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A Basic Study on the Hat Production for Aged Women

Shim, Boo-Ja* · Yoo, Hyun
Prof., Division of Fashion & Textiles, Dong-A University*
Lecturer, Division of Fashion & Textiles, Dong-A University

Abstract

This study aims to suggest basic data for the production of hats for aged women. The subjects were 151 females who are 60 years old or above and live in Busan. Their hat-wearing reality was inquired and their head parts were measured, which led to the following conclusion:

1. Results of Hat-Wearing Reality Inquiry

64.9% answered they are unsatisfied with the size system of the available hats at present, implying the necessity for improving the current dimension system.

92.7% responded hat dimensions need to be subdivided, while 97.4% were for the necessity of hat size system. 74.8% expressed their will to buy ordered hats because they can find the hats of right sizes and designs.

2. Results of Head-Part Measurement Experiments

According to head-part measurement, head circumference A was 53.26㎝, head circumference B 54.19㎝, and head circumference C 57.69㎝ on the average.

Cluster analysis revealed three types. Type 1 (24%) with small head length and circumference is the smallest head with a wide upper part. Type 2 (33%) has long head height, short bitragion arc A, and thick head breadth. Type 3 (43%), owing to big head circumference and length as well as high values in vertical items.

Considering head circumference B (HCB) and bitragion arc A (BAA), a new hat size system of 3 sizes (HCB: BAA) was chosen: S (52㎝: 29㎝), M (53~55㎝: 30㎝), and L (56~57㎝: 31㎝).

Key Words : hat-wearing reality, head-part measurement, hat size system

Ⅰ. Introduction

Average human life is gradually growing and the population of the aged is rapidly growing thanks to the developed modern medicine and the improved living standards. The Korean society already started to show some symptoms of an aged people's society from the 1970s.

The rate of the 65-year-old and above among the whole Korean population was 3.8% (1980),

Corresponding author: Shim, Boo-Ja, Tel.+82-51-200-7329, Fax.+82-51-200-7329
E-mail: shimbooja@hanmail.net

5.1% (1990), 5.9% (1995), and 7.1% (2000). It is expected to reach 19.3% in 2030, when Korea will enter an ultra-aging society.[1] According to this trend, there are growing interest in various social system, health problems, food, clothing and shelter for old people.

As the last one in the stages of human development, the aged class goes through physical, mental, social, and economical changes quite different from other classes. Today's old people are not passive or negative anymore, mainly owing to the improvement in educational background and income and the increase in social participation. As a result, they pursue more active and consumptive lifestyles that are deeply reflected in clothing activities.

Various kinds of clothes regardless of sex and age are sold for the target of aged customers, differing in functions, colors, and styles. In the case of hats, however, divisions in sex and age are clear and rigid. Their size system is centered on young and middle-aged classes, so hats fitting for the aged people who are experiencing aging process are insufficient.[2]

In addition, the research on the hats for the aged is still not enough. Among the main studies in human engineering and clothing science so far are old people's heads and face patterns for product dimensions and designs,[3] size systems for the hats of male adults,[4] hat pattern development for Korean women,[5] head shape analysis for hat production,[6] and head shape analysis for the hat designs of female adults.[7]

This study aims to understand the hat-wearing reality of aged women, measure their heads, and provide basic data for the production of desirable hats. The following are objectives:

1. Analyze the hat-wearing reality of old women through a questionnaire
2. Measure the head part one-dimensionally and comparatively analyze the characteristics of each head shape
3. Provide fundamental data for the dimension systems of some use in designing and wearing hats

II. Research Methods

1. Inquiry of Hat-Wearing Reality

1) Subjects & Period

The subjects for this research were female senior citizens who are 60 years old (in full age) and above and live in Busan. The inquiry period was May 12 through June 6, 2005. Out of all 160 copies of the prepared questionnaire, 151 complete copies were taken for analysis.

