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Classification of Somatotype of the Elderly Women by the Lateral View

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Abstract : The purpose of this study was to classify the somatotype of elderly women and to extract discriminant factors of the classification. The subjects were 218 elderly women aged 60-85 years old. Data were collected from 46 anthropometric and photographic measurements of each subject and analyzed by frequencies, crosstabs, analysis of variance and discriminant analysis. The somatotype was classified into 5 types according to the lateral view. The normal type was defined as the type which the plumb line passes through the cervicale and the lateral malleolus. The lean-back type positioned the plumb line more posteriorly than normal type. The swayback type positioned the plumb line at about the same line as the lean-back type, but curvature of lateral view was prominent. The lean-forward type I and II positioned the plumb line more anteriorly than normal, but the spinal curvature of the type II disappeared. As the result of discriminant analysis, significant discriminant factors of anthropometric measurement were cervicale height, anterior waist height, neck point to posterior waist length, anterior waist length. Photographic measurement were C valve, D value, $\angle\alpha$ and $\angle\beta$.

Key wards : elderly women, lateral view, somatotype, discriminant factors

INTRODUCTION

These days are gradually changing into the aged society, so, the people take the growing interest in the social system, health, clothes, food, and shelter for the welfare of the aged. The elderly women have the various somatotype characteristics due to the physiological function lowering and the change of physical appearance in experiencing the physical aging course. The change of the lateral view according to the aging is the most remarkable factor in the somatotype change factors. In terms of supplementing the lost physical, psychological change, it is required to make the ready-to-wear suitable to the elderly women.

The studies to solve the somatotype problems of the aged women includes the suggestion of the principal component and the typical somatotype representing the elderly women's body shape by analysing the principal component (Lee, 1982), and the classification of somatotype according to the cluster analysis by factor scores (Hrasawa & Nagai, 1993; Kim & Choi, 1995; Kim & Sohn, 1996; Nam & Choi, 1997). When classifying the somatotypes by the factor analysis, the 1st and 2nd factors are the size and fatness factors, and we can notice that the characteristics of each group by the side shape are reducing. Also, when classifying the somatotypes according to the inclination angle and the projection degree to understand the side shape, an outstanding somatotype change of the elderly women (Lee, 1983; Hahm, 1985), it suggests the lateral body type, but needs a consideration on the various somatotype information.

To provide the basic data for the clothing design of the elderly women, this study will classify the lateral view by the visual judgement, and consider the somatotype change according to the increase of age, and suggest the formal characteristics of each somatotype and the distinction factor of them.

METHODS

Subjects and measurement

The Subjects were 218 women over 60 years old living in the metropolitan area (Seoul and Inchon). The range of age is presented in Table 1.

The measuring was done from August to September, 1998. Total 46 measurements were taken, 40 anthropo-

Table 1. Range of the subjects' age

Age	N	Percent
60's	114	52.3
70's	83	38.1
80's	21	9.6
Total	218	100.0%

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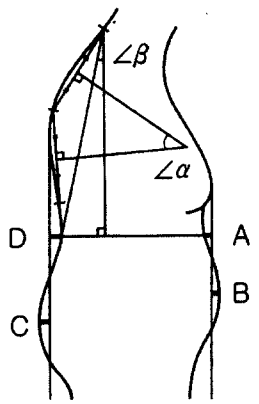

Fig. 1. Indirect measurement.

metric measurements and 6 photographic. Anthropometric measurements included the height 6, length 9, depth 7, breadth 10, girth 7 and weight. Photographic measurements included ∠α, ∠β, A, B, C and D value as shown in Fig. 1. The angle α represent the spinal curvature of upper back. When drawing the definite line, identical with the length from the projection of the back to the cervicale, the angle α is formed by crossing of the perpendicular bisectors of each definite line. The angle β represent the forward tip of the upper body. When connecting the bend of waist level and the cervicale by straight line, and drawing the perpendicular line from the cervicale, the β is an angle formed by these two line. The value A and B are protrudent quantity at the anterior waist and abdominal projection level on a basis of the plumb line from the nipple point. The value C and D are protrudent quantity at the posterior waist and hip level on a basis of the plumb line from the projection of the back side.

