

A Classification of Somatotypes of Korean Males in Thirties(Part I) - Focused on the Upper Body -

Jin-Sun Kim, Kue-Nam Shim* and Won-Ja Lee**

Full-time Lecturer, Dept. of Fashion Design, Daegu Mirae College

*Professor, Dept. of Clothing and Textiles, Mokpo National University

**Professor, Dept. of Apparel Design, Kon-Kuk University

Abstract

The purpose of this study was to classify the somatotype centering around a upper body of 30's men. The subjects were 202 working men aged from 30 to 39 and the data of 33 items including computed items were analyzed by factor analysis and cluster analysis. The results were as follows;

As a factor of somatotype in evaluating males in 30's, the horizontal area represented the chest circumference at scye and the breadth items, the vertical region indicated full length posterior, front length, back length, the breadth difference and the length difference.

The somatotype by cluster analysis was classified with 3 types. Type 1 as the Rohrer's index 1.21 indicating the smallest in the circumference and weight item was classified as the thin and long featuring bending somatotype. Type 2 with the Rohrer's index 1.35 showing the mid-group between type 1 and 3 had the highest distribution rate as the balanced featuring the standard somatotype. Type 3 as the rohler's index 1.40 was the largest physical condition group in the obesity featuring the turning over somatotype.

Key words: somatotype, upper body, factor and cluster analysis, the rohrer's index, the bending somatotype, the standard somatotype, the turning over somatotype.

I. Introduction

The construction of clothing for a good fitness must be preceded the exact antropometry measurement and the dimensions and shape of body, namely, the study of somatotype. The somatotype was changed as age, sex, nation, race etc, and shaped from mixed state of various conditions like nutritive conditions, way of life etc.

The body of males with the maximum growth in mid of 20's showed large frame and muscle development, and especially the somatic characteristic of reverse triangle in their developed upper body. The latter half of 20's decreased drop value more than the first half totally as ages become older, the chest, waist and hip region enlarges, which resulted in cylindrical body¹⁾. Also, the obesity factor had effect on somatotype by the prominence of waist and

E-mail : jskim@dmc.ac.kr

¹ K.Y. Kim, "A Study on the Body Measurement and Factor Analysis of Male Adults -Centering around Taegu and Kyongbuk areas-", (Master's thesis, Hyosung Women's University, 1993).

abdominal part²⁾. This kind of phenomenon occurring obviously from 30's led to dissatisfaction of consumers turning their preferences into easy-order or custom-made consequently.

The propose of this study is, therefore, to classify the somatotype of upper body in 30's men. The somatotype classification includes: (1) practicing measurement, (2) analyzing factor analysis for factor extract, and (3) undertaking cluster analysis for the classification of somatotype.

II. Methods and Procedure

1. Anthropometric Measurement Data

The 30's(aged 30~39) working men totalling 202 in Seoul, Daegu & Kyungbuk and Chunnam were subjected to body measurement on the spots from July 1, 1999 to July 15, 1999. There were 28 anthropometry measurement items in which 5 items are related to length item, 6 items are related to circumference items, 7 items are related to breadth items, 4 items are related to depth items, 3 items are related to deuli items and 3 are related to shoulder slope and others as listed in <Table 1>.

The antropometry measurement was based on the method of R. Martin's and KS A 7004³⁾, and the terminology of KSA 7003⁴⁾, also used jointly the terminology and method of manufacturing industry. The subjects were wearing trunks, and standing upright with their toes spread 45° apart.

Also, the measurement of deuli item was practiced vertically fixing state on the ground of 2m length stature measure instrument. Looking from the side on basis of the projecting part of scapula, length between back neck point and stature measure instrument, length between the deepest-set part of waist line and stature mea-

sure instrument and length between the projecting part of hip and stature measure instrument are called neck deuli, waist deuli and hip deuli respectively.

