Journal of Fashion Business
Vol. 11, No. 6, pp.35~51(2007)

The Wearing Sense of Male Adult Shoes

– Comparison of Common Shoes with Elevated Shoes –

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Abstract

This research was administered in order to know the effects of heels on the foot by comparing the foot environmental characteristics when common shoes and elevated shoes are worn. First, 157 male adults in their 20s through 40s living in Busan were the inquiry subjects to reveal the shoes-wearing reality of adult males. Second, 7 male adults in their early 20s became the subjects for the experiments of wearing common shoes and elevated shoes.

1. Inquiry Results of Shoes-Wearing Reality

Common-shoes wearers were in the order: 20s (43.9%) > 30s (24.8%) > 40s (8.3%). Elevated-shoes wearers were mostly 20s (12.1%), followed by 30s (8.3%) and 40s (2.5%).

Among the wearing effects of elevated shoes were 'looking taller' (66.7%), 'no height complex & more confidence' (30.6%), and 'higher work efficiency' (2.8%). In sum, 97.3% of the male subjects believed in great positive effects by wearing elevated shoes.

2. Shoes-Wearing Experiment Results

In foot skin temperature, significant differences between the two groups were admitted in outer foot a ($p<0.05$) and other areas ($p<0.001$), except in the instep. Elevated-shoes group had bigger skin temperature, while the order of temperature was the instep, the big toe, inner foot a/b/c and outer foot a/b/c.

Significant difference was accepted in total sweat rate ($p<0.05$) and local sweat rate ($p<0.01$). Elevated-shoes group appeared higher in both rates.

Significant difference ($p<0.001$) between the two groups was recognized in fatigue degrees after wearing, whereas significance ($p<0.05$) in elevated-shoes group was approved in fatigue before and after exercise. So elevated-shoes group experienced more fatigue, especially after exercise.

Key Words : common-shoes group, elevated-shoes group, skin temperature, fatigue measurement, total sweat rate, temperature-humidity measurement of shoes

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Ⅰ. Introduction

Feet are one of the most overworked and most neglected parts of body since human beings started waking on foot. They are composed of 52 bones and 100-odd tendons and ligaments, lying below the outer circumference of lower legs and playing a great role in supporting human body and keeping the balance.

The average walking distance of a 60-year-old human being is about 160,000㎞. The pressure each foot feels after walking 1㎞ is 15t or so, spreading toward the heart. That's why feet are called the second heart. Feet-protecting shoes are then the essence of foot health.[1)]

Shoes have a great effect on foot health. Long walking leads to weak or lengthened ligaments and muscles, easy fatigue, and lots of pains in thighs, knees, and shoulders. In severe cases, backache and pedialgia are caused.[2)]

The research on shoes has been mainly for women. These days, however, high-heeled shoes are no longer for females only. Heels are also applied to men's shoes, particularly targeting young males. So foot disorder is recently a hot issue. Thus this study on shoes fitness centered on male shoes with high heels is significance. A main focus here is on the different effects of common shoes and elevated shoes on feet.

The concrete contents of this research are as follows:

1. Analyze the shoes-wearing reality of males through a questionnaire
2. Compare the environmental characteristics of common and elevated shoes thrcugh wearing experiments
3. Reveal the influences of common and elevated shoes on the sense of foot comfort to be used as fundamental data for shoes production

Ⅱ. Research Methods & Contents

1. Inquiry of Shoes-Wearing Reality

1) Subjects & Period

The inquiry subjects were male adults in their 20s through 40s wearing leather shoes. From May 16 through May 23, 2005, 160 copies of a questionnaire were distributed. Except 3 incomplete and unfaithful copies, 157 were used for analysis.

2) Inquiry Contents

The questionnaire for this research was composed in order to know the wearing effects of common shoes and elevated shoes on the feet and body of male adults. Each question item was made by consulting previous researches and concerned references and went through preparatory inquiry for correction and compensation. The inner trust degrees of the completed 39 questionnaire items were 0.81 (Cronbach's alpha).

2. Shoes-Wearing Experiments

1) Experiment Dates & Place

Preparatory experiments were held on June 24~27, 2005 and main experiments were given on July 6~19, 2005 at the Clothing Human Engineering Laboratory in Dong-A University in Busan, Korea. The environment conditions of the laboratory are shown in Table 1.

2) Subjects

According to the 5th Korean Human Body Dimension Materials (Size Korea: 2004), seven healthy subjects in their early 20s were chosen whose foot shapes were measured normal. To prevent the effects of body temperature changes

following different biological rhythms, experiments were administered in the identical time belt.