For the direct measurement, the Martin's anthropometric instruments have been used, and KS A7003 and KS A7004 have been applied to anthropometry.

For the indirect measurement, it was measured from the side photograph of the subject wearing only the measuring costume, and the subject kept the distance 20 cm from the screen (10× 10 cm grid), 300 cm from the camera, and the height of camera was fixed at 125 cm from the floor.

Somatotype classification by the side shape

The bases of the somatotype classification by the visual judgement of the side shape are diverse according to the investigator. Kamita (1975) has defined the normal type as the one which delineates the side center line by connecting the shoulder point and the bisection point of the waist depth in the side, and which the plumb line from the front armpit corresponds to the side center point at the waist line. Nam (1991) defines the straight type as the one which the plumb line from the tragion passes by the center point of the shoulder joints and the bisection point of the waist depth. However, as the somatotype of the elderly women shows that the head hangs down because the upper body bends with aging, and the legs bend because the centroid of body moves forward, and the waist and the abdomen part show the characteristics of becoming fat (Kim & Choi, 1995; Kim & Sohn, 1996; Nam & Choi, 1997). In the precedent studies, the body type was classified by the angle and the protrudent quantity at the hip level on a basis of the plumb line from the projection of the back side (Lee, 1983; Hahm, 1985). However, these two lateral factors are correlation. The anterior contour of the lateral view is more influenced by the size than the posterior contour (Choi, 1997). Thus, it is not desirable to fix the base line in the same way with the precedent studies.

This study is concentrated to the posterior forms relatively influenced little by the size. The plumb line from the cervicale was fixed as the base line, and the type which this line passes by the lateral malleolus was defined as the normal one. The straight distance between the plumb line from the cervicale and the base line was measured. This measurement was as follows : Mean is -0.23 cm, star. deviation 3.16 cm, maximum 8.80 cm, minimum -8.63 cm. The Range of the normal types is $\overline{X} \pm 0.5\sigma$. The side shape has been classified into 5 types according to the position of the base line as shown in Fig. 2. Each type has been defined as the normal type, the lean-back type, the swayback type, the lean-forward type I and the lean-forward type II.

The lean-back type is that the base line moves backward, compared with the normal one. The swayback type is that the base line moves backward, but the upper back bends forward. The lean-forward type I and II are that the base line moves forward, compared with the normal one, and the lean-forward type II is that the back shape is round and spinal curvature disappeared.

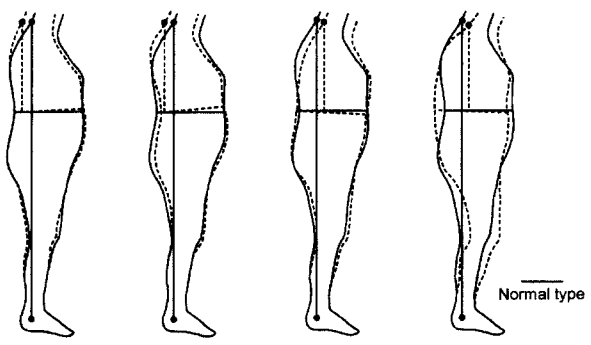

Fig. 2. Classification basis compared with the normal type.

Table 2. Distribution of body type

Type	N	Percent
Normal	73	33.5
Lean-back	31	14.2
Swayback	43	19.7
Lean-forward I	43	19.7
Lean-forward II	28	12.9
Total	218	100.0%

According to the basis of somatotype classification, the specialist group, consisted of 5 persons, classified the side shape of the subjects into 5 types.

Analysis

To understand the somatotype change according to the age, we analysed the somatotype distribution per age group, and performed analysis of variance and Duncan-test per type to clarify the concrete characteristics of each somatotype, and performed also the discriminant analysis on the variables showing the significant mean difference per type to suggest the discriminant factors of the somatotype.