2) Inquiry Contents

The questionnaire about the subjects' hat-wearing reality had 21 items of questions, created from the examination of precedent studies. They were about hat wearing, hat purchase, dimension satisfaction with the presently available hats, necessity for dimension subdivision and clear inscription, and purchase will of ordered hats.

2. Head-Part Measurement Experiment

1) Subjects & Period

The subjects for measurement were 151 females 60 years old or above and residing in Busan. They were chosen by random sampling. The measurement was held from June 29

through July 10, 2005 by visiting four welfare centers in Seo-gu, Dong-gu, Haeundae-gu, and Dongnae-gu.

2) Measurement Items & Criterion Points

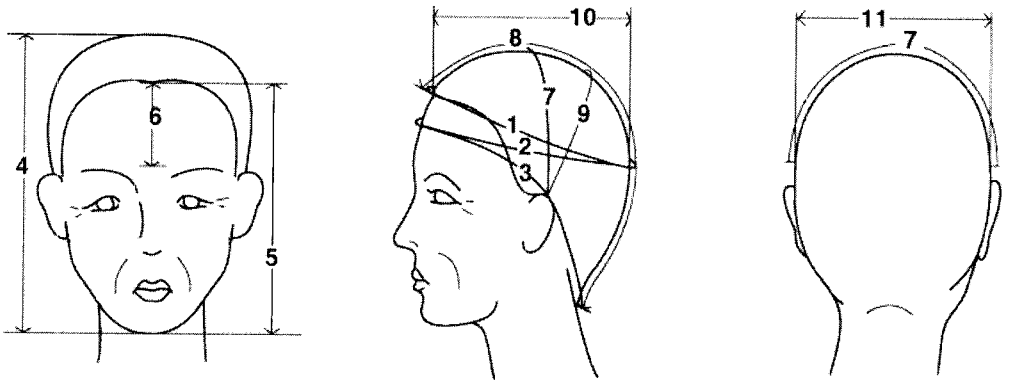
Martin Anthropometric Instruments were used for head-part measurement. Based on KSA 7003,[7] KSA 7004,[8] and Oh Sun-heui (1998),[5] 9 measurement criterion points and 11 measurement items were selected. Measurement items and contents are summed up in Fig. 1 and Table 1.

3. Data Processing & Analysis

SPSS/WIN(ver 12.0) was used for data processing, while analysis was done in the following methods:

1) For the reality inquiry, each item's frequency percentage was calculated.

2) After factor analysis of the measured values, factor points were used for cluster analysis to classify head shapes. The Duncan test finally checked significance.



<Fig. 1> Measurement items

<Table 1> Measurement items and contents

Measurement Items		Contents
Circumference (3 Items)	1. Head Circumference A	Forehead beginning to occiput
	2. Head Circumference B	Mid-forehead to occiput
	3. Head Circumference C	Mid-forehead to inion via upper ear
Vertical (3 Items)	4. Head Height	Vertex to menton
	5. Face Height	Forehead beginning to chin tip
	6. Forehead Height	Forehead beginning to glabella
Length (3 Items)	7. Bitragion Arc A	1㎝ above both ears passing vertex
	8. Pre-post length	Forehead beginning to inion
	9. Bitragion Arc B	Points above both ears passing hair whirl
Width-Breadth (2 Items)	10. Head Length	Forehead beginning to occiput (linear distance)
	11. Head Breadth	Between the protruded parts on both sides (linear distance)

3) Representative items for hat designing and wearing were chosen to result in the cross table.

III. Results & Discussion

1. Inquiry Results of Hat-Wearing Reality

1) Hat Necessity & Favorite Hat Designs

Table 2 shows the inquiry results concerning hat necessity and favorite hat designs. 97.4% were for the necessity of hats (72.2%: necessary, 25.2%: quite necessary), while 2.6% were neither for nor against it. Among the reasons of necessity were to 'shade sunlight' (89.4%), 'skip hair arrangement' (6.6%), and 'stop coldness' (2.6%). In short, the subjects felt the necessity to protect their skin as aging led to the decrease of skin resistance.

