

An Analysis of Body Shapes in Aged Abdominal Obese Women for Apparel Pattern Design

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복부비만 노년 여성의 의복패턴설계를 위한 체형연구

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Abstract

The purpose of this study is to provide the basic data useful in designing apparel patterns for aged abdominal obese women. The body measurements of 318 women were taken at random, whose ages were over 60 and fields of action were colleges, sports centers, or business sites in Seoul and the neighboring districts. A total of 33 features in the upper body and lower body were used for the anthropometric measurement and analysis using anthropometry. The collected measurement data were processed statistically using the SPSS 12.0 program for technical statistical analysis, t-test, frequency analysis, correlation analysis. The results of the study are as follows:

1. Subjects were classified into two groups as a result of analysis for measurement data. It was revealed that 251 (about 79 percent) women of total subjects (n=318) have a characteristic of abdominal obese body type and elderly women of these group usually had big abdomen rather than hip. The criteria of abdominal obesity based on waist-hip ratio, WHR(=0.85).

2. Aged abdominal obese women have shown much larger size in most body measurements except items of some vertical length, such as bust point-bust point, front interscye, back interscye with circumference and depth of armscye, bust, waist, abdomen and hip while showing no difference in height, biacrominal breadth, hip width, neck shoulder point to breast point, crotch length.

3. Vervaeck index(=100.1) and Rohrer index(=1.7) indicated that the abdominal obese women were fat in overall body. And aspect ratio of waist(=0.86), abdomen(=0.92) and hip(=0.75) also appeared high that the shape of cross sections in those regions was similar to a figure of circle.

4. In view of the correlation coefficient between hip circumference and the rest measurement items, and between hip circumference inclusively of the abdomen protrusion and the rest measurement items, there were found some differences for each group. In case of Group (abdominal obese group), the former is smaller than the other.

5. In case of Abdominal obese women, hip circumference inclusively of the abdomen protrusion is more mutually related to the rest items related to make apparel pattern as waist circumference, depth of armscye and so on than what hip circumference is. This result indicated which must be considered hip circumference inclusively of the abdomen protrusion to make apparel patterns for abdominal obese women unlike women of common body types.

Key words: Aged-women, Abdominal obese, Body shape, Apparel pattern design; 노년 여성, 복부비만, 체형, 의복패턴설계

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I. Introduction

Physical changes occur gradually during aging, including a host of changes in body structure that may mandate sizing systems not now available in ready-to-wear apparel. The most prevalent physical changes that occur with advancing age are thickened waist, enlarged hips, protruding abdomen, and drooping bustline (Kim & Choi, 2004). These changes have a marked influence on the fit of clothing. It has been especially observed that elderly women are more unsatisfied with ready-to-wear fit dresses than younger women especially in fit at the waist, abdomen and hip of the body.

Studies on the body shape of aged women (Ha, 2001; Jo & Park & Choi, 1997; Kim & Choi, 2001; Kim & Seong, 2002; Kim & Sohn, 1996; Lee & Kim, 2004) have been limited to the problem of curved spines; there have been no studies on post-menopausal, abdominally obese women and clothing who felt poor fit wearing ready-to-wear, especially in case of pants and skirts. Therefore, this study is to measure the bodies of such women and verify the significant differences between two groups: normal and abdominally obese figures. To take into consideration the clothing-design needs of abdominally obese women, this study will find obesity characteristic of the whole age group, analyze the reciprocal relation of body measurements, extract measurements for application to patterns, and suggest the basic data for clothing design.