Table 2 describes the physical characteristics of the 7 experimental subjects, Table 3 physiological characteristics, Table 4 flat-foot characteristics, and Fig. 1 flat-foot measurement method.

<Table 1> Laboratory environment conditions

Environment Conditions	Temperature (℃)	Humidity (%)
Lab Control Room & Lab*	24±1	50±10

* Standard temperature of ASHRAE's indoor environment (comfort with more than 80% of satisfaction)

<Table 2> Physical characteristics of the subjects (n=7)

Unit: cm

Item	Mean		SD	
	Left	Right	Left	Right
Foot length	25.9	25.8	0.5	0.4
Foot width	10.8	10.8	0.5	0.6
Foot circumference	25.7	25.6	1.3	1.3
Instep circumference	25.7	25.7	1.0	0.9
Ankle circumference	23.0	23.1	0.5	0.7
Instep height	6.9	6.8	0.3	0.4
Heel width	6.4	6.6	0.2	0.3
Height	172.8		3.2	
Weight (kg)	72.2		4.5	
Age (years old)	21.9		1.5	

<Table 3> Physiological characteristics of the subjects (n = 7)

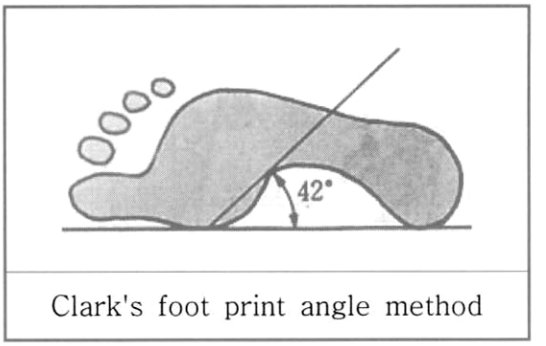
Body Temperature (℃)		Blood Pressure (mmHg)				Pulse (beat/min)	
		Min		Max			
Mean	SD	Mean	SD	Mean	SD	Mean	SD
36.1	0.2	77.4	10.9	121.4	11.9	76.4	4.6

<Table 4> Flat-foot characteristics of the subjects (n = 7)

Unit: °

Item \ Subject	Mean		SD	
	Left	Right	Left	Right
Foot Print Angle*	49.1	46.4	6.9	8.3
Flat-Foot Stage	Normal			

* Clark's foot print angle method: 42° = normal



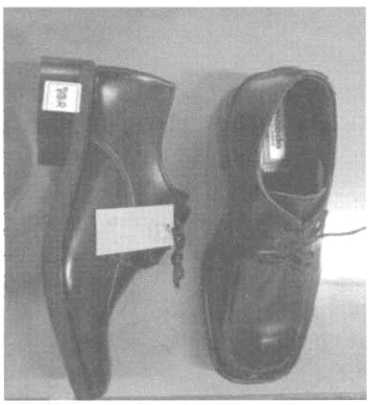
Clark's foot print angle method

<Fig. 1> Flat-foot measurement method

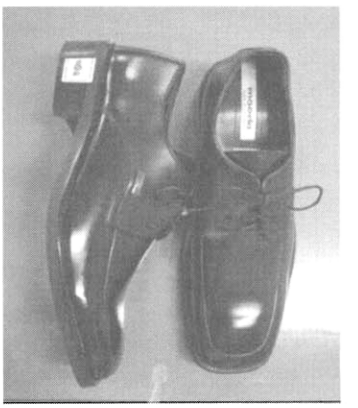
3) Experimental Wearing Conditions

(1) Experimental Shoes

Based on the shoes-wearing reality inquiry, experimental shoes were selected. With 3㎝ (common) and 6㎝ (elevated) heels, 2 pairs of wing tap shoes (general room: 5㎜) were chosen for each kind. Fig. 2 illustrates the shapes of experimental shoes, while Table 5 sums up their characteristics. Seven subjects were received shoes wearing experiments. They wear two kinds of shoes(Common Shoes, Elevated Shoes).



Common Shoes



Elevated Shoes

<Fig. 2> Shapes of experimental shoes

<Table 5> Characteristics of experimental shoes

Item / Experimental	Size (mm)	Heel Height (mm)	Weight (g)		Remarks
			Left	Right	
Shoes 1	265	30	284.5	275.5	Common
Shoes 2		60	280.5	278.5	Elevated
Shoes 3	270	30	328.5	319.0	Common
Shoes 4		60	301.5	306.5	Elevated

(2) Experimental Socks

White business-suit-style socks of cotton 100 % were chosen to eliminate any influence on the experiments. Their characteristics are seen in Table 6.