2. Statistics Analysis of Data

The collected data were processed not only for means and standard deviations in somatotypes differences of Korean males in 30's using SPSS-PC package but for statistical significance using F-test. Plus, factor analysis was conducted to determine the somatotype factors, whereas the cluster analysis of somatotype classification was operated by the Euclidian distance and the minimum-distribution method of Ward.

III. Results and Discussion

1. Comparative of Measurement Data

The data of this study and the National Anthropometric Survey of Korea⁵⁾ compared a mean value of respective measurement data centering mainly on the same items with criterion of same ages.

The comparative results between measurement value had some differences in all items. On the basis of this study there were many differences in full length posterior, and back length item. Especially, the stature, the full length posterior, the back length, the hip breadth, the hip depth and the armhole circumference were large, whereas the shoulder length posterior, the back interscye breadth, the armhole depth, the waist breadth, the waist circumference and the weight were small in measurement value of this study.

Difference between stature and full length posterior was 26.66cm from the National Anthropometric Survey⁶⁾ and 25.26cm from this study. Also, the difference of back length had judge-

² G. U. Kim and S. W. Lee, "A Study on the Trend of Bodytype Change -On the Adult Male between Age 19 and 54-", *Journal of the Korean Society of Clothing and Textiles*, 20(1) (1996).

³ Agency for Technology and Standards, KS A 7003 anthropometric measurement terminology, (1999).

⁴ Agency for Technology and Standards, KS A 7004 anthropometric measurement method, (1999).

⁵ National Antropometric Survey of Korea. *Korea Research Institute of Standards and Science*, National Institute of Technology and Quality(NITAQ), (1997).

<Table 1> Comparative of Measurement Datum

(unit : cm)

Items	Measurement region	This Study (n=202)		97NASK (n=424)
		Means	SD	Means
Length item	Stature	171.83	3.88	170.42
	Full length posterior	146.57	3.50	143.76
	Back length	45.80	1.77	43.81
	SNP~Waist	48.22	1.77	48.26
	Front length	48.23	1.83	-
Circumference item	Armhole circumference	42.37	1.76	40.99
	Chest circumference at scye	94.40	4.10	94.04
	Waist circumference	80.34	5.06	82.74
	Abdominal circumference	86.75	5.19	85.42
	Hip circumference	93.56	3.65	93.25
Breadth item	Shoulder length posterior	42.10	1.81	43.85
	Front interscye breadth	35.55	1.65	35.35
	Back interscye breadth	38.00	1.58	39.60
	Armhole depth (c)	20.89	1.73	21.96
	Chest breadth at scye	31.91	1.35	32.65
	Waist breadth	27.83	1.88	28.40
	Hip breadth	33.43	1.33	32.40
Depth item	Chest depth at scye	21.73	1.32	22.00
	Waist depth	21.19	1.55	21.26
	Hip depth	23.60	1.52	22.70
Angle and others item	Right shoulder slope(°)	21.43	0.97	21.59
	Left shoulder slope(°)	20.95	0.91	20.60
	Weight(kg)	67.38	4.51	68.16

*97 NASK - the National Anthropometric Survey of Korea(1997, NITAQ)

ment reason for the selection of landmark. From the National Anthropometric Survey, back length was from cervicale to waist line, and the region of waist line was the most sunken-in spot around back waist line. While the waist and abdominal area of men in 30's had a huge difference forming various somatotype, the waist line according to prominence position of abdominal area was moved to the upper and lower parts. Therefore, this study measured on the basis of iliospinale antierius located on both sides of waist line. In addition, similar measure-

ment value items between researches were SNP-waist, chest circumference at scye, front interscye breadth, waist depth, hip circumference and so on. The right and left shoulder slope were not even equal with slanting more droop on right shoulder.

It is thus considered that the differences of study should be basically responsible to subjects though; and back length and shoulder length posterior be judged from the difference of landmark; and abdominal depth, hip depth, armhole circumference, chest circumference at scye, ab-

⁶ National Antropometric Survey of Korea. *op. cit.* (1997).

dominal circumference, hip circumference and others be the difference of measurement method, posture and uses.