RESULTS AND DISCUSSION

Somatotype classification by the side shape

The somatotype has been classified into 5 types as a result of dividing the side shape according to the position of the plumb line from the cervicale. Table 2 presents the distribution per type. The normal type is 33.5%, the lean-back type 14.2%. The swayback type which the base line moves back but the spinal curvature of upper back is 19.7%. The lean-forward type I and II which the base line moves forward are 32.6%. Differently from the precedent studies (Lee, 1983; hahm, 1985), the lean-back type was included.

When classifying the somatotype, the whole accordance degree of the 5 specialists is 87.14%, the normal type 92.05%, the lean-back type 80.65%, the swayback type 91.63%, the lean-forward type I 84.19%, and the lean-forward type II 85.71%. The base line of lean-back type moves back, but, compositely has the aging features which the upper back bends forward, similar to the normal type, so, the accordance degree appears low relatively.

Somatotype distribution per age

To grasp the somatotype change according to the age, we analysed the type distribution per age group as shown in Table 3.

As a result, in the first part the sixties, the normal type occupies 37.3%, the lean-back type 32.8%, but, in the latter part of that, it shows that the lean-back type (12.8%) reduces and the normal type occupies 46.8%, and the swayback type increases to 25.5%. After seventies, as the age increases, the normal, the lean-back, and the swayback types reduce, and the lean-forward type I and II increase prominently. In the latter part of the seventies, the lean-forward type I is 32.6%, the lean-forward type II 42.8% in eighties. As clarified in the precedent study (Hahm, 1985), it shows that the lean-forward type II is the last aging somatotype step. From the latter part of seventies, the normal type and the lean-back type decrease sharply, and the lean-forward type I and II increase. This means that, in the middle part of the seventies, the body type changes severely according to the aging. It shows a difference from the precedent studies which classified the elder women's body type change into the former and latter parts starting from the seventy years old (Kim & Choi, 1995 : Nam & Choi, 1997).

Physical characteristics per somatotype

Direct measurements per somatotype : To examine the physical characteristics per somatotype, we performed the analysis of variance and Duncan-test on the height, length item as showen in Table 4. As a result, it shows that there wasn't any significant difference per type in the posterior waist height, the scye depth, the neck point to nipple length and the arm length. It seams that these are

Table 3. Somatotype distribution per age

Type \ Age	60-64	65-69	70-74	75-79	80 over	Total
Normal	25 (37.3%)	22 (46.8%)	15 (37.5%)	8 (18.6%)	3 (14.3%)	73 (33.5%)
Lean-back	22 (32.8%)	6 (12.8%)	3 (7.5%)	0 (0.0%)	0 (0.0%)	31 (14.2%)
Swayback	11 (16.4%)	12 (25.5%)	8 (20.0%)	9 (20.9%)	3 (14.3%)	43 (19.7%)
Lean-forward I	7 (10.5%)	6 (12.8%)	10 (25.0%)	14 (32.6%)	6 (28.6%)	43 (19.7%)
Lean-forward II	2 (3.0%)	1 (2.1%)	4 (10.0%)	12 (27.9%)	9 (42.8%)	28 (12.9%)
Total	67 (100.0%)	47(100.0%)	40(100.0%)	43 (100.0%)	21(100.0%)	218 (100.0%)

X^2=77.338 df = 16 P≤.001

Table 4. Mean difference of the perpendicular measurements (cm)

