

A Study on the Body Types of Chinese and Korean Women in Their Early 20s for the Development of the Torso Dummy

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Abstract

This study aimed to provide the Korean apparel companies trying to localize their business in the Chinese markets with some data about Chinese young women's body types useful to the development of the apparel designs fitting the Chinese consumers. To this end, the adult women aged between 19 and 25 living in Beijing, Shanghai and Korea were sampled, and thereby, their body sizes and types were measured.

All in all, the results of this study confirmed that Korean and Chinese women in the early 20s had similar vertical body sizes but different horizontal body sizes. In addition, the body types were different between Beijing and Shanghai women groups.

Key Words : comparison of body types, torso dummy, Chinese women

I. Introduction

1. Purpose of the Study

Many Korean apparel companies have advanced into the Chinese apparel markets since the establishment of the diplomatic relations between Korea and China in 1992, and they have accumulated much experiences and knowhow. However, the recent global financial

crisis has hit them hard, and thus, they cannot but plan their marketing strategies anew to survive in the Chinese markets. Currently, China is the top apparel exporter and manufacturer in the world, while endeavoring to grow into a fashion power. The Chinese apparel markets are most vigorous in the world; they change rapidly with increasing fashion brands. The global fashion brands compete fiercely with each other, while trying to be positioned well there. In this

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course, the global fashion brands open their outlets increasingly in the Chinese markets, while taking themselves public¹⁾. Hence, materials and designs should be creative, being at a global level. On the other hand, as the demands are increasing, the prices are rising. Now, the highly potential Chinese apparel markets attract attention from the apparel businesses in the world. As 'the global factory' turns into 'a global consumer market,' China's apparel industry is restructured into a knowledge-based industry aiming at high-quality and high added value. Hence, Korean apparel companies are seriously awakened of the problems involving the apparel fitness at the stages of planning and production due to Chinese consumers' different body types from their Korean counterparts²⁾³⁾⁴⁾. Hence, it is deemed necessary to survey Chinese consumers for such basic body data as body sizes and types, and thereupon, produce the standard body 인디스 for the Chinese consumers. The purpose of this study is to analyze Chinese adult women's body sizes and types in comparison with Korean women's ones and thereby, provide for some basic data useful to the development of the apparels befitting Chinese adult women's standard body sizes.

2. Study Points

This empirical study aims to analyze the differences of body sizes and types between Chinese women in their early 20s and their Korean counterparts. Specifically, this study

1) comparatively analyzes the differences of body sizes and types among young women samples (among Beijing, Shanghai and Korea and between Beijing/Shanghai and Korea) whose body sizes and types were measured in 2004, and thereupon, compares their body size/type data of 2004 with those of 2008 to examine the

changes of sample women's body sizes and types.

2) conducts the Factor Analysis for sample women's body measurements to estimate each factor scores by regime (Beijing and Shanghai) and by year (2004 and 2008), and thereby, determines the body type factors and analyzes the body characteristics by factor.

II. Methods and Procedures of the Study

1. Sample

For this study, the adult women in their early 20s were sampled, considering that their body has developed enough to vary little. In 2004, the Chinese women were sampled in China's capital Beijing and China's economic and trade center Shanghai, while the Korean women were sampled throughout the nation because it was deemed that the deviations of Korean women's body types were negligible. In 2008, 210 women in their early 20s (19~24 years old) were sampled randomly in Shanghai to be subject to the body measurement. They were attending Donghua College of Shanghai. Since the college admits the students from various regions in China, the women students sampled might well represent the entire Chinese women in their early 20s in terms of body sizes and types. Excluding the extreme values, the body measurements of 189 women were used for the final analysis.

In order to comparatively analyze the body sizes and types of the Chinese women, 49 items of measurement were determined out of the total 111 ones produced in 2004, and in order to analyze the data in comparison with Korean women, 27 items of measurement matching those of Korean women's measurements

were selected. <Table 1> shows the sample groups. The total sample numbered 1,063 women, but in order to ensure the representation of the sample, the women with some extreme body measurements or those with their Rohrer index below 1.0 or above 1.6 were excluded from the entire sample. Thus, the final sample numbered 991. (See Table 2).

2. Data Processing

The data about sample women's body measurements were processed statistically using the SPSS/WIN 12.0 program.

First, the data were about 991 Chinese and Korean women's body measurements in 2004 and 2008. 49 items of measurements were comprised of 13 heights, 8 widths, 7 depths, 7 circumferences, 11 lengths, weight and 2 angles. 44 indices and calculations were added up to 49 items, and thus, a total of 93 items were used for measurement. For the comparison of measurements between Chinese and Korean women groups, 33 items of measurements matching those of Korean women's body measurements (Size Korea) were selected, and thereby, F-test, T-test and Duncan test were conducted.

Second, in order to determine the factors of Chinese women's body types, their measurements in 49 items were subject to the Factor Analysis

using the Varimax rotation. Then, the results of Scree-test and the factors themselves were interpreted and thereby, the body type factors were determined. In addition, the factor scores were estimated by year and region to be subject to F-test and Duncan test to test the differences of body types among groups.