2. Somatotype Classification

1) Factor Analysis

In order to determine the somatotype factors of males in 30's, the factor analysis was applied to 33 variances including directly measured items and computed items. As the results of factor analysis and interpretation, 6 factors were determined as comprising the somatotype.

The accumulative contribution rate of these 6 factors was 75.7%. The unique value and variance of each factor calculated with Verimax revolution are shown in <Table 2>, and the results and contents of analysis were as follows.

Factor 1 included the circumference item of upper body, the breadth and depth items and the deuli items etc., exclusive of waist region. The characteristic of this factor represents the obesity and fatness of the upper body, and the representative items were the back interscye breadth, the front interscye breadth, the chest circumference at scye, the shoulder length posterior, and the chest breadth at scye etc. Its eigenvalue is 15.07, which explains approximately 38.64% of the entire variance. Factor 2 involved the length item of body, exclusive of back length, front length, SNP-waist item, the rohrer's index and the hip breadth. This factor represents the length factor of body and upper body. Its eigenvalue is 7.14, which explains about 18.32% of the entire variance. Factor 3 containing the armhole depth, the breadth difference(back interscye breadth-front interscye breadth), the length difference(front length-back length), the neck root circumference, and the neck deuli etc., represents the somatotype factor of specification region in body. Its eigenvalue is 2.71, which explains about 6.96% of the entire variance. Factor 4 including the drop value, the waist circumference, the waist breadth and the waist depth, is represented by

specification region in body. While factor 5 represents the length of upper body, factor 6 involving with the left and right shoulder slopes item, represents specific region in body.

Based on analysis above, it will be helpful to select representative item indicating characteristic of each somatotype according to simplification of measurement items for easy drawing pattern.

2) Somatotype Classification by Cluster Analysis

Based on the results of factor analysis, the somatotype and dimensions of upper body in 30's males were appeared well, 20 items(Table 3) were selected for an easy antropometry measurement of body, and the cluster analysis (Table 5) was practiced for the somatotype classification of males upper body.

The cluster analysis was conducted to classify a 3, 4 and 5 cluster, and the subjects distribution of each cluster represented characteristic of somatotype. Accordingly, 3 cluster was in this study selected which has a distinctive subject distribution and somatotype characteristic.

As a result of the cluster analysis which was practiced to observe a distribution, characteristic and relationship between subjects according to types, significant difference of $p < .001$ was appeared in all measurement item exclusive of drop value. For the post verification, significant difference of Tukey(Table 5) was practiced.

(1) Somatotype Comparison according to Rohrer's Index

From the National Anthropometric Survey of Korea⁷⁾, median 50% of distribution was classified the standard somatotype, less than 25% was thin somatotype and 75% or more was obese somatotype among the somatotype classification by rohrer's index of 30~39 aged men(Table 4).

The results of comparison according to somatotype were as follows.

Type 1, 2, 3 showed a correlative significance difference, indicating significance difference in the

⁷⁾ National Antropometric Survey of Korea. *op. cit.*, (1997).