Item \ Type	Normal (n=73)		Lean-back (n=31)		Swayback (n=43)		Lean-forward I (n=43)		Lean-forward II (n=28)		F-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Stature	148.41 ab	5.04	150.59 a	5.59	148.97 ab	6.38	147.34 b	4.69	144.44 c	4.78	5.499***
Cervicale H.	127.69 ab	4.89	129.04 a	5.10	127.90 ab	6.01	126.51 b	4.53	123.85 c	4.54	4.682**
Acromion H.	123.14 ab	4.68	124.79 a	5.01	123.65 ab	5.91	122.00 b	4.37	119.43 c	4.59	5.228***
Nipple H.	101.25 b	4.99	104.17 a	5.36	101.76 ab	6.75	98.60 c	5.24	95.81 d	4.57	11.010***
Posterior waist H.	91.78	4.28	92.19	3.81	92.00	4.55	92.22	3.43	89.72	3.17	2.099
Anterior waist H.	91.79 bc	3.91	92.85 ab	3.97	94.19 a	4.15	90.78 c	3.76	90.05 c	3.29	6.740***
Scye D.	19.60	1.35	19.68	1.22	20.04	1.15	19.63	2.42	19.04	1.17	1.745
Posterior waist L.	37.81 ab	2.18	38.66 a	2.09	38.45 a	2.62	36.51 c	2.16	36.93 bc	2.62	6.132***
Neck point to posterior waist L.	40.33 a	2.00	41.24 a	2.27	40.81 a	2.77	38.76 b	2.08	39.04 b	2.69	8.144***
Anterior waist L.	31.97 b	2.55	33.99 a	1.96	29.75 cd	3.10	30.81 bc	2.50	28.78 d	3.30	18.847***
Neck point to nipple L.	29.93	2.27	29.89	1.50	29.92	2.17	30.61	2.44	29.96	2.06	0.861
Neck point to anterior waist L.	40.12 b	2.67	42.07 a	2.01	38.51 cd	2.75	39.58 bc	2.49	37.63 d	2.97	13.567**
Arm L.	53.95	2.55	53.88	4.34	55.01	2.69	54.38	2.28	54.19	2.09	1.163
Hip L.	19.93 a	1.85	19.84 a	1.79	19.90 a	1.53	19.20 a	1.78	18.83 b	2.20	4.813***
Crotch D.	29.20 a	1.85	28.85 ab	1.83	28.87 ab	1.60	29.28 a	1.99	28.04 b	1.92	2.450*

Duncan-test a>b>c>d *p<.05 **p<.01 ***p<.001
H.=Height, L.=Length, D.=Depth

little related to the stature, prominent individual difference.

The stature is the highest in the lean-back type (150.59 cm) and the lowest in the lean-forward type (144.44 cm). The stature, the cervicale height and the acromion height have little difference in the normal, the lean-back, and the swayback types. The normal and the swayback type don't show difference to the lean-forward type I, but, defer from the lean-forward type II. The nipple height is high in the lean-back type (104.17 cm) and the swayback type (101.76 cm) which the base line moves backward, and is low in the lean-forward type I and II which the base line moves forward. The anterior waist height showes a same tendence with the nipple height.

In the lean-back type having relatively a high stature, all length items are long, and they are short in the lean-forward type II. The posterior waist length don't show a significant difference in the lean-back (38.66 cm), the swayback (38.45 cm), and the normal type (37.84 cm). In the anterior waist length, it shows the lean-back type (33.99 cm) > the normal type (31.97 cm), the lean-forward type I (30.81 cm) > the swayback type (30.81 cm), the lean-forward type II (28.78 cm). The hip length and the crotch depth are shortest in the lean-forward type II.

In general, the more the upper body leans forward, the more the anterior length of the upper body shortens. In the swayback type, the posterior length is longer than in the lean-forward type I and II, but the anterior length is similar to theirs. When considering that the upper body is tipped backward in the swayback type, we can know that the spinal curvature of the upper back as well as the lumbar influences on the anterior and posterior lengths of the upper body.

We performed the analysis of variance and Duncan-test on the depth, breadth, and the girth items showing the horizontal characteristics of the somatotypem as shown in Table 5. As a result, the chest depth, bust depth, waist depth, abdominal breadth, hip breadth, posterior interscye, and abdominal girth don't show any significant difference. In all type, the hip girth is larger than the abdominal girth.

The normal type is that the bust girth is 95.36 cm, the waist girth 84.18 cm, and hip girth 94.28 cm.

In the lean-back type, all sizes are large relatively, the bust girth is 98.39 cm, the waist girth 87.84 cm, and the hip girth 95.93 cm. The armhole depth, chest breath, bust breath, anterior interscye, nipple to nipple breath, under bust girth, waist girth, and weight are larger than the normal one.