III Results and Discussions

1. Results of Analyzing the Body Measurements by Region and Year

Let's discuss the following results of analyzing the sample women's body measurements for 49 items and 44 indices and calculations by region and year by means of F-test and Duncan test:

1) Results of the Comparative Analysis

(1) Heights

The results of analyzing sample women's heights by region and year can be summed up as in <Table 3>.

In almost all heights, no significant difference was found among the three groups, but in hip height, the Shanghai women group in 2008 showed a significantly highest value.

<Table 1> Sampled women by year

Year	Bei- jing	Shang- hai	Korea	Sum
2004	157	195	501	853
2008	.	210	.	210
Sum	157	405	501	1063

<Table 2> Samples by year

Year	Bei- jing	Shang- hai	Korea	Sum
2004	144	179	479	802
2008	.	189	.	189
Sum	144	368	479	991

<Table 3> Results of the Comparative Analysis of Sample Women's Heights

unit: cm

Hei- ghts	part measured	2004				2008				F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
Item	stature	159.98	5.44	159.67	5.28	160.46	5.24	161.04	5.53	0.74	
	menton height	137.33	5.04	137.35	4.88					0.00	
	anterior neck height	130.69	5.29	130.75	4.95			131.01	5.18	0.19	
	side neck height	135.19	4.96	134.42	5.41			135.13	5.27	1.16	
	posterior neck height	135.94	5.09	135.24	4.83			136.03	5.15	1.30	
	biacrominal height	130.16	5.02	129.35	4.99			130.53	5.09	2.59	
	armpit height	119.53	6.12	118.72	4.90					1.72	
	chest height							124.08	5.02		
	bust height	115.02	4.94	114.43	4.74			114.79	4.93	0.60	
	underbust height							109.31	4.77		
	waist height	99.83	4.28	99.76	4.20	100.31	3.96	100.81	4.48	2.49	
	abdomen height	89.43	3.89	89.70	4.01			90.18	4.23	1.48	
	hip height	79.04	4.40	78.86	3.70	78.44	3.59	80.71	4.05	15.99** *	b b b a

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

※ In case of the Korean women group, the data about the two items matching their Chinese counterparts were analyzed only.

When the heights were compared by body part, the Beijing group showed the highest values in biacrominal height-waist height and nipple height-waist height, while the Shanghai group of 2008 showed the highest values in biacrominal height-nipple height. It was found that the Korean women group had the highest waist and hips, while the Shanghai group of 2008 had the lowest waist and hips.

(2) Widths

<Table 4> shows the results of analyzing the widths. The differences of widths were significant among three groups. While the width values between Beijing and Shanghai groups in 2004 were not much different, the Shanghai group of 2008 showed the largest width values. As a result

of comparing the width values between Korean and Chinese groups, it was found that the differences of widths were much significant, which suggests that the body widths or forms differ widely between Korean and Chinese young women. The chest was widest in Shanghai group, followed by Korean and Beijing groups in their order, while the bust was widest in Korean group, followed by Shanghai and Beijing groups in their order, and the waist was wide in Korean group and Shanghai group of 2008. The hips were narrow in Shanghai group of 2004.

All in all, the Korean group had wider bust and waist than their Chinese counterparts, and Shanghai group of 2008 had the narrowest hips. As a result of comparing the body types among Chinese groups, it was found that the differences were not significant in 2004, but that Shanghai

<Table 4> Comparison of Widths among Beijing, Shanghai and Korean Women Groups

unit: cm

Width	Part measured	2004				2008				F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
Item	neck base width	12.23	1.18	12.08	0.90			13.39	0.60	116.54***	b b a
	biacrominal width	33.26	1.51	34.01	1.46			34.58	1.44	32.84***	c b a
	chest width	27.31	1.87	28.04	1.92	27.14	1.59	28.31	1.54	27.95***	b a b a
	bust width	25.93	1.51	26.23	1.59	26.73	1.60	26.39	1.46	11.54***	c b a b
	underbust width	24.72	1.45	24.74	1.55			25.21	1.40	6.25***	b b a
	waist width	22.70	2.08	22.60	1.89	23.42	1.65	23.73	1.62	18.89 ***	b b a a
	abdominal width	30.10	1.84	29.25	2.17			29.59	1.85	7.53***	a b a
	hip width	32.24	1.95	31.84	1.58	32.28	1.54	32.34	1.61	3.78*	a b a a

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

group of 2008 showed the largest widths. Namely, the Shanghai women group had wider chest, while their body part between waist and hips was smaller than their Beijing counterpart. In contrast, the Beijing women group had wider hips only.

On the other hand, as a result of comparing the body widths centering around the waist width between the three Chinese groups, it was found that the Shanghai group of 2004 had the largest widths in the parts from neck base to bust, while such widths were similar between Beijing group of 2004 and Shanghai group of 2008. In contrast, the Beijing group of 2004 had the largest widths in the parts from underbust to hips, while the Shanghai group of 2008 had the smallest widths in the same parts. As a consequence of comparing Korean and Chinese groups, it was found that the Korean group had the smallest widths in all parts. Namely, the Chinese women groups had wider chest, waist and hips than their Korean counterparts. In other words, their waist was relatively narrow.

(3) Depths

<Table 5> shows the results of analyzing sample women's body depths. The body depths differed significantly in 5 body parts, but the differences between Beijing and Shanghai groups in 2004 were not much significant. In all body parts but hips, the three groups of 2004 showed larger depths, while the Shanghai group of 2008 showed larger hip depth only. As a result of comparing Korean and Chinese groups, the differences of depth in chest, bust and hips were significant between them, but the differences themselves were too minimal to be distinctive to bare eyes.