<Table 2> Factor Analysis Results of Measurement Items

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Back interscye breadth	.955	.086	-.062	.018	.075	.074
Front interscye breadth	.915	.006	.191	.097	.012	.084
Chest circumference at scye	.890	.093	.335	.068	-.063	.167
Shoulder length posterior	.884	-.008	-.009	.074	.095	.041
Chest breadth at scye	.859	.095	.237	.045	-.045	.200
Chest depth at scye	.792	.114	.297	.052	-.012	.165
Hip circumference	.655	.155	.405	.281	.106	.256
Abdominal breadth	.604	.130	.379	.420	-.006	-.109
Abdominal circumference	.582	-.078	.543	.453	.003	-.108
Weight(kg)	.568	.365	.440	.222	.095	.274
Hip deuli	-.550	.006	-.372	-.121	-.020	-.341
Abdominal depth	.519	-.123	.356	.483	-.027	-.070
Waist deuli	-.474	.000	-.458	-.063	-.203	-.116
Hip depth	.468	-.031	.306	.385	-.010	.366
Stature	.122	.917	-.124	.039	.162	-.180
Full length posterior	.127	.911	-.082	.058	.169	-.193
Rohrer's index(c)	.390	.505	.492	.157	-.059	.409
Hip breadth	.487	.500	-.047	.080	.155	.084
Armhole depth(c)	.362	.134	.678	.067	-.219	.244
Breadth difference(c)	.007	.188	-.613	-.197	.149	-.031
Length difference(c)	.555	-.014	.586	.076	.116	-.094
Neck root circumference	.187	-.213	.563	.310	.019	-.019
Neck deuli	-.353	.316	-.549	-.069	-.200	-.005
Armhole circumference	.198	.108	.511	.152	-.134	.177
Drop value(c)	.278	-.020	-.015	.901	-.078	-.069
Waist circumference	.517	.090	.282	.716	.006	.185
Waist breadth	.536	.123	.205	.695	-.049	.193
Waist depth	.408	-.005	.367	.658	.123	.166
Front length	.150	.518	.052	.058	.814	-.013
Back length	-.016	.538	-.128	.036	.803	.016
SNP~waist	.041	.544	-.106	.040	.798	.026
Left shoulder slope(°)	.210	-.291	.159	.078	-.014	.765
Right shoulder slope(°)	.202	-.271	.054	.113	.036	.756
Eigenvalue	15.07	7.14	2.71	1.74	1.62	1.27
Proportion(%)	38.64	18.32	6.96	4.45	4.14	3.24
Cumulative(%)	38.64	56.96	63.92	68.37	72.52	75.76

(c) : computation item

<Table 3> Variances and Items according to Factor used in Cluster Analysis

Factors	Items	Selected variance & variance name
Factor 1	9	back interscye breadth, front interscye breadth, chest circumference at scye, shoulder length posterior, hip circumference, weight, hip deuli, waist deuli, hip depth
Factor 2	2	rohrer's index, hip breadth
Factor 3	4	length difference, breadth difference, neck deuli, armhole circumference
Factor 4	1	drop value
Factor 5	2	front length, back length
Factor 6	2	left shoulder slope, right shoulder slope

<Table 4> Somatotype Distribution according to Cluster Type and Rohrer's Index

Cluster no.	Cluster type	Subjects (n=202)	Percentage (%)	Somatotype distribution according to Rohrer's index		
				Thin somatotype	Standard somatotype	Obesity somatotype
3	1	50	24.75	39	11	0
	2	88	43.56	2	86	0
	3	64	31.68	0	52	12

type of breadth difference, length difference and neck deuli, waist deuli, hip deuli, ..., etc. Therefore, type 1 (Table 5) at 1.21 rohrer's index belonging to thin somatotype, indicated the narrowest shoulder width but the smallest in the circumference, breadth difference, length difference, deuli item and weight as compared to the length item, so that it could be classified as the group featuring bending somatotype. Even if length item, deuli item and drop value appeared totally thin somatotype, it showed the bending somatotype with volume.

Type 2 belongs to the standard somatotype for it represents the mean value from rohrer's index, stature, weight, breadth difference and length difference. Its circumference or the breadth items represented the mean. It showed the smallest in the items of length and others among 3 types.

Type 3 classifying into the obese somatotype represented largest the mean value of rohrer's index, circumference item, breadth item and

depth item with the characteristic of turning over somatotype from breadth and length difference.

(2) Comparison · Analysis of Measurement Data according to Somatotype

The results (Table 5) of comparison and analysis according to somatotype were as follows.