Their favorite headgear designs were 'sun caps' (49.7%), 'cloche hats' (26.5%), and 'bonnets' (9.3%). This has a lot to do with their necessity to hide themselves from sunshine.

2) Dimension Satisfaction of Available Hats & Necessity of Dimension Subdivision

<Table 2> Hat necessity & favorite hat designs

Division	Contents	Frequency (People)	Rate (%)
Necessity	Quite necessary	38	25.2
	Necessary	109	72.2
	So-so	4	2.6
	Total	151	100.0
Reasons for Necessity	Stop coldness	4	2.6
	Shade sunlight	135	89.4
	Hide hair loss	0	0.0
	Skip hairdo	10	6.6
	Charm	1	0.7
	Etc.	1	0.7
	Total	151	100.0
Favorite Designs	Toque	4	2.6
	Tarolian Hat	3	2.0
	Cloche	40	26.5
	Cap	1	0.7
	Kaplin Hat	12	7.9
	Casket Hat	1	0.7
	Canoche Hat	1	0.7
	Sun Cap	75	49.7
	Bonnet	14	9.3
	Total	151	100.0

Table 3 summarizes the inquiry results regarding the dimension satisfaction of the available hats at present and the necessity of dimension subdivision. The responses were 'unsatisfactory' (56.3%), 'so-so' (31.8%), and 'quite unsatisfactory' (8.6%). In other words, 64.9% of the subjects expressed their dissatisfaction with the current size system of the hats.

As to the necessity for dimension subdivision, the answers were in the order of 'necessary' (64.2%), 'quite necessary' (28.5%), and 'so-so' (6.6%). That is, 92.7% were for subdividing dimensions. About the necessity of dimension inscription, 95.4% felt the need (53.0%: needed, 42.4%: needed indeed), while 4.0% reserved their answers.

3) Purchase Will & Necessity of Ordered Hats

Table 4 digests the questionnaire results regarding the purchase will and any necessity of ordered hats. As much as 74.8% of the answerers expressed a will to buy those headgear because they can purchase the hats of 'right sizes' (61.6%), 'right designs' (7.9%), and 'right colors' (4.0%).

In sum, 74.8% wanted to buy ordered headgear and 61.6% desired to wear right-size hats. This reflects their high dissatisfaction with the present hat-dimension system. However, as ordered hat production has limits in cost and popularization, the correct dimension system for the aged class is No. 1 priority.

<Table 3> Dimension satisfaction of available hats & necessity of dimension subdivision

Division	Contents	Frequency (People)	Rate (%)
Dimension Satisfaction	Quite unsatisfactory	13	8.6
	Unsatisfactory	85	56.3
	So-so	48	31.8
	Satisfactory	5	3.3
	Quite satisfactory	0	0.0
	Total	151	100.0
Dimension Subdivision	Quite unnecessary	0	0.0
	Unnecessary	1	0.7
	So-so	10	6.6
	Necessary	97	64.2
	Quite necessary	43	28.5
	Total	151	100.0
Dimension Inscription	Quite unnecessary	0	0.0
	Unnecessary	1	0.7
	So-so	6	4.0
	Necessary	80	53.0
	Quite necessary	64	42.4
	Total	151	100.0

<Table 4> Purchase will & necessity of ordered hats

Division	Contents	Frequency (People)	Rate (%)
Purchase Will	Yes	113	74.8
	No	38	25.2
	Total	151	100.0
Necessity of ordered hats	Right sizes	93	61.6
	Right colors	6	4.0
	Right designs	12	7.9
	Special hats for me	3	2.0
	Etc.	37	24.5
	Total	151	100.0

<Table 5> Comparison of head-part measurements

(n=151, Unit: cm)