As a result of comparing the ratio of body depths to the waist depth between the three Chinese women groups, it was found that the two Chinese groups of 2004 had larger chest and underbust depths, while the Shanghai group of 2008 had larger hip depth.

(4) Circumferences

<Table 6> shows the results of analyzing sample women's body circumferences. The differences of body circumferences were significant in 6 body parts. The Beijing group of 2004 had the largest bust circumference, while the Shanghai

group of 2008 had the largest waist and hip circumferences. As a result of comparing Korean and Chinese groups, it was disclosed that the Korean group showed the waist and hip circumferences similar to those of the Shanghai group of 2008. Korean group's other body circumferences were similar to those of the Shanghai group of 2004.

<Table 5> Comparison of Body Depths among Beijing, Shanghai and Korea groups

unit: cm

Depth	Part measured	2004				2008				F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
	neck base depth	·	·	·	·	·	·	10.78	0.60		
Item	chest depth	17.98	1.54	17.83	1.17	17.74	1.34	17.32	1.23	8.16***	a a a b
	bust depth	21.60	2.09	21.18	1.96	20.44	1.76	21.38	1.83	21.94***	a b ab a
	underbust depth	18.96	2.21	18.65	1.64	·	·	18.11	1.56	9.79***	a a b
	waist depth	17.51	2.16	17.34	1.57	17.06	1.62	17.51	4.51*	0.59	
	abdominal depth	20.06	2.31	19.49	1.96	·	·	19.90	1.70	3.57*	a b ab
	hip depth	20.20	1.94	20.27	1.70	20.67	1.66	21.41	1.52	19.12***	c c b a

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

<Table 6> Comparison of Body Circumferences among Beijing, Shanghai and Korean groups

unit: cm

Circumferences	Part measured	2004년				2008년				F-test	Duncan test
		북경 (N=144)		상해 (N=179)		한국 (N=479)		상해 (N=189)			
		M	SD	M	SD	M	SD	M	SD		
Item	neck base circumference	37.23	1.57	36.33	1.80			39.76	1.42	226.00 ***	b c a
	chest circumference	82.68	4.47	81.13	4.36	81.49	4.48	81.83	4.47	3.66	a b b ab
	bust circumference	84.22	5.09	82.17	4.85	81.69	5.15	83.43	5.23	11.83***	a b b a
	underbust circumference	73.59	5.11	72.35	4.26	71.02	4.18	73.04	3.96	18.91***	a b c ab
	waist circumference	66.37	5.33	65.09	4.40	66.49	4.89	67.42	4.47	7.35***	b c ab a
	abdominal circumference	81.53	5.75	80.61	5.71			80.17	5.26	2.49	
	hip circumference	90.38	4.71	88.66	4.35	90.88	4.36	90.23	4.42	10.98***	a b a a

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

Since the Beijing women had large bust and hip circumferences in reference to their waist circumference, they look voluminous. In contrast, the Shanghai women had slim and plain lower part of the body in comparison with their upper part of the body. The Korean women had a plain upper part of the body, but had a thick lower part of the body. Hence, the Korean women had a strongly indented body silhouette. In addition, the Korean women had a slim overbust

like the Shanghai women, while having a thick lower part of the body like the Beijing women. All in all, the Korean women had slim upper body and thick lower body.

(5) Lengths

<Table 7> shows the results of analyzing sample women's body lengths. The three Chinese groups showed significant body lengths except for 3 body parts.

<Table 7> Comparison of Body Lengths among Beijing, Shanghai and Korea Groups

unit: cm

Length	Part measured	2004						2008		F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
Item	waist front length	32.74	1.94	32.51	1.83	32.15	1.93	32.29	1.93	3.23	
	length from neck shoulder point to breast point	24.93	1.58	24.87	1.52	24.84	1.90	25.79	2.08	13.22***	b b b a
	length from neck point to breast point to waist line	39.92	1.74	39.55	1.89	39.63	2.12	39.65	2.29	0.31	
	interscye front length	31.44	1.86	31.94	1.75	32.15	1.94	32.02	1.60	5.64**	b a a a
	horizontal length between nipples	17.11	1.58	17.05	1.45	17.16	1.57	18.75	1.58	55.97***	b b b a
	waist back length	37.35	1.69	36.89	1.56	38.06	2.10	36.83	1.80	27.85**	b c a c
	shoulder length	12.22	1.00	12.61	0.85	12.79	1.10	11.85	0.97	42.73***	b a a c
	bilateral shoulder length	38.39	2.24	39.15	1.99	39.67	2.21	38.97	2.12	14.85***	c b a b
	lateral neck to waist line length	39.95	1.81	39.59	1.76			39.08	1.93	9.39***	a a b
	interscye back length	34.79	2.26	34.90	2.12	36.27	2.22	35.00	1.97	29.46***	b b a b
	lateral hip length	22.03	2.19	21.96	2.41			21.64	2.07	1.47	

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

1) lateral neck to waist line length=back length,

2) length from neck point to breast point to waist line: front length

3) interscye back length= shoulder width

4) interscye front length = breast width

There were found no significant differences among the groups as far as the waist front length was concerned, but the Beijing group of 2004 showed the largest waist back length. Shanghai groups of 2004 and 2008 showed a large interscye front length. However, there was found no significant difference of interscye back length among the groups. On the other hand, the Shanghai group of 2008 had larger length from neck shoulder point to breast point, which was deemed attributable to the fact that they had no brasier when measured. In 2004, they had higher nipple points. Also, the Shanghai group showed the largest bilateral should length.