The swayback type is that the bust girth is 92.40 cm, the waist girth 80.45 cm, and the hip girth 92.15 cm. In the abdominal depth and the hip depth, the backsway type is smaller than the other ones, and is smaller than the normal one in the chest breath and the shoulder breath.

The lean-forward I is that the bust girth is 93.70 cm, the waist girth 83.43 cm, the hip girth 94.73 cm, but, don't

Table 5. Mean difference of the horizontal measurements (Unit : cm, Kg)

Item \ Type	Normal (n=73)		Lean-back (n=31)		Swayback (n=43)		Lean-forward I (n=43)		Lean-forward II (n=28)		F-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Chest D.	22.52	2.15	22.99	2.23	21.86	2.06	22.22	2.18	22.86	1.96	1.736
Armhole D.	11.37 b	1.41	12.18 a	1.07	10.62 c	1.65	11.25 bc	1.52	10.74 bc	1.70	5.945***
Bust D.	25.37	2.72	26.13	1.75	24.54	3.02	25.33	2.88	25.08	5.20	1.223
Under bust D.	23.10 ab	2.88	23.88 a	1.83	22.00 b	2.75	22.98 ab	2.61	23.31 a	2.75	2.499*
Waist D.	23.66	3.46	24.17	2.61	22.22	3.03	23.90	3.24	23.69	2.85	2.380
Abdominal D.	26.30 a	3.18	27.05 a	2.09	24.55 b	2.73	26.73 a	3.29	25.78 ab	2.74	4.475**
Hip D.	24.41 a	3.08	25.22 a	1.81	22.70 b	2.49	25.20 a	2.90	24.21 a	3.98	5.038**
Chest B.	29.85 b	2.32	31.26 a	1.46	28.54 c	2.41	29.08 bc	2.55	28.21 c	2.39	9.357***
Bust B.	29.21 b	2.75	30.53 a	1.60	28.08 bc	2.72	28.33 bc	2.74	27.90 c	2.66	5.888***
Under bust B.	26.76 ab	2.08	27.53 a	2.02	26.03 bc	2.04	26.29 bc	2.12	25.56 c	1.66	4.496**
Waist B.	27.10 ab	2.71	28.16 a	2.41	26.49 b	2.22	26.81 b	2.89	26.07 b	2.03	3.050*
Abdominal B.	32.16	2.20	32.47	1.71	31.27	2.65	31.89	2.73	31.59	2.18	1.591
Hip B.	32.20	2.22	32.76	2.04	32.24	2.15	32.31	1.73	32.00	1.40	0.618
Shoulder B.	37.20 ab	1.92	38.03 a	1.70	36.28 c	1.88	36.81 bc	2.08	35.30 d	1.71	9.371***
Anterior interscye	31.99 b	1.96	32.94 a	1.59	31.56 bc	1.59	31.32 bc	2.24	30.92 c	2.62	4.768**
Poserior interscye	34.02	1.98	34.26	1.73	33.32	2.44	33.55	2.26	32.96	2.35	2.136
Nipple to nipple B.	18.55 b	1.95	19.87 a	1.94	18.27 b	1.62	18.30 b	1.67	17.84 b	1.64	5.766***
Neck base G.	36.41 ab	2.05	37.06 a	1.84	35.64 b	2.01	36.33 ab	1.86	35.90 b	2.33	2.566*
Chest G.	88.15 ab	6.13	90.76 a	3.80	85.34 b	5.72	86.81 b	6.48	85.98 b	6.45	4.646**
Bust G.	95.36 ab	8.06	98.39 a	5.06	92.40 b	8.36	93.70 b	8.16	93.27 b	7.98	3.127*
Under bust G.	83.43 b	7.51	86.82 a	4.69	80.17 b	6.66	82.45 b	6.88	82.37 b	7.10	4.469**
Waist G.	84.18 b	9.28	87.84 a	5.59	80.45 b	7.65	83.43 b	8.53	81.79 b	7.90	4.078**
Abdominal G.	96.64	8.12	98.50	5.68	94.31	7.33	97.63	8.44	94.50	7.45	2.114
Hip G.	94.28 ab	6.50	95.93 a	4.14	92.15 b	6.44	94.73 ab	6.06	91.93 b	5.61	2.829*
Weight	56.00 b	8.80	60.69 a	6.71	52.32 bc	8.55	54.85 b	9.71	50.23 c	7.57	6.949***

Duncan-test a>b>c>d *p<.05 **p<.01 ***p<.001
D.=depth, B.=Breadth, G.=Girth

have any difference to the normal one in all items.