II. Method

The body measurements of 318 women over the age of 60 were taken at random in 2002; the women were found at colleges, sports centers, or business sites in Seoul and neighboring districts. The subjects wore only non-constricting briefs. A total of 33 body features were used for measurement and analysis using anthropometry (1997, Korean Anthropometric Survey). The subjects were healthy and active. The age of the subjects is shown in <Table 1>. The basic characteristics of physical shape are analyzed by arithmetical average and standard deviation. We

Table 1. Age mean(x) and number of subjects(n) in age classes

Age class	x	n	%
60-69	66.0	70	22.0
70-79	74.7	139	43.7
80 and above	83.8	109	34.3
Total	75.9	318	100.0

compared average body measurements and computational figures for the normal and the abdominally obese aged, and verified body shape differences with a T-test. And to extract human body measurements that cover the abdominal protrusion, We compared the correlation coefficients between hip circumference and other measurements and those between Hip external circumference and other measurements of two groups. Industrial skirts pattern and pants pattern generally uses hip circumference reckoning without hip external circumference which can allow for abdominal prominence even when their target consumer is abdominal obesity. We supposed that a poor fit of subjects' skirts and pants would be due to these problem and try to find the origin cause.

Hip circumference is measured the horizontal circumference of trunk at the level of the maximum protrusion of the right buttock using a tape. And hip external circumference is measured the horizontal circumference of trunk at the level of maximum protrusion of the whole lower body including abdominal protrusion and buttock protrusion using the cellophane paper attached a measuring tape.

III. Results

A random sampling of 318 women over the age of 60 were divided into two groups classified as normal or abdominally obese by the waist-hip ratio (WHR). The result is shown in <Table 2>. The criteria for abdominal obesity is $WHR=0.85$ (The Herald business, 2005; The Economist, 2003).

To verify the physical shape differences by degree of abdominal obesity, we examined the differences of analyzing measurements by group with a T-test. T-tests did not indicate any significant difference

Table 2. Clusters of elderly women according to body type

Group	Characteristics	WHR	Age	n	Percentage(%)
I	Normal(WHR<0.85)	0.82	77.8	67	21.1
II	Abdominal obesity(WHR≥0.85)	0.92	75.4	251	78.9
Total		0.90	75.9	318	100.0

WHR means waist-hip ratio(waist circumference/hip circumference)

Table 3. Comparison of Group I and Group II in body measurements

(cm)

Measurement	Group	Group I		Group II		T-value
		Mean	S.D.	Mean	S.D.	
Stature		149.6	6.6	149.2	5.7	0.32
Weight(kg)		49.2	8.7	55.9	8.9	-5.55***
Cervical Height		128.2	6.1	128.2	5.5	0.04
Bust Height		100.8	5.9	101.1	5.8	-0.26
Waist Height		94.0	4.3	92.5	4.2	2.58**
Hip Height		72.9	5.3	73.7	3.7	-1.43
Crotch Height		68.2	4.1	67.2	3.6	1.87
Biacrominal Breadth		33.1	1.9	33.4	2.1	-1.10
Bust Breadth		26.0	2.5	28.2	3.9	-4.34***
Bust Point-Bust Point		16.4	2.1	18.3	2.0	-6.58***
Waist Breadth		24.8	2.2	27.8	2.4	-9.55***
Abdominal Breadth		30.5	1.9	31.5	2.2	-3.31***
Hip Width		31.6	1.6	31.8	1.8	-0.86
Armseye Depth		10.5	1.9	11.8	1.7	-5.19***
Bust Depth		23.0	2.9	25.7	2.5	-7.66***
Waist Depth		20.2	3.3	24.0	2.9	-9.33***
Abdominal Depth		23.2	3.1	25.8	2.9	-6.53***
Hip Depth		21.9	3.8	23.8	3.5	-3.95***
Neck Base Circumference		37.7	2.8	39.9	2.6	-6.03***
Armseye Circumference		40.1	4.5	42.9	4.7	-4.37***
Bust Circumference		84.9	8.2	93.7	7.3	-8.48***
Waist Circumference		76.2	8.0	87.4	7.7	-10.53***
Abdominal Circumference		89.9	7.9	96.0	7.7	-5.74***
Hip Circumference		91.9	7.7	94.7	6.9	-2.84**
Waist Front Length		28.8	3.4	30.6	4.4	-3.08**
Neck Point to Breast Point		28.0	3.4	30.6	4.4	-1.94
Neck Point to Breast Point to Waistline		30.5	3.5	32.6	4.5	-3.41***
Front Armseye Length		32.1	2.5	33.0	2.5	-2.70**
Back Armseye Length		34.4	3.1	35.7	2.9	-3.26***
Waist Back Length		37.2	3.5	38.1	3.2	-2.01*
Crotch Length		70.9	8.2	71.9	7.2	-0.91
Outside Leg Length		88.5	3.6	86.3	4.9	3.42***
Hip External Circumference		95.8	7.6	101.0	7.2	-5.15***