Compared with the Korean women group, Chinese women's waist front lengths did not differ significantly, but their waist back was longer than the Korean women. Both Shanghai and Korean women had larger interscye front length, while Chinese women had smaller interscye back length than Korean women. On the other hand, the Korean women had larger waist back length—waist front length as well as shoulder and breast widths than their Chinese counterparts. Both Beijing and Shanghai groups had smaller shoulder length and bilateral shoulder lengths. Namely, both Chinese groups had smaller shoulders than the Korean group and shorter waist back in reference to the waist front length, with larger interscye front length.

Namely, Chinese women's, particularly, Shanghai women's upper part of the body was rather pulled back.

(6) Angles

There was found no significant difference of shoulder slopes within the Shanghai group, but the Beijing group had larger angles in both right and left shoulders, which suggests that the Beijing women's shoulders were drooped down more than their Shanghai counterparts.

2) Results of the Comparative Analysis of Indices and Calculations

Let's discuss the results of analyzing the indices and calculations about body heights, widths and depths and comparing the proportions of sample women's body. (See Figure 1.)

(1) Heights

As shown in <Table 1>, there were significant differences of vertical proportions between Chinese and Korean groups only in terms of hip height and stature. The Korean group had the smallest hip height and stature in terms of proportion, while the Shanghai group of 2008 had the best proportion. Namely, since the Korean women's hips were low in comparison

<Table 8> Comparison of Shoulder Angles among Groups

Angle	Part measured	2004						2008		T/F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
Item	left shoulder slope(°)	23.13	3.72	21.20	3.68	·	·	21.77	3.53	11.62***	a b b
	right shoulder slope(°)	23.47	3.78	21.23	3.68	·	·	21.62	3.35	17.07***	a b b

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

<Table 9> Comparison of Heights between Beijing and Shanghai Groups

unit: cm

Heights	Part measured	2004						2008		F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
Calculation	biacrominal height-waist height	30.32	2.30	29.59	2.24			29.72	1.89	5.26**	a b b
	biacrominal height-nipple height	15.14	2.11	14.92	2.21			15.73	1.82	7.81***	b b a
	nipple height - waist height	15.18	2.24	14.67	2.06			13.98	2.12	13.31***	a b c
	waist height-hip height	20.79	3.38	20.90	2.47	21.87	2.04	20.10	2.29	27.89***	b b a c
Indices	mention height/stature	0.86	0.01	0.86	0.01			0.81	0.01	3.20	
	anterior neck height/stature	0.82	0.01	0.82	0.01			0.84	0.01	9.20***	a a b
	side neck height/stature	0.85	0.01	0.84	0.02			0.84	0.01	9.31***	a b c
	posterior neck height/ stature	0.85	0.01	0.85	0.01			0.81	0.01	15.37***	a b c
	biacrominal height/stature	0.82	0.01	0.81	0.01			0.81		5.72***	a b b
	armpit height/stature	0.75	0.02	0.74	0.02			0.77	0.01	2.24	
	chest height/stature							0.71	0.01		
	bust height/stature	0.72	0.01	0.72	0.01			0.68	0.01	9.88***	a a b
	underbust height/stature							0.63	0.01		
	waist height/stature	0.62	0.01	0.62	0.01	0.62	0.01	0.56	0.01	0.74	
	abdominal height/stature	0.56	0.01	0.56	0.01			0.50	0.01	1.79	
	hip height/stature	0.49	0.02	0.49	0.01	0.48	0.01	0.50	0.14	33.48***	b b c a
	(biacrominal height -nipple height)/ (biacrominal height -waist height)	0.50	0.06	0.50	0.06			0.53	0.06	13.05***	b b a
(nipple height-waist height)/ (biacrominal height -waist height)	0.50	0.06	0.50	0.06			0.47	0.06	13.05***	a a b	
waist-hip height ratio (waist height-hip height)/ (biacrominal height -waistheight)	0.69	0.14	0.71	0.10			0.68	0.09	3.73*	ab a b	

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

with their stature, their lower part of the body was rather short.

Upon comparing the Beijing and Shanghai groups of 2004 with the Shanghai group of 2008, it was found that the differences of proportion were significant in 6 body parts. In almost all body parts, Shanghai women showed larger values than their Beijing counterparts. Namely, Beijing women had higher neck, shoulder and bust than Shanghai women but lower hips.