Measurement Items \ Measurement Dimensions		M	SD	MIN	MAX
Circumference	Head circumference A	53.26	1.60	49.00	57.00
	Head circumference B	54.19	1.51	50.50	58.00
	Head circumference C	57.69	2.27	52.80	64.00
Vertical	Head height	21.96	1.62	17.30	25.90
	Face height	18.33	1.01	15.60	21.00
	Forehead height	5.89	0.90	3.50	8.50
Length	Bitragion arc A	29.53	1.28	26.00	32.00
	Pre-post length	32.20	1.61	28.00	36.50
	Bitragion arc B	30.03	1.52	25.50	34.00
Width-Breadth	Head length	17.10	0.82	15.00	19.00
	Head breadth	15.23	0.63	13.60	16.70

2. Results of Measurement Experiments

1) Comparison of Head-Part Measurements

Table 5 describes the measurement results of the subjects' head parts. As it shows, the old class had 53.26㎝ (head circumference A), 54.19 ㎝ (head circumference B), and 57.69㎝ (head circumference C) on the average.

2) Results of Factor Analysis

Table 6 reveals the results of factor analysis by using direct measurement values to find the types of aged women's head shapes. Along with 10 direct measurements and 6 calculated measurements, 10 measurement items in 4 parts of circumference, vertical, length, and width-breadth were used as variables for factor analysis.

The results were five factors: 1 (circumference and length), 2 (contrast of head height and face

height), 3 (contrast of bitragion arc B with bitragion arc A and pre-post length), 4 (forehead height and face height), and 5 (width-breadth). The rate of accumulation contribution was 83.28%, and each factor was as follows:

Factor 1 had an eigenvalue of 3.99 accounting for 24.96% of all variables. As it includes head circumference A, head circumference B, pre-post length, and bitragion arc A, it can be explained as the factor of circumference and length.

Factor 2 had an eigenvalue of 3.69 amounting to 23.06% of all variables. This factor includes head-face height, head height, and face height/head height × 100. So it is explained as the contrast of head height and face height.

Factor 3 had 2.68 as an eigenvalue, explaining 16.78% of variables. Bitragion arc B/pre-post length × 100, bitragion arc A/pre-post length × 100, and bitragion arc B are included. Thus, this can be interpreted as the contrast of bitragion arc.

<Table 6> Results of head-part factor analysis

Variable Contents	Factors / Variable Names	1	2	3	4	5
Circumference & length	Head circumference A	.84	-.28	.04	-.04	.05
	Head circumference B	.81	-.28	.12	.02	.05
	Pre-post length	.66	.15	-.44	-.36	.17
	Bitragion arc A	.60	-.14	.59	-.15	-.06
Contrast of head height and face height	Head height-face height	-.18	.93	-.06	-.10	-.09
	Head height	-.04	.88	.10	.36	-.09
	Face height/head height × 100	.16	-.87	.13	.22	.13
Contrast of bitragion arc	Bitragion arc B/ pre-post length × 100	-.09	.05	.91	.27	-.07
	Bitragion arc A/ pre-post length × 100	-.11	-.24	-.85	.21	-.20
	Bitragion arc B	.53	.20	.69	-.03	-.20
Forehead height and face height	Forehead height	-.16	.09	.08	.91	.08
	Forehead height/ head height × 100	-.15	-.38	.05	.79	-.15
	Face height	.18	.14	.25	.72	-.01
Breadth & width	Head length/head breadth×100	.08	-.18	-.14	-.15	.95
	Head length	.59	.02	-.24	.01	.64
	Head breadth	.57	.28	.-09	.24	-.59
Eigenvalue		3.99	3.69	2.68	1.68	1.27
Total contribution rate (%)		24.96	23.06	16.78	10.52	7.95
Accumulation contribution rate (%)		24.96	48.02	64.80	75.32	83.28

Factor 4 had an eigenvalue of 1.68, amounting to 10.52% and including forehead height, forehead height/head height × 100, and face height. It is then the factor of forehead height and face height.