In length item type 1 showed the biggest, whereas type 2 the smallest. In length difference type 3 represented the biggest and the type 1 smallest. In breadth item type 3 represented the biggest in most items, whereas type 1 showed bigger in hip breadth, chest breadth at scye, back interscye breadth and shoulder length posterior between type 1 and 2. Also, the armhole depth was represented in order of type 3, 2, 1 according to size of chest circumference at scye, weight etc. It is thus found that armhole depth increases in proportion with weight and chest circumference at scye.

The depth item shows a big increment de-

<Table 5> Result of Cluster Analysis according to Types

Items	Measurement region	Type 1 (n=50)	Type 2 (n=88)	Type 3 (n=64)	F value
Length item	Stature	174.85 A	169.28 C	173.00 B	55.518***
	Full length posterior	148.98 A	144.35 B	147.75 A	48.344***
	Back length	47.33 A	44.77 C	46.02 B	61.576***
	SNP ~waist	49.68 A	47.13 C	48.57 B	63.061***
	Front length	49.38 A	47.03 B	48.99 A	59.069***
	Length difference	2.05 C	2.26 B	2.97 A	88.740***
Circumference item	Armhole circumference	41.00 B	42.36 B	43.47 A	33.864***
	Neck root circumference	40.92 C	44.80 B	47.25 A	65.556***
	Chest circumference at scye	91.89 B	92.43 B	99.06 A	162.318***
	Waist circumference	77.06 C	78.74 B	85.08 A	75.621***
	Abdominal circumference	82.28 C	85.75 B	91.60 A	97.781***
	Hip circumference	91.26 B	91.93 B	97.61 A	146.616***
Breadth item	Shoulder length posterior	41.30 B	41.28 B	43.83 A	72.357***
	Front interscye breadth	34.51 C	34.78 B	37.42 A	136.401***
	Back interscye breadth	37.52 B	37.13 B	39.56 A	90.806***
	Breadth difference	3.00 A	2.35 B	2.14 C	32.250***
	Armhole depth	19.87 C	20.55 B	22.15 A	44.423***
	Chest breadth at scye	31.26 B	31.23 B	33.35 A	108.835***
	Waist breadth	26.74 B	27.26 B	29.47 A	61.949***
	Abdominal breadth	29.68 C	29.95 B	31.78 A	56.492***
Depth item	Hip breadth	33.92 A	32.45 B	34.38 A	76.999***
	Chest depth at scye	21.10 B	21.11 B	23.07 A	88.736***
	Waist depth	20.12 C	20.81 B	22.54 A	54.962***
	Abdominal depth	21.20 C	21.96 B	23.80 A	45.703***
Deuli item	Hip depth	22.49 C	23.31 B	24.87 A	63.580***
	Neck deuli	5.85 A	5.23 B	4.68 C	36.343***
	Waist deuli	4.82 A	4.76 A	4.01 B	9.789***
	Hip deuli	2.24 A	1.92 B	1.22 C	27.239***
Angle and others item	Right shoulder slope(°)	20.92 B	21.45 A	21.81 A	9.558***
	Left shoulder slope(°)	20.20 B	21.06 A	21.39 A	10.895***
	Weight(kg)	64.46 C	65.52 B	72.21 A	103.708***
	Rohrer's index	1.21 C	1.35 B	1.40 A	93.194***
	Drop value	14.82 A	13.69 A	13.98 A	1.422