On the other hand, as a result of analyzing the vertical proportions by body part except for hip height and stature, it was found that the Shanghai group of 2008 had the largest biacrominal height–nipple height/biacrominal height–waist height, while showing the smallest heights in the other two parts of the body. Considering that the 2004 data were obtained from the sample women with brasier and that 2008 ones were estimated with no brasier, the Shanghai group of 2008 showed lower nipple points. Namely, such state of measurements needed to be taken into consideration. As a result of analyzing the ratios of three items, namely biacrominal height–nipple height, nipple height–waist height and waist height–hip height, it was found that 2004 Beijing women's ratio was 1:1:1.38, 2004 Shanghai women's one 1:1:1.4 and 2008 Shanghai women's ratio was 1.3:1:1.45. In reference to the ideal body part ratio 1:1:1.2, both Beijing and Shanghai groups had a lower hip position. <Table 9> shows the ratios of the front to the vertical lengths in Beijing and Shanghai groups of 2004 and Shanghai group of 2008.

(2) Widths

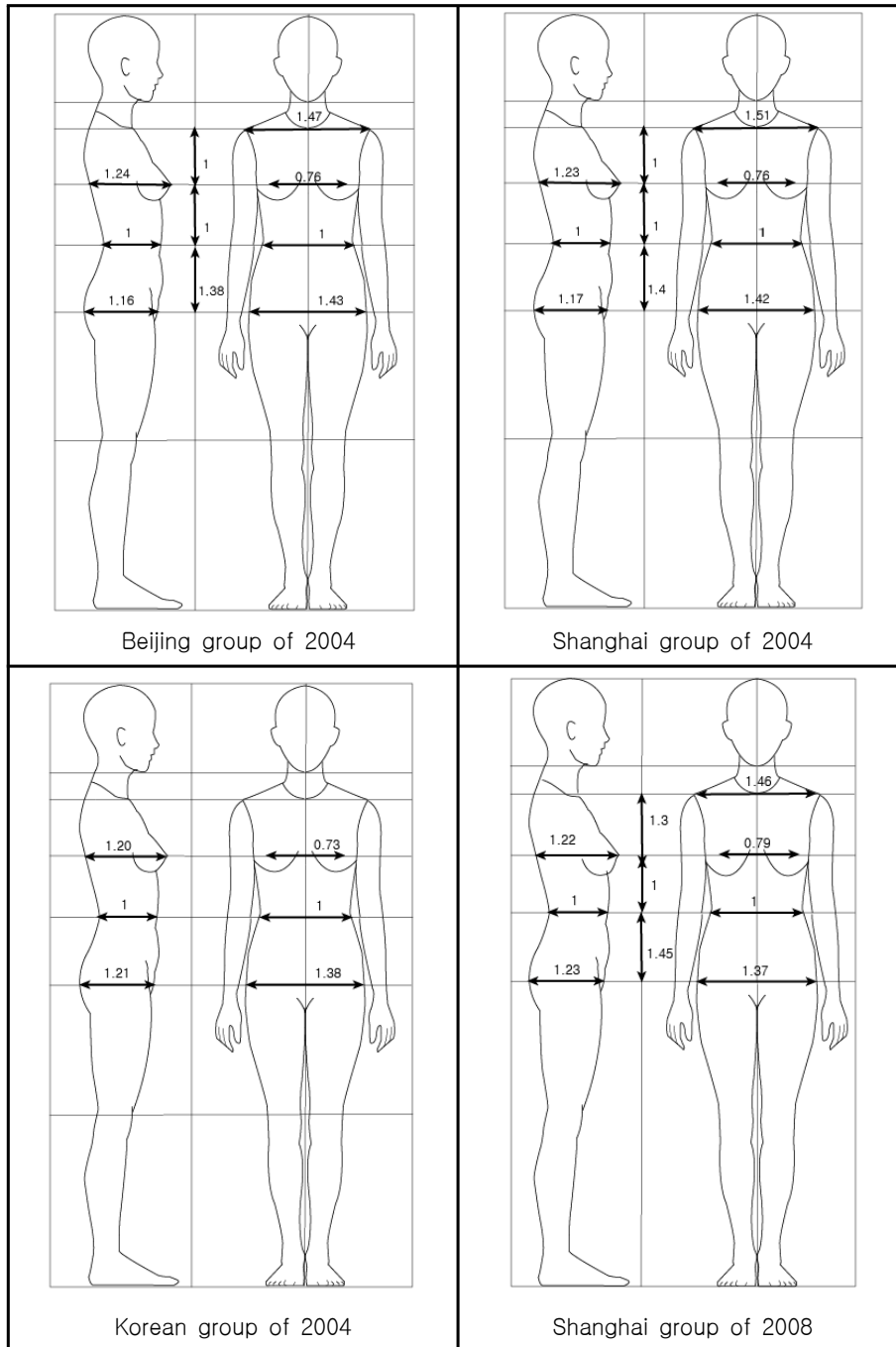
In comparison with the ideal ratio of the body width 1.5:0.8:1:1.4, the Shanghai group of 2008

showed rather smaller biacrominal and hip widths in reference to their waist width. <Table 10> shows the body width ratios of the Chinese women groups.