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

Table 4. T-test of Group I and Group II in indexes and a drop measurement

measurement	Group	Group I		Group II		T-value
		Mean	S.D.	Mean	S.D.	
Rohrer Index		1.47	0.23	1.68	0.22	6.08***
Vervaeck Index		89.64	10.07	100.16	9.28	-6.73***
Bust-Flat Ratio		0.88	0.08	0.92	0.09	-8.09***
Waist-Flat Ratio		0.82	0.10	0.86	0.08	-2.84**
Abdomen-Flat Ratio		0.76	0.07	0.82	0.07	-4.14***
Hip-Flat Ratio		0.69	0.11	0.75	0.11	-6.41***
Hip Circumference-Abdominal Circumference(cm)		2.07	3.57	-1.27	4.10	-3.90***

** $p < .01$, *** $p < .001$ /Flat Ratio=depth/breadth

Between two groups in all height measurements except waist height. It means height measurements and abdominal obesity of subjects has no correlation each other. But, as for depth and circumference measurements, in all measurements of subjects' body there is significant difference at the degree of 0.001 significant probability that aged women with abdominal obesity have greater figures in nearly every obese factor measurements such as bust and interseye besides the abdomen. Biacrominal breadth has no difference between groups, as the measurement of the shoulders relies more on the skeletal structure itself by acromion-right and left standard. Group I had bigger measurements in outside leg length and waist height, while Group II had bigger measurements in waist back length. It seems that obese women have bulging backs by accumulating fat on their back besides abdomens(Table 3).

Group II had surplus figures in the Vervaeck (=100.16) and Rohrer(=1.68) indexes, meaning that abdominally obese women have a higher degree of obesity in general. Also Group II had greater measurements in waist-flat, abdomen-flat, and hip-flat ratios (respectively 0.86, 0.82, and 0.75), leading to the conclusion that the torso of the abdominally obese is closer to the cylinder form with bigger depth-to-breadth ratio compared to that of the normal. This proves the extensive increase in depth versus breadth that excess fat in the waist and abdomen creates, corresponding with the result in a study by Haheejung(2001) showing the protrusion of the front part of

waist due to increased fat in that part of the body.

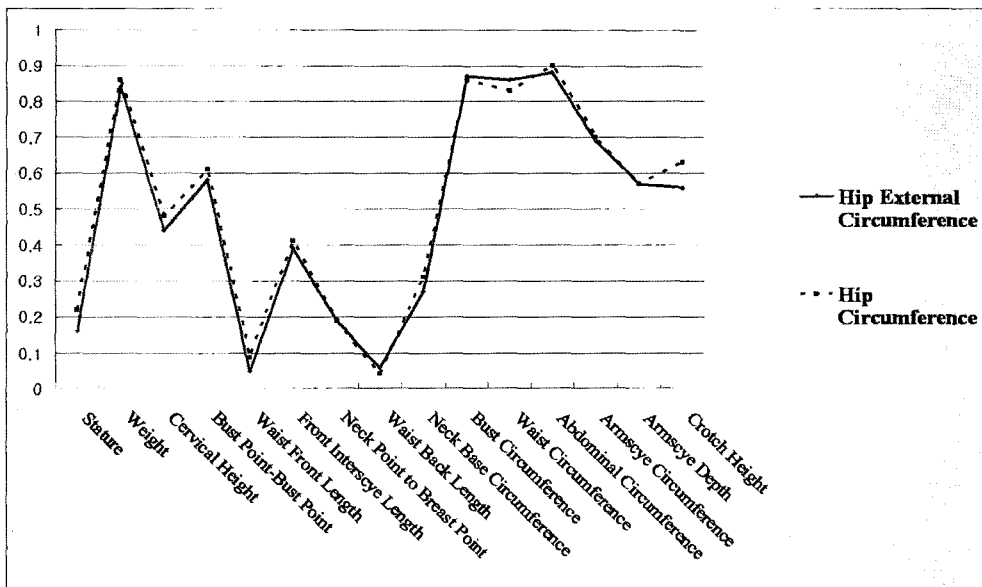
According to the drop measurement using hip and abdominal circumference, Group I had an average 2.07cm, while Group II has an average of -1.27 cm, which means the abdominal circumference is greater than that of the hip. The current Korean sizing system(KS) for clothing covers height, bust breadth, and hip circumference for upper garments, and waist and hip circumferences for lower garments, which means it excludes the abdomen, a critical measurement for determining the amount of dart for apparel patterns. The dissatisfaction of aged women with clothing is bound to be great, in that 78.9% of them are abdominally obese(Table 4).

