3cm height, there were 17~21 stitches.

When urethane mixture is similar expansion rate is higher while number of 1 inch zigzag are high. For elasticity, zigzag stitch expand side ways for more expansion.

Size 75 and 80 brassieres were purchased from 7 different brands as above and patterns were compared. The result shows that there could be high variation for front cover length, Front upper line of cup, Side upper line of cup and Front center height for design purposes but there should be lower variation on lower breast circumference. But same sized brassieres from different brand showed different sizes. Domestic underwear grading type increases cup size one grade when lower breast circumference increase one grade. But size of breast, circumference of breast and lower breast circumference sizes are not proportional and there were problems in cup size determination by differences between breast circumference and lower breast circumference. It represents that the report that 20~30% of consumers uses the exact size of bra is not caused by their wrong acknowledgement. It suggests that it is irrational to perform brassiere grading with outer-wear grading type and there should be a consistent size system among manufacturers.

With the foundation of these data, standard size products according to Korea Standard Association need to be researched and developed. Also manufacturer need to put more efforts to produce products that are according to standard sizes.

References

- 1) Mi Ran Kong (2006), *Design for Innerwear*. Keoung Chun Sa publishing company, p.92
- 2) Pechter E.A(1988), New Method for Determining Bra Size & Predicting Postaugmentation Breast Size. *PRS* 102:1259
- 3) Sohn, Hee-Soon(2006), A Study on the comparative analysis of bra pattern between girl students and adults, *Journal of Fashion Business* 10(4), p.95~113
- 4) Yi, Kyong Hwa(1995), *A study on breast shape and brassiere sizing system for elderly women*, Ewha Womans University Doctoral Dissertation,
- 5) Hei-Sun Choi, Kyung-Mi Lee(1999), A Study on the Development of Mastectomy Bras and Protheses(1), *Journal of the Korean Society of Costume* 51(3), p.12
- 6) Kyong-Hwa Yi(1997), A Study on Analysis of Breast Shapes by Replica Experiments, *Journal of the Korean Society of Clothing and Textiles* 21(4), p.40
- 7) Park, You-Shin(2006), A Study on the adaptedness of brassiere underbust length, *Journal of Fashion Business* 10(1), p.39
- 8) Park, You-Shin(2002), *A Study on Establishment of Brassiere Size and Clothing pressure for the Twenties-aged Women*, Sejong University Doctoral Dissertation,p.68

Received 21 September 2006, Accepted 29 November 2006.