(3) Experimental Clothes

The Clo value of heat retention toward experimental clothes minimized their influence on the shoes environment. Table 7 displays their characteristics.

4) Measurement Items & Methods

(1) Total Sweat Rate

According to the sweat measurement method (TAMURA, 1989), a precision balance (ID5, Mettler-Toledo AG, Germany, sensitivity: 0.01g) was used to get total sweat rate (ΔW): W_1 (pre-experiment weight) - W_2 (post-experiment weight).

(2) Local Sweat Rate of Foot

Local sweat rate was measured at the center of the sole by way of the commonly-used filtering method (Thmura, 1988). Three filters (4㎝ × 5㎝) were attached to the sole's center and dried in a desiccator at 110℃ for 1 hour before use. The weight was measured by an electronic balance (LIBROR EB-2800, Shimadzu, Japan, sensitivity: 0.001g).

(3) Skin Temperature of Foot

Thermistor data recording device (K730, Takara, Japan) was used to measure the skin temperature in 8 parts of the right foot: toe, instep, a/b/c (outer), and a/b/c (inner).

(4) Temperature-Humidity Measurement of Experimental Shoes

Thermo Recorder (TR-72S, T & D Corporation, Japan) was used to measure the shoes-inside temperature and humidity before and after experiments.

(5) Fatigue Measurement

Flicker (501b, Japan) was the device to measure the degrees of fatigue before the exercise

<Table 6> Characteristics of experimental socks

Item / Sample	Material	Weave method	Weight (kg)	Fabric Density (wale × course/inch)	Depth (mm)	Clo Value
Experimental Socks	Cotton 100%	knitted structure	0.019	43 × 29	0.53	0.09

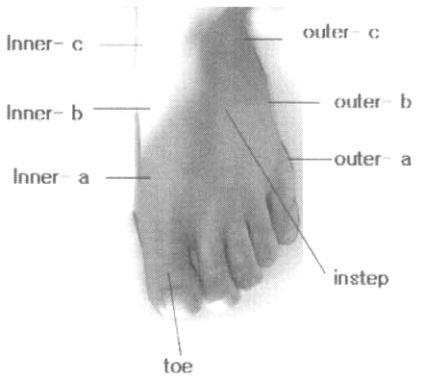
<Table 7> Characteristics of experimental clothes

Item / Sample	Material	Weave method	Weight (kg)	Fabric Density (wale × course/inch)	Depth (mm)	clo Value
Half-Sleeved Shirt	Cotton 100%	knitted structure	0.143	68×44	0.44	0.02
Short Pants	Cotton 100%	Twill	0.249	42×25	0.50	0.25

and the conditions of subjects every 10 minutes after the exercise.

(6) Physiological Reaction

An electronic thermometer (IRT1020, Netherlands) was utilized to measure eardrum temperature, while an electronic tonometer (NA-732, Japan) was employed to know blood pressure and pulse.



<Fig. 3> Measurement points of skin temperature

(7) Psychological Reaction

Psychological reaction was measured by the comfort-sense measures of the Japan Hygiene Engineering Society and the moisture-sense measures of ASHRAE. Table 8 shows the degrees of psychological reaction.

5) Experimental Order

The experiments were proceeded like Fig. 4.

(1) Experimental clothes were placed in constant conditions of temperature and humidity for a week before experiments.

(2) The shoes-inside temperature and humidity as well as the weight of experimental clothes, experimental shoes, and filters were measured.

(3) After a rest for 30 minutes in the control room, the subjects had their physical characteristics measured and wore experimental clothes.

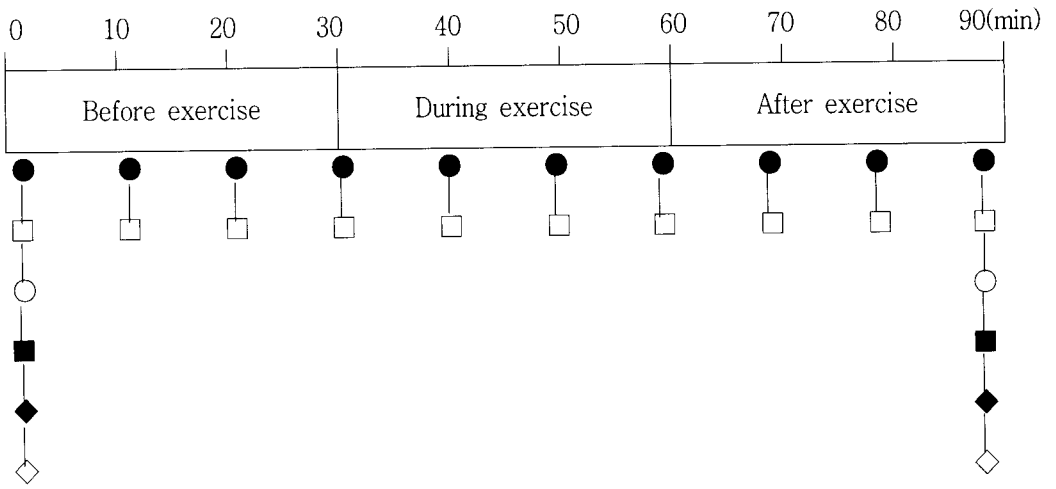
(4) After taking a rest for 30 minutes in the laboratory, the subjects had their bodies and soles attached with sensors and filters. Their skin temperature at rest, physiological responses, and psychological responses were measured before exercise.