The lean-forward II is that the bust girth is 93.27 cm, the waist girth 81.79 cm, the hip girth 91.93 cm. It is smaller than the normal type in the upper body : the chest breath, the bust breath, under bust breath, shoulder breath, and anterior interscye.

Indirect measurements per somatotype : To consider the characteristics of the side shape per type, we performed the analysis of variance and the Duncan-test on the items to be measured indirectly. From Table 6, it showed a significant difference in all items.

In the lean-back type, ∠α and C are similar, A and B

Table 6. Mean difference of the indirect measurements (Unit : cm, °)

Item \ Type	Normal (n=73)		Lean-back (n=31)		Swayback (n=43)		Lean-forward I (n=43)		Lean-forward II (n=28)		F-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
∠α	29.38 bc	3.76	27.53 bc	5.93	33.76 a	5.97	27.16 c	4.96	29.70 b	5.88	10.914***
∠β	8.96 c	2.16	4.66 e	1.96	6.81 d	3.18	14.29 b	4.87	17.07 a	5.15	73.901***
A	-0.62 b	1.49	0.58 a	1.52	-0.61 b	1.56	-2.22 c	1.64	-2.55 c	1.38	24.238***
B	1.31 b	1.23	2.28 a	1.45	2.73 a	1.60	-0.60 d	2.05	0.18 c	1.53	31.450***
C	1.90 b	1.60	1.33 b	1.59	-2.45 c	2.23	5.92 a	2.99	2.15 b	2.34	81.258***
D	-1.79 b	1.00	-3.31 c	1.19	-3.54 c	1.27	1.51 a	2.45	1.44 a	1.91	90.874***

Duncan-test a>b>c>d>e *p<.05 **p<.01 ***p<.001

Table 7. Mean difference of the flatness index

Index \ Type	Normal (n=73)		Lean-back (n=31)		Swayback (n=43)		Lean-forward I (n=43)		Lean-forward II (n=28)		F-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Chest	75.49 bc	4.85	73.60 c	6.80	76.73 b	5.75	76.57 b	6.52	81.20 a	5.86	7.078***
Bust	86.90	5.61	85.62	3.93	87.33	6.08	89.49	6.75	89.54	17.20	1.574
Under bust	86.22 b	8.07	87.15 b	9.11	84.41 b	7.25	87.39 b	6.54	91.06 a	7.36	3.353*
Waist	87.44 ab	11.71	86.39 ab	12.07	83.68 b	7.39	89.11 a	7.16	90.75 a	6.80	2.849*
Abdomen	81.65 ab	6.55	83.31 a	5.09	78.81 b	8.80	83.81 a	7.61	81.56 ab	5.79	3.220*
Hip	75.97 a	9.59	77.16 a	5.86	70.43 b	6.66	77.91 a	7.30	75.49 a	10.47	5.240***

Duncan-test a>b>c *p<.05 **p<.01 ***p<.001

Table 8. Mean difference of the length index

Index \ Type	Normal (n=73)		Lean-back (N=31)		Swayback (n=43)		Lean-forward I (n=43)		Lean-forward II (n=28)		F-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Posterior waist H./Stature	61.83 bc	1.68	61.22 c	1.13	61.75 bc	1.35	62.60 a	1.62	62.13 ab	1.42	4.198**
Posterior waist H./Anterior waist H	99.99 b	2.17	99.32 b	1.80	97.69 c	2.93	101.64 a	2.72	99.66 b	1.76	15.512***
N.P to A.W L./Posterior waist L.	106.24 a	6.19	109.00 a	5.43	100.39 b	7.32	108.68 a	7.90	102.12 b	7.70	12.089***
Anterior waist L./Posterior waist L.	84.66 b	6.04	88.05 a	4.98	77.62 c	8.54	84.57 b	7.27	78.09 c	8.89	14.872***
N.P to A.W L./N.P to P.W. L.	99.49 b	4.73	102.17 a	4.78	94.61 c	7.16	102.26 a	6.39	96.51 c	6.28	13.149***