(3) Depths

In case of Rohrer index about the ratio of depths to widths, the Beijing group of 2004 showed the largest Rohrer index in the ratio of bust depth to waist width, while the Shanghai group of 2008 showed the largest hip Rohrer index. Namely, Beijing women had a round body type with their chest and waist deeper than their hips, while Shanghai women had deeper hips and abdomen with higher hip Rohrer index. Consequently, Beijing women had deeper upper body, while Shanghai women had deeper lower body. Upon comparing Chinese and Korean women, the bust depth in reference to the waist depth was largest in Beijing group, followed by Shanghai and Korean groups in their order, and the hip depth was largest in the Korean group. On the other hand, the bust Rohrer index was highest in Beijing group, followed by Shanghai and Korean groups in their order, which means that Beijing group had deep bust in reference to their bust width, and that the Korean group had a flat bust. And the waist Rohrer index was high in Beijing and Shanghai groups, and low in the Korean group. In overall terms, Beijing women had shallow hips in reference to their hip width, and had deeper bust and waist. In case of the Korean women, the parts of the body are deeper and deeper downwards from bust to hips. Namely, Beijing women had a round body type over their waist, while the Korean women had a round body downwards.

Compared with the ideal ratio of the body part depths 1.3:1:1.3⁵⁾, the Shanghai group of 2008 seemed to be most ideal, but all four groups



<Figure 1> Comparison of Body Part Ratios among Groups

had rather shallow bust and hips in reference to of body part depths in the four groups.
their waist depth. <Table 11> shows the ratios

<Table 10> Comparison of the Body Width Ratios among Groups

unit: cm

Width	Part measured	2004						2008년		F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
In-dices	neck base width/waist width	0.54	0.06	0.54	0.05			0.57	0.05	17.93***	b a b
	biacrominal width/waist width	1.47	0.11	1.51	0.12			1.46	0.09	11.08***	b a b
	chest width/waist width	1.21	0.08	1.25	0.10	1.16	0.06	1.20	0.08	56.20***	b a c b
	inter-nipple length/waist width	0.76	0.07	0.76	0.07	0.73	0.06	0.79	0.07	34.36***	b b c a
	bust width/waist width	1.15	0.06	1.16	0.07	1.14	0.05	1.11	0.05	24.44***	b a b c
	underbust width/waist width	1.09	0.07	1.10	0.08			1.06	0.05	15.37***	a a b
	abdominal width/waist width	1.33	0.09	1.30	0.09			1.25	0.07	41.10***	a b c
	hip width/waist width	1.43	0.11	1.42	0.10	1.38	0.09	1.37	0.08	18.05***	a a b b

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

<Table 11> Comparison of Body Depths among Groups

unit: cm

Depth	Part measured	2004						2008		F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
Index	neck base depth/waist depth	0.62	0.04		
	chest depth/waist depth	1.04	0.10	1.03	0.09	1.04	0.08	0.99	0.07	18.13***	a a a b
	bust depth/waist depth	1.24	0.11	1.23	0.09	1.20	0.08	1.22	0.08	10.71***	a b c b
	underbust depth/waist depth	1.09	0.10	1.08	0.07	.	.	1.04	0.07	20.74***	a a b
	abdominal depth/waist depth	1.15	0.10	1.13	0.10	.	.	1.14	0.06	2.71	
	hip depth/waist depth	1.16	0.10	1.17	0.10	1.22	0.09	1.23	0.07	29.92***	b b a a
	bust Rohrer index	0.83	0.07	0.81	0.06	0.77	0.05	0.81	0.05	75.54***	a b c b
	waist Rohrer index	0.77	0.07	0.77	0.06	0.73	0.05	0.74	0.04	41.87***	a a b b
	hip Rohrer index	0.63	0.06	0.64	0.05	0.64	0.05	0.66	0.04	15.62 ***	c b b a

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

(4) Circumferences

As a result of examining the drop sizes to determine bust and hip silhouettes in reference to the waist, it was found that the Beijing group had the largest sizes, followed by the Shanghai group of 2004 and 2008 in their order. When the Korean group was included, bust circumference-waist circumference size was largest in Beijing group, followed by Shanghai groups and the Korea group in their order. The hip circumference-waist circumference size was small in the Shanghai groups in comparison with their Beijing or Korean counterparts. Bust circumference-underbust circumference size (hereunder referred to as 'cup size') was smallest in the Shanghai groups, but all the sample women corresponded to the 'A' cup brasier size.

(5) Lengths

There was found no significant difference in waist back length-waist front length among groups.

Statistically, shoulder length-breast length was largest in the 2004 data, but the differences were not significant. Namely, the results from this study are similar to Nam Yun-ja's (1991)⁶⁾ study that the women with their upper body pulled back had larger lengths than those with the straight upper body, but that both groups showed similar values in shoulder and breast lengths. However, the Shanghai group showed smaller shoulder and breast widths, which suggests that their upper body was rather pulled back compared with their Beijing counterparts.

(6) Other Measurements

Such obesity indices as weight and Rohrer index were higher in Beijing and Korean groups and lower in Shanghai groups. The Rohrer index indicating obesity was 1.28 for Beijing and Korean groups, which suggests that both groups had a normal body type. It was 1.25 for Shanghai groups, which means that they were rather slim.