(5) The subjects had treadmill exercise (load: 3.4 RMR 90m/min) for 30 minutes. Foot skin temperature during exercise was measured, while their psychological responses were heard every 10 minutes.

(6) After exercise, physiological and psychological responses were measured 4 times every 10 minutes. Also, the shoes-inside temperature and humidity as well as the weight of experimental clothes and experimental shoes were measured.

<Table 8> Degrees of psychological reaction

Sense of Comfort	Sense of Moisture
1. Very uncomfortable	1. Very moist
2. Uncomfortable	2. Moist 3. Slightly moist
3. Slightly comfortable	4. Indifferent 5. Slightly dry
4. Comfortable	6. Dry 7. Very dry



● Foot skin temperature measured

□ Listening to psychological responses

○ Shoes-inside temperature and humidity measured

■ Physiological responses measured

◆ Fatigue degrees measured

◇ Weight of experimental clothes and shoes measured

<Fig. 4> Experimental order

(7) The weight of the subjects were measured after experiments to know total sweat rate, whereas that of the sole-attached filters was measured to reveal local sweat rate.

3. Data Processing & Analysis

The data of this research were processed by SPSS/Win (ver 11.0) according to the following analysis methods:

① The wearing-reality inquiry of common and elevated shoes produced frequency distribution and percentage for each item.

② Paired t-tests were held for the approval of significance in environmental characteristics (total sweat rate, local sweat rate, skin temperature, shoes-inside temperature and humidity, and fatigue degrees), physiological characteristics (body temperature, blood pressure, and pulse), and psychological responses (senses of moisture and comfort).

III. Results & Discussion

1. Inquiry Results of Shoes-Wearing Reality

1) Characteristics of the Inquiry Subjects & Their Wearing Reality of Elevated Shoes

Table 9 displays the characteristics of the

inquiry subjects and their wearing reality of elevated shoes. Their ages were 20s (12.1%) > 30s (8.3%) > 40s (2.5%). Significance ($p<0.01$) by job groups was recognized: professional (12.1%) > office (4.5%) > self-employed (3.2%). Among 157 answerers, 77.1% wore common shoes and 22.9% (36 people) elevated shoes. This number, about 1/5, is thought not small at all.

2) Hopes of Wearing Elevated Shoes by Those Who Wear Common Shoes

Table 10 summarizes the hopes of wearing elevated shoes by those who wear common shoes. As much as 38.0% (46 people) expressed their wishes to wear elevated shoes sometime. Then, more than a half (82/157: 52.2%) of male adults are expected to use elevated shoes. On the contrary, among the reasons of refusing elevated shoes were 'feeling no necessity' (64.0%) and 'expectation of discomfort' (20.0%).

<Table 9> Characteristics of the inquiry subjects & their wearing reality of elevated shoes

Unit: People (cell %)

Contents		Common Shoes	Elevated Shoes	Total
Age	20s	69(43.9)	19(12.1)	88(56.1)
	30s	39(24.8)	13(8.3)	52(33.1)
	40s	13(8.3)	4(2.5)	17(10.8)
	Total	121(77.1)	36(22.9)	157(100.0)
Job	Students	35(22.3)	4(2.5)	39(24.8)
	Office	34(21.7)	7(4.5)	41(26.1)
	Self-Employed	10(6.4)	5(3.2)	15(9.6)
	Officials	2(1.3)	0(0.0)	2(1.3)
	Production	7(4.5)	0(0.0)	7(4.5)
	Professional	24(15.3)	19(12.1)	43(27.4)
	Etc.	9(5.7)	1(0.6)	10(6.4)
	Total	121(77.1)	36(22.9)	157(100.0)