<Table 7> Dispersion analysis among the measurement items of three types

Items (No.) \ Types		Type 1 (n=36)		Type 2 (n=50)		Type 3 (n=65)		F-value
		M	SD	M	SD	M	SD	
Circum-ference (2)	Head Circumference A	52.27 a	1.37	52.70 a	1.55	53.99 b	1.48	13.91 ***
	Head Circumference B	53.74 a	1.36	53.60 a	1.50	54.88 b	1.31	14.47 ***
Vertical (3)	Head Height	21.86 a	1.70	22.72 b	1.23	21.45 a	1.65	9.80 ***
	Face height	17.85 a	1.00	18.45 b	.90	18.51 b	1.02	5.80 **
	Forehead height	5.39 a	.86	6.13 b	.72	5.98 b	.94	8.68 ***
Length (3)	Bitragion Arc A	29.96 b	1.12	28.68 a	1.27	29.95 b	1.04	20.77 ***
	Pre-post length	31.55 a	1.44	31.41 b	1.58	32.40 b	1.65	4.03 *
	Bitragion Arc B	30.50 b	1.24	28.92 a	1.34	30.63 b	1.32	27.25 ***
Width-Breadth (2)	Head Length	16.51 a	.66	17.87 b	.71	17.61 c	.68	33.85 ***
	Head Breadth	15.13 a	.54	15.47 b	.58	15.10 a	.67	5.67 **
Calculation (6)	Face height/head height × 100	82.36 a	5.83	81.41 a	5.10	87.07 b	5.28	18.20 ***
	Forehead height/ head height × 100	24.79 a	3.84	27.03 b	3.10	28.07 b	4.12	8.89 ***
	Bitragion arc A/ pre-post length × 100	95.11 c	5.01	88.60 a	4.14	92.59 b	4.52	23.14 ***
	Bitragion arc B/ pre-post length × 100	96.81 c	5.06	89.36 a	4.89	94.71 b	5.20	26.20 ***
	Head length/head breadth × 100	109.28 a	5.50	109.14 a	5.27	116.74 b	5.45	36.03 ***
	Head height-face height	4.00 a	1.36	4.27 b	1.31	2.94 a	1.19	17.44 ***

Alphabets represent significant groups at P≤0.05 in Duncan test results: a<b<c.

* p≤0.05 ** p≤0.01 *** p≤0.001

Factor 5 had an eigenvalue of 1.27, accounting for 7.95% and containing head length/head breadth × 100, head length, and head breadth. So it is understood as the factor of breadth and width.

3) Results of Cluster Analysis

With 5 factor points from factor analysis as independent variables, cluster analysis was done. In consideration of people's distribution and different characteristics, three types were finally classified. The results of dispersion analysis among each type's measurement items are seen in Table 7.

Type 1, taking 24% among head shapes, has small head length and head circumference. It is the smallest head with a wide upper part. Type 2, 33%, has long head height, short bitragion arc A, and thick head breadth. Type 3, 43%, has the biggest head circumference, head length and high values in vertical items.

4) Suggestion of a New Hat Dimension System

The first factors in factor analysis, items of circumference and length, were considered proper materials to make a new dimension system. Table 8 is a cross table between head circumference B (HCB) and bitragion arc A (BAA).

According to the table, HCB was 51~58㎝ and BAA was 26~32㎝. The divisions showing 2% or more in coverage were shaded. They were 19 dimension divisions, covering 83.4% and ranging 52~58㎝ (HCB) and 27~32㎝ (BAA). The dimensions with the highest coverage were 54㎝ (HCB) and 30㎝ (BAA).

Even though this study adopts 19 dimension divisions, companies use 3~4 size systems. All the divisions with 2%-or-more coverage cannot be made into diverse dimensions, which could only confuse rather than benefit customers.

Therefore, in this study with the target of the women in their 60s, 3 sizes (HCB: BAA) were chosen: S (52㎝: 29㎝), M (53~55㎝: 30㎝), and L (56~57㎝: 31㎝). These three dimensions were selected owing to their high frequency and possibility of increasing coverage rate. The new system is briefly shown in Table 9.