This study analyzed the correlation of 16 measurements to find influential measurements in apparel pattern design. The results of the correlation between hip circumference and other measurements, and between hip external circumference and other measurements, of Groups I and II are the following: in Group I, 10 measurements have higher correlation in hip circumference than in hip external circumference, while in Group II, only 2 measurements have such results. That is, for the aged, abdominally obese women, hip external circumference has closer correlation with body figure than hip circumference does. Therefore pattern design and measurement establishment for clothing in ready-to-wear should consider the hip external circumference(Table 5), (Fig. 1), (Fig. 2).

Table 5. The correlation coefficients between hip external circumference/hip circumference and other measurements

Measurement	Group	Group I		Group II	
		Hip External Circumference	Hip Circumference	Hip External Circumference	Hip Circumference
Stature		0.16	0.22	0.22	0.22
Weight		0.84	0.86	0.83	0.79
Cervical Height		0.44	0.48	0.14	0.14
Bust Point-Bust Point		0.58	0.61	0.40	0.36
Waist Front Length		0.05	0.09	0.14	0.14
Front Interscye Length		0.39	0.41	0.42	0.37
Neck Point to Breast Point		0.19	0.19	0.25	0.21
Waist Back Length		0.06	0.04	0.17	0.17
Neck Base Circumference		0.27	0.31	0.54	0.48
Bust Circumference		0.87	0.86	0.77	0.74
Waist Circumference		0.86	0.83	0.81	0.76
Abdominal Circumference		0.88	0.90	0.85	0.77
Armscye Circumference		0.69	0.70	0.50	0.46
Armscye Depth		0.57	0.57	0.50	0.51
Crotch Length		0.56	0.63	0.45	0.41

☐ Shadow means a higher thing of correlation coefficients between hip external circumference and hip circumference

**Fig. 1. Comparison of correlation coefficients within measurements(Group I).**

IV. Conclusion and Implications

This study divided women over 60 into two groups

by their degree of abdominal obesity, analyzing their body measurements and finding the significant differences between Groups I and II. 31 measurements