*** p<.001.

pending on the amount of somatotyp obesity, especially in the abdominal depth, the waist depth and the chest depth at scye among types. The circumference item is represented bigger and bigger as it goes from type 1 to 3, and the chest circumference at scye and the hip circumference is shown a great difference between type 1, 2 and type 3. In the deuli items mea-

sured for lateral somatotype classification of body, type 1 appeared the biggest, type 2, and type 3 in turn. Observing on the basis of type 2, the back area of upper body bent round, the lower body of hip area and region under waist located in front of waist circumference line and hip circumference line showing a typical bending somatotype of reverse S style because type 1

lies in front of type 2 in terms of cervicale, waist circumference line, hip circumference line. In the mean value of each item type 3 appeared smaller than type 2. The reason why such as this is that it is smaller than the standard somatotype in neck deuli, waist deuli, hip deuli, featuring the flatness of back area because of the upper body gone beyond back from front and the turning over somatotype of S style due to prominence of hip region. As analysed above, it is found that this study is consistent with that of Suh⁸⁾ in classification of somatotype. In shoulder slope items right shoulder is lower than left one, showing the lowest in type 3 and high in type 1. The weight was appeared the highest in type 3.

Therefore, type 1 was classified as the bending somatotype featuring thin somatotype, type 2 as the standard somatotype of balanced body, and type 3 as the turning over somatotype with

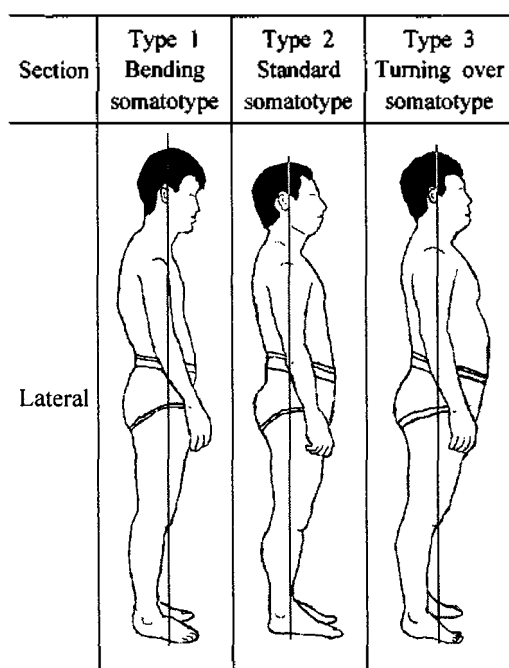
obese somatotype characteristic. As a result of this study, basic data for measurement item selection of upper body was acquired, which becomes a guideline of basic area establishment required for drawing and construction of clothing. And lateral photo of subjects according to types was presented in <Fig. 1>.

IV. Conclusion and Summary

1. The results of factor analysis based on measurement data, factor 1 including the circumference, breadth and depth item of upper body, and the weight, the waist deuli, hip deuli etc., represents the obesity factor of upper body. The typical items are the back interscye breadth, the front interscye breadth, the chest circumference at scye, the shoulder length posterior, and the chest breadth at scye etc. Factor 2 involving the length item, the rohrer's index and the hip breadth, represents the length of upper body. Factor 3 representing the lateral of body, the breadth difference and the length difference, is classified as the lateral somatotype factor of body. Factor 4 containing the waist region, represents the obesity factor. Factor 5 including the front length, the back length, SNP ~waist, represents the length factor of upper body.

Therefore, as a somatotype factor of males in 30's, the horizontal circumference represents the chest circumference at scye and the breadth item of back interscye breadth, front interscye breadth and shoulder length posterior, the vertical region represented full length posterior, front length, back length, the breadth difference and the length difference.

2. The somatotype was classified with 3 types by the cluster analysis. Type 1, the rohrer's index 1.21, indicated the smallest in the circumference and weight item, classifying as the thin group with characteristic of the



<Fig. 1> Lateral Photo of Subjects according to Types.

⁸ S. K. Suh, *The Pattern Textbook of Men's Wear*, Seoul; Daehan Costume Institute, (1988).

bending somatotype. Type 2 as the standard somatotype with rohrer's index 1.35 indicated the smallest in the length item, but type 2 which is a mid- group between type 1 and type 3 has the highest distribution rate as the balanced featuring the standard somatotype in the most of items. Type 3 as the rohrer's index 1.40 is the largest group in the obesity featuring the turning over somatotype.

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