Duncan-test a>b>c *p<.05 **p<.01 ***p<.001
H.=Height, L.=Length, N.P=Neck point, A.W.=Anterior waist, P.W.=Posterior waist

measures are larger than the normal type. $\angle\beta$ and D are the smallest in all types. So, the curvature of the upper back is normal, and the abdomen has been projected because the curvature of waist level is severe while the upper body is leaned back.

In the swayback type, $\angle\alpha$ is the largest in all types, and $\angle\beta$ is smaller than the normal type, but larger than the lean-back one. The value B and D are similar to the lean-back type, and C is smaller than the normal one. So, the degree which the upper body is leaned back is smaller than the lean-back one, but the hip becomes thin and the abdomen is projected because the curvature of upper back and waist level is severe.

In the lean-forward type I, $\angle\alpha$ is similar to the normal one, A is smaller, and $\angle\beta$, C, and D and larger. The value B shows the minus value and the smallest in all types, so, although the back is straight, the upper body moves forward while the lumbar bends, and the abdomen becomes hollow and the hip projects.

In the lean-forward type II, $\angle\alpha$ doesn't show any difference to the normal one, $\angle\beta$ and D are larger, A and B are smaller. The value A and D don't have any difference, compared with the lean-forward type I, but, $\angle\beta$ and B are larger. Therefore, although the curvature of the upper back is normal, the upper body moves forward, and the spinal curvature of the lumbar disappears, then, the projects of waist level more than the hips.

Relation of the somatotype and the index value : To grasp the relation of the physical proportion and the somatotype, we performed the analysis of variance and the Duncan-test as shown Table 7 and Table 8.

As a result, because the flatness index of bust doesn't show any significant difference per type. The normal type don't show any significant differences to the lean-back and the lean-forward I in all flatness indexes. In the flatness index of hip, the swayback type is the smallest in all types, and is smaller than the lean-forward type I in the waist and the abdomen. In the lean-forward type II, the flatness index of the waist, abdomen, hips don't show any significant difference to normal one, but, the chest and under bust are the largest in all types. So, in the swayback type, the lower body is relatively flat, and in the lean-forward type II, the upper body is thick.

As for the posterior waist height/stature, there isn't any difference in the lean-forward type I (62.60) and II (62.13), but, the lean-forward type I is larger than the normal (61.83), the lean-back (61.22) and the swayback one (61.75).

In the posterior waist height/anterior waist height, the lean-forward type I is the largest, and the swayback type is the smallest. As for the neck point to anterior waist length/the posterior waist length, they are the normal

type, the lean-back type, the lean-forward type I> the swayback type and the lean-forward type II, and for the neck point to anterior waist length/ neck point to posterior waist length, they are the lean-back type, the lean-forward type I > normal type > swayback type, lean-forward type II. It shows that the lean-forward type I is relatively longer than the swayback type in the anterior length of the upper body. Generally, the more the upper body leans back, the longer the anterior length is relatively than the posterior length, but, in case of the aged somatotype, it represents that the curvature of the upper back and the lumbar act as a composite factor.