IV. Conclusion & Suggestion

This study aims to suggest basic data for the production of hats for aged women. The subjects were 151 females who are 60 years old or above and live in Busan. Their hat-wearing reality was inquired and their head parts were measured, which led to the following conclusion:

1. Results of Hat-Wearing Reality Inquiry

(1) 97.4% of the subjects said hats are necessary, while the reasons why they need headgear were 'shading sunlight' and 'skipping hair treatment' among others.

(2) 64.9% answered they are unsatisfied with the size system of the available hats at present, implying the necessity for improving the current dimension system.

(3) 92.7% responded hat dimensions need to be subdivided, while 97.4% were for the necessity of hat size inscription.

(4) 74.8% expressed their will to buy ordered hats because they can find the hats of right sizes and designs.

2. Results of Head-Part Measurement Experiments

(1) According to head-part measurement,

<Table 8> Cross table of head circumference B and bitragion arc A

Unit: People (%)

Head Circumference B (cm) \ Bitragion Arc A (cm)		26	27	28	29	30	31	32	Total
S	51	1 (0.7)	1 (0.7)	1 (0.7)	2 (1.3)	1 (0.7)			6 (4.0)
	52		3 (2.0)	3 (2.0)	3 (2.0)	2 (1.3)	1 (0.)7		12 (7.9)
M	53		2 (1.3)	7 (4.6)	4 (2.6)	9 (6.0)	2 (1.3)	1 (0.7)	25 (16.6)
	54		3 (2.0)	2 (1.3)	9 (6.0)	16 (10.6)	8 (5.3)		38 (25.2)
	55		1 (0.7)	4 (2.6)	8 (5.3)	14 (9.3)	11 (7.3)	4 (2.6)	42 (27.8)
L	56				2 (1.3)	10 (6.6)	3 (2.0)		15 (9.9)
	57				1 (0.7)	2 (1.3)	4 (2.6)	2 (1.3)	9 (6.0)
	58					1 (0.7)		3 (2.0)	4 (2.6)
합 계		1 (0.7)	10 (6.6)	17 (11.3)	29 (19.2)	55 (36.4)	29 (19.2)	10 (6.6)	151 (100.0)

+: S, M, and L are hat classification changeable to KS K 0059 sizes.
++: Shades stand for 2.0% or above in distribution rate.

<Table 9> Dimension system for hat production

(Unit: cm)

Item \ Size	S	M	L
Head Circumference B	52	53-55	56-57
Bitragion Arc A	29	30	31

head circumference A was 53.26㎝, head circumference B 54.19㎝, and head circumference C 57.69㎝ on the average.

(2) Factor analysis produced five factors: 1 (circumference and length), 2 (contrast of head height and face height), 3 (contrast of bitragion arc B with bitragion arc A and pre-post length), 4 (forehead height and face height), and 5 (width-breadth).

(3) Cluster analysis revealed three types. Type 1 (24%) with small head length and circumference is the smallest head with a wide upper part. Type 2 (33%) has long head height, short bitragion arc A, and thick head breadth. Type 3 (43%), owing to big head circumference and length as well as high values in vertical items, represents aged women.

(4) Considering head circumference B (HCB) and bitragion arc A (BAA), a new system of 3 sizes (HCB: BAA) was chosen: S (52㎝: 29㎝), M (53~55㎝: 30㎝), and L (56~57㎝: 31㎝).

To sum up, the class of old women felt the necessity of wearing headgear according to the examination of hat-wearing reality. They also demanded dimension subdivision and dimension inscription. Therefore, this new size system reflecting head circumference B and bitragion arc A is expected to improve the hat size fitness for aged women.

As this study is restricted in the investigation area, these research results need to be handled carefully. Next studies will have to deal with different characteristics of head shapes according to regions and sexes for the development of desirable dimension systems and hat patterns.

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