<Table 12> Comparison of Circumferences among the Groups

unit: cm

Circumferences	Part measured	2004						2008		F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
drop item	chest circumference-bust circumference	-1.55	2.67	-1.04	2.47			-1.61	3.08	2.32	
	bust circumference-waist circumference	17.85	3.12	17.08	2.46	15.20	3.35	16.02	3.26	35.64***	a b d c
	abdominal circumference-waist circumference	15.16	3.97	15.51	3.45			12.75	3.00	34.38***	a a b
	hip circumference-waist circumference	24.01	3.57	23.57	3.32	24.39	3.44	22.81	3.23	9.45***	a b a c
	bust circumference-underbust circumference	10.64	3.17	9.82	2.73	10.67	2.34	10.40	2.93	3.70*	a b a a

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

<Table 13> Comparison of Body Lengths among the Groups

unit: cm

Lengths	Part measured	2004						2008		F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
Calculations	waist back length-waist front length	4.61	2.20	4.39	1.91	5.90	1.89	4.54	1.76	44.54***	b b a b
	shoulder length ¹⁾ -breast length ²⁾	0.03	1.85	0.04	1.83			-0.56	2.07	5.72***	a a b
	shoulder width ³⁾ -breast width ⁴⁾	3.35	2.67	2.96	2.48	4.12	2.55	2.98	2.06	11.89***	b b a b

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

¹⁾ length from neck shoulder point to waist line = shoulder length

²⁾ length from neck point to breast point to waist line = breast length

³⁾ interscye back length = shoulder width

⁴⁾ interscye front length = breath width

<Table 14> Comparison of Other Body Measurements among the Groups

Others	Part measured	2004						2008		T/F-test	Duncan test
		Beijing (N=144)		Shanghai (N=179)		Korea (N=479)		Shanghai (N=189)			
		M	SD	M	SD	M	SD	M	SD		
Index	weight (kg)	52.58	6.33	50.47	5.97	52.96	6.11	51.74	6.00	4.97**	b a b b
	Rohrer index	1.28	0.13	1.24	0.12	1.28	0.13	1.24	0.12	7.05***	a b a b
	BMI	20.52	2.04	19.77	1.83	20.54	2.03	19.92	1.80	6.98***	a b a b

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

To be more specific, the Chinese groups had smaller horizontal body widths than their Korean counterparts, but their body depths centering around the chest were larger. Hence, their chest and waist were round, while their hips were flat with their upper body pulled back more. In contrast, the Korean women had a round body type with their hips larger. All in all, all the groups had a normal body type, but the Shanghai group women were rather slim.

2. Body Type Factors

1) Confirmation of the Body Type Factors

In order to determine the body type factors, the data from the measurement of 49 body parts were subject to Factor Analysis, and then, the results of Scree-test and the factors themselves were interpreted. Furthermore, in order to examine the characteristics of each factor, the data were processed using the

Varimax rotation. <Table 15> shows the results of the Factor Analysis. All in all, 4 body type factors were determined; their accumulated explanatory

power coefficient was 63.72%. <Table 15> shows load and value of each factor, their explanatory power coefficients and characteristics.

<Table15> Result of the Factor Analysis for the Chinese Groups

Item	Factor 1	Factor 2	Factor 3	Factor 4	Explanatory power(h ²)
bust circumference	0.88	0.05	0.22	-0.02	0.83
waist circumference	0.85	0.06	0.14	0.06	0.74
chest circumference	0.84	0.12	0.25	0.06	0.79
weight	0.82	0.38	0.27	0.07	0.89
abdominal depth	0.81	0.00	0.05	0.06	0.66
bust width	0.81	0.12	-0.01	-0.03	0.67
underbust circumference	0.80	0.07	0.28	-0.04	0.73
waist circumference	0.80	0.00	0.04	0.01	0.64
abdominal circumference	0.78	0.12	0.23	0.01	0.68
underbust width	0.77	0.13	-0.06	-0.07	0.62
waist width	0.77	0.14	-0.09	0.07	0.62
bust depth	0.76	-0.01	0.29	-0.03	0.66
hip circumference	0.74	0.28	0.23	0.09	0.54
underbust depth	0.74	-0.04	0.22	-0.01	0.59
abdominal width	0.72	0.24	0.05	0.05	0.59
hip depth	0.70	0.16	-0.15	0.08	0.54
hip width	0.67	0.31	0.05	0.06	0.55
chest width	0.59	0.27	-0.09	-0.06	0.44
length from neck shoulder point to breast point	0.58	0.16	-0.12	0.04	0.38
chest depth	0.54	0.01	0.49	0.09	0.54
interscye back length	0.55	0.12	-0.16	0.37	0.47
neck base circumference	0.51	0.31	-0.33	0.26	0.54
inter-nipple length	0.51	0.20	-0.48	0.05	0.53
posterior neck height	0.21	0.95	0.11	0.03	0.89
biacromial height	0.20	0.95	0.12	-0.09	0.96
stature	0.16	0.95	0.17	0.01	0.95
bust height	0.09	0.94	0.10	-0.06	0.90
anterior neck height	0.16	0.93	0.10	0.01	0.90
neck shoulder height	0.17	0.92	0.10	0.04	0.89
waist height	0.15	0.88	0.26	-0.05	0.87
abdominal height	0.08	0.86	0.21	-0.01	0.80
hip height	0.10	0.79	0.30	-0.07	0.72
waist front length	0.10	0.29	0.65	0.03	0.52
length from neck point to breast point to waistline	0.29	0.30	0.57	-0.05	0.49
waist back length	0.10	0.36	0.54	0.12	0.44
neck base width	0.28	0.32	-0.54	0.25	0.35
interscye front length	0.31	0.24	0.44	0.05	0.35
right shoulder slope	-0.04	-0.10	0.02	0.84	0.72
left shoulder slope	-0.09	-0.13	0.05	0.82	0.70
bilateral shoulder length	0.34	0.31	0.07	0.52	0.48
shoulder length	0.13	0.10	0.44	0.45	0.42
original value	14.33	4.83	2.56	1.86	
explanatory power	38.72	13.05	6.93	5.02	
accumulated explanatory power	38.72	51.77	58.70	63.72	