Discriminant factors of the somatotype

To clarify the discriminant factors into 5 somatotypes, we performed the discriminant analysis by means of the 29 direct measurements and the 6 indirect measurements showing the mean difference per type as analysis of variance, and analysed the relative importance of each variable by comparing the coefficient of the standardized discriminant function. In the discriminant function 1 having the highest contribution degree, the coefficients of the cervicale height (-2.480), anterior waist height (1.519) and neck point to posterior waist length (0.985) are high. In the discriminant function 2, the anterior waist length (-0.857) is high, the cervicale height (1.378) in the discriminant function 3, the coefficients of the anterior waist height (1.457) and the cervicale height (-1.325) in the discriminant function 4. So, we can see that the cervicale height, anterior waist height, anterior waist length, neck point to posterior waist length are the main factors distinguishing the somatotype into 5 types. The Hit-ratio of the somatotype classification by these discriminant functions is 50%, so, we can see that to classify the somatotype by only the direct measurements isn't good in the discrimination.

When examining the coefficient of the standardized discriminant function by the indirect measurements of Table 10, in the discriminant function 1 having the highest contribution degree, the coefficient of C value (0.777) is high, D value coefficient (1.292) in the discriminant function 2, C (1.959), $\angle\beta$ (-1.872) and $\angle\alpha$ coefficient (1.560) in the discriminant function 3, C value (-1.209) and $\angle\beta$ coefficient (0.955) in the discriminant function 4. So, these C and D value, $\angle\alpha$, $\angle\beta$ have the excellent discrimination of the side somatotype, and the Hit-ratio of somatotype classification by the discriminant function of these indirect measurements is 77.5%.

Table 9. Standardized canonical discrimination function coefficient of the direct measurements

Item \ Func	Func 1	Func 2	Func 3	Func 4
Cervicale height	-2.480	-0.366	1.378	-1.325
Nipple hight	0.774	0.700	0.338	0.129
Anterior waist height	1.519	-0.450	-0.317	1.457
Hip depth	-0.524	-0.099	-0.139	0.648
N.P to P.W length	0.985	-0.064	-0.693	-0.379
Anterior waist length	0.224	-0.857	-0.378	0.268
Hit-ratio		50.0%		

Table 10. Standardized canonical discrimination function coefficient of the indirect measurements

Item \ Func	Func 1	Func 2	Func 3	Func 4
$<\alpha$	0.075	-0.160	1.560	0.280
$<\beta$	0.221	-0.496	-1.872	0.955
C value	0.777	-0.578	1.959	-1.209
D value	0.090	1.292	-0.053	0.559
Hit-ratio		77.5%		

CONCLUSIONS

This study has a purpose of providing a basic data for the clothing design to supplement the somatotype change of the aged women. Data were collected from 46 anthropometric and photographic measurements of the 218 elderly women 60-85 years old. We classified the lateral view contour by visual judgement, considered the somatotype change according to the age increase, the formal characteristics of each type, and suggested the discriminant factors for the types.

The result is as follows.

1. The somatotype has been classified into 5 type with base line's position falling plumb from the cervicale. In the distribution per type, the normal type is 33.5%, the lean-back type 14.2%, the swayback type 19.7%, the lean-forward type I 19.7%, the lean-forward type II 12.8%. In the middle part of 70 years old, the body type according to the aging changes severely.

2. The characteristics of the elderly women's body was affected by the lateral view : the curvature of the upper back and the lumbar.

The normal type is defined that the base line falling plumb from the cervical point passes by the lateral malleolus. The lean-back type is tall and big relatively. The anterior waist line raises and the anterior breadth is wide. The curvature of upper back is the normal, but the lumbar leans forward, the abdomen projects. In the swayback type, the stature and size is normal. The anterior waist line raises, and the curvature of the upper back and the lumbar is severe, the abdomen projects.

In the lean-forward type I, the stature and size is normal. The anterior waist line is low, the abdomen becomes hollow and the hips projects. As the back is straight, the posterior length is normal. In the lean-forward type II, the stature is short, and the curvature of upper back is normal. But the lumbar bends is severe, the spinal curvature disappears, the anterior length is short, the depth of the upper body is thick relatively.

3. The discriminant factors distinguishing the somatotype into 5 types are the cervicale height, anterior waist height, neck point to posterior waist length and anterior waist length in the direct measurements, and C, D value, $\angle\alpha$ and $\angle\beta$, in the indirect measurements.

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