**: $p<0.01$

<Table 10> Hopes of wearing elevated shoes

Contents		Frequency (People)	Percentage (%)
Hope to Wear?	Yes	46	38.0
	No	75	62.0
	Total	121	100.0
Reasons of No Wish	Discomfort expected	15	20.0
	Shy if found wearing	5	6.7
	No necessity of wearing felt	48	64.0
	Poor activity	5	6.7
	Etc.	2	2.7
	Total	75	100.0

3) Shoes-Wearing Discomfort & Its Reasons

Table 11 shows the sense of discomfort and its reasons. Common-shoes wearers (51.2%) felt it less than elevated-shoes ones (83.0%). Main reasons of feeling discomfort were 'hard soles' (29.6%), 'new shoes' (13.3%), 'tough materials' (10.2%), and 'too tight shoes' (10.2%) for the former; 'improper heel height' (11.2%), 'hard soles' (6.1%), and 'new shoes' (6.1%) for the latter.

4) Heel Height of Elevated Shoes & Their Wearing Effects

<Table 11> Shoes-wearing discomfort & its reasons

Contents		Common Shoes	Elevated Shoes
Sense of Discomfort?	Yes	68 (51.2)	30 (83.0)
	No	53 (43.8)	6 (17.0)
	Total	121 (100.0)	36 (100.0)
Reasons of Discomfort	Improper heel height	3 (3.1)	11 (11.2)
	Tough materials	10 (10.2)	3 (3.1)
	Hard soles	29 (29.6)	6 (6.1)
	Improper dimensions	1 (1.0)	0 (0.0)
	Too low insteps	0 (0.0)	3 (3.1)
	Too narrow shoe toes	1 (1.0)	0 (0.0)
	Too tight shoes	10 (10.2)	1 (1.0)
	New shoes	13 (13.3)	6 (6.1)
	Etc.	1 (1.0)	0 (0.0)
	Total	68 (69.4)	30 (30.6)

<Table 12> Heel height of elevated shoes & their wearing effects

Division		Frequency (People)	Percentage (%)
Heel Height	3cm~5cm	15	41.7
	5cm~6cm	16	44.4
	6cm~8cm	3	8.3
	8cm~10cm	2	5.6
	Total	36	100.0
Wearing Effects	Looking taller	24	66.7
	No height complex & more confidence	11	30.6
	Higher work efficiency	1	2.8
	Total	36	100.0
Wearing Period	Below 1 year	3	8.3
	1~2 years	16	44.4
	2~3 years	11	30.6
	3~4 years	2	5.6
	Above 4 years	4	11.1
	Total	36	100.0
Continue to Wear?	Yes	32	88.9
	No	4	11.1
	Total	36	100.0

Table 12 shows the survey results about the heel height of elevated shoes and their wearing effects. The height was in the order of 5㎝~6㎝ (44.4%), 3~5㎝ (41.7%), and 6~8㎝ (8.3%). So, more than a half of adult males were found wearing elevated shoes with the height of above 5㎝, about the size of women's high-heeled shoes.

Principal effects of wearing elevated shoes were 'looking taller' (66.7%) and 'no height complex and more confidence' (30.6%). In other words, 97.3% of the surveyed males believed that elevated shoes could bring about big effects.

The shoes-wearing period was 1~2 years (44.4%), 2~3 years (30.6%), and above 4 years (11.1%). As to the question of continuing to wear elevated shoes, 88.9% nodded. The number of elevated-shoes users has sharply increased in recent 2~3 years, and most of them hope to continue to wear heeled shoes.

2. Results of Shoes-Wearing Experiments

1) Foot Skin Temperature

Table 13 and Fig. 5-1, 5-2 explain the t-test results of foot skin temperature in shoes environment.

According to the above table, significant differences were admitted in outer foot a ($p<0.05$) and other areas ($p<0.001$), except in the instep, which had the highest temperature followed by the big toe, inner foot a/b/c and outer foot a/b/c.

As Fig. 5-1, 5-2, the great toe gradually rose during exercise and retained the highest skin temperature when the 30-minute exercise was done. After exercise, the skin temperature of both shoes dropped a little but stayed still high. The instep had small skin temperature differences between both shoes, and turned the highest at the end of exercise. In particular, elevated shoes showed an increase of skin temperature in 30 minutes after exercise, while common shoes tended to go down little by little.

2) Temperature-Humidity Measurement Results Before and After Wearing Shoes

Table 14 depicts the t-test results of temperature-humidity differences before and after wearing experimental shoes. Significance ($p<0.001$) was seen in temperature only. This is thought to be the result of the fact that elevated shoes wearers had the distribution of higher skin temperature than common shoes users.

<Table 13> T-test results of foot skin temperature according to shoes

Unit: ℃