(1) Factor 1

This factor comprised of all width, depth and circumference values 'represents obesity and horizontal size of the body.' Its load was highest in bust circumference (0.88), followed by waist circumference (0.85), chest circumference (0.84), underbust circumference (0.80), abdominal circumference (0.78) and hip depth (0.70) in their order. The explanatory power of this factor was highest, especially as far as obesity and horizontal size of the body were concerned. Its original value is 14.33, with its explanatory power amounting to 38.72%.

(2) Factor 2

This factor comprised of such vertical values as stature (0.95), bust height (0.92), waist height (0.92) and hip height (0.80) 'represents the horizontal size of the body.' Its original value is 4.83, with its explanatory power amounting to 13.05%.

(3) Factor 3

This factor comprised of waist front length (0.65), length from neck point to breast point to waistline (0.57) and waist back length (0.54) 'represents the length of the upper body.' If the score of this factor

is higher, the upper body is longer that much. Its original value is 2.56, with its explanatory power amounting to 6.93%.

(4) Factor 4

This factor comprised of both shoulder slopes and sizes 'represents the shoulder drops and sizes.' Its original value is 1.86, with its explanatory power amounting to 5.02%.

2) Comparison of the Factor Scores by Region and Year

As discussed above, the four women groups' body measurements were subject to the Factor Analysis to determine the body type factors, and as a result, four factors were determined. Then, the score of each factor was estimated by means of F-test and Duncan test in order to test the differences of body type among the groups. <Table 16> shows the results. All in all, it was found that the scores of each factor differed significantly depending on regions and years.

The Beijing group scored highest in Factor 1, which means that this group had the highest obesity and horizontal size in relation with circumference, width, depth and weight. The Shanghai groups showed similar obesity and horizontal

<Table 16> Scores of Each Factor and Results of F-test

	region-year Characteristics of factor	2004				2008		F-test	Duncan -test
		Beijing		Shanghai		Shanghai			
		M	SD	M	SD	M	SD		
Factor 1	Obesity and horizontal size of the upper body	0.20	1.07	-1.74	0.96	0.10	10.95	3.59*	a b b
Factor 2	Vertical size of the body	0.79	0.98	-0.72	0.95	0.08	1.01	0.12	
Factor 3	Length of the upper body	0.05	1.00	-.02	0.98	-.02	0.85	0.39	
Factor 4	Shoulder drops and sizes	0.03	0.96	0.24	0.93	-.25	1.00	7.59***	b a c

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

size over time. Thus, the difference of Factor 1 scores was significant between two regions. On the other hand, the Shanghai groups scored higher in Factor 4, which suggests that their shoulders dropped more, being larger.

Upon reviewing the preceding studies about the results of the Factor Analysis to determine the body type factors of adult women⁽⁷⁾⁽⁸⁾⁽⁹⁾, it was confirmed that Factor 1 represented obesity and horizontal size of the body, Factor 2 represented height and depth of the body, and Factor 3 represented the shoulder type. Although the measurement items differed among the studies, the important factors were similar.

IV. Conclusion

This study aimed to provide the Korean apparel companies trying to localize their business in the Chinese markets with some data about Chinese young women's body types useful to the development of the apparel designs fitting the Chinese consumers. To this end, the adult women aged between 19 and 25 living in Beijing, Shanghai and Korea were sampled, and thereby, their body sizes and types were measured. In addition, the young women living in Shanghai were surveyed again 4 years later in an effort to examine the changes of their body sizes and types. This study can be concluded as follows:

As a result of analyzing sample women's body sizes in 2004 and 2008, it was found that the four groups did not show any significant differences of body heights. However, Beijing women showed larger body widths and depths than their Shanghai counterparts. Consequently, Beijing women had larger horizontal body sizes, while Shanghai women had longer legs. Both

Chinese women groups had smaller horizontal body sizes than their Korean counterparts but had larger body depths. In addition, the Chinese women groups had deeper chest and waist but rather flat hips. In other words, the Chinese adult women had rather round chest and waist with flat hips, compared with the Korean women. Furthermore, the Chinese women had their upper body pulled back more. In view of obesity, Beijing and Korean women showed a normal obesity, while Shanghai women were rather slim.

As a result of analyzing factors affecting Chinese women's body types, four factors could be identified. Factor 1 represented 4 body parts related with obesity and horizontal size of the body, Factor 2 represented the vertical size of the body, Factor 3 represented the length of the upper body, and Factor 4 represented shoulder drops and sizes. The scores of Factor 1 and 4 differed significantly among the groups and over time.

All in all, the results of this study confirmed that Korean and Chinese women in the early 20s had similar vertical body sizes but different horizontal body sizes. In addition, the body types were different between Beijing and Shanghai women groups.

This study aimed to analyze the Chinese young women's body sizes and thereby, provide for some basic data useful to the development of the apparel designs fitting the Chinese young consumers will be followed up continuously.

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