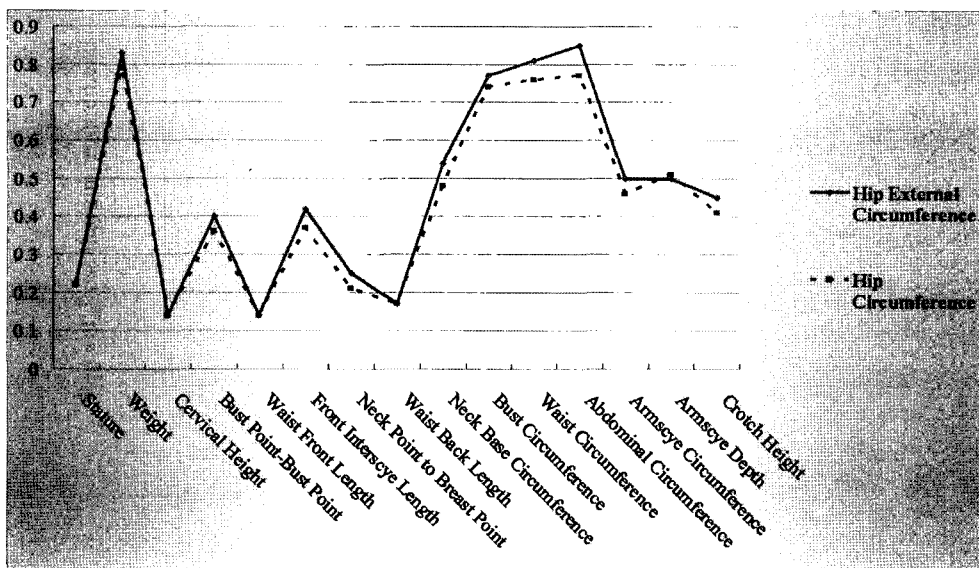


Fig. 2. Comparison of correlation coefficients within measurements(Group II).

out of 33 body data were higher in Group II, which also had higher figures in the obesity index and flat ratio. The torsos of women with abdominal obesity have a thick cylinder form and a greater hip-to-abdomen circumference, compared to the flat form of aged women with average figures. Hip external circumference has greater correlation with other measurements, which leads to the conclusion that considerations are required of hip external circumference to cover abdominal bulging rather than hip circumference in establishing size measurements. If we consider the physical characteristics of these abdominally obese women for the pattern design and size system of the ready-made clothing industry, aged abdominal obese customers can purchase clothing that fits their body fitness and function. And apparel companies can make a profit by decreasing stock and reduce cost by product planning. It can well be utilized to meet the growing needs of mass customization as well as demand activated manufacturing in apparel industry, which is in fashion in most modern manufacturing industries.

This study is limited by the following and suggests further study: these results cannot be generalized with the entire population of aged women, as the subjects were limited to Seoul and Gyunggi area. As

the aged grow older, the individual differences in body figures becomes greater in size and appearance. So it's important to study these characteristics. Following studies are to be performed for utilizing a sizing system and grading to ready-made clothing, and for developing ready-made clothing with good fit to these abdominally obese women. And also detailed studies are needed to graft data from other fields, so that these aged women feel a difference not only in their body figure but also by physiological and psychological factors.

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요 약

본 연구는 복부가 비만한 노년 여성의 의복의 패턴설계를 위한 기초 자료를 제공하기 위한 목적으로 수행되었으며 이들의 체형특성을 분석하고 일반 노년 여성과의 상반신 및 하반신 체형특성의 차이점을 파악하고자 하였다. 연구대상은 60세 이상 서울 및 서울 근교에 거주하는 노년 여성 318명-복부비만 251명, 일반인 67명-이며 직접측정을 실시하였다. 복부비만의 기준은 허리엉덩이둘레비(WHR)가 0.85 이상인 피험자로 하였다. 높이항목, 두께항목, 너비항목, 길이항목 및 몸무게로 구성된 총 33개 측정치 및 측정치를 토대로 한 계산치 및 지수치를 이용하여 기술통계분석, 상관분석, T검정을 실시함으로써 이들의 복부돌출요인에 따라 의복구성에 고려해야 할 체형특성을 파악하고, 이를 일반 노년 여성과 비교·분석하였다. 연구결과 복부비만 노인은 일반 노인보다 높이항목과 어깨너비 등 어깨관련항목을 제외한 두께, 둘레, 길이 항목에서 유의한 차이를 보이며, 로리지수와 버벡지수, 체간부의 편평률에서도 유의차를 보여 전체적인 비만도가 높으며 체간부 형태가 원통형을 나타낸다. 또한 복부비만 노년 여성의 경우 상관관계 분석결과 엉덩이둘레보다 배둘레나 엉덩이외포둘레가 패턴 설계에 필요한 주요 항목들과 더 높은 선형적 상관성을 보이므로 패턴의 기준항목 설정 시 이를 고려하여 제작하여야 할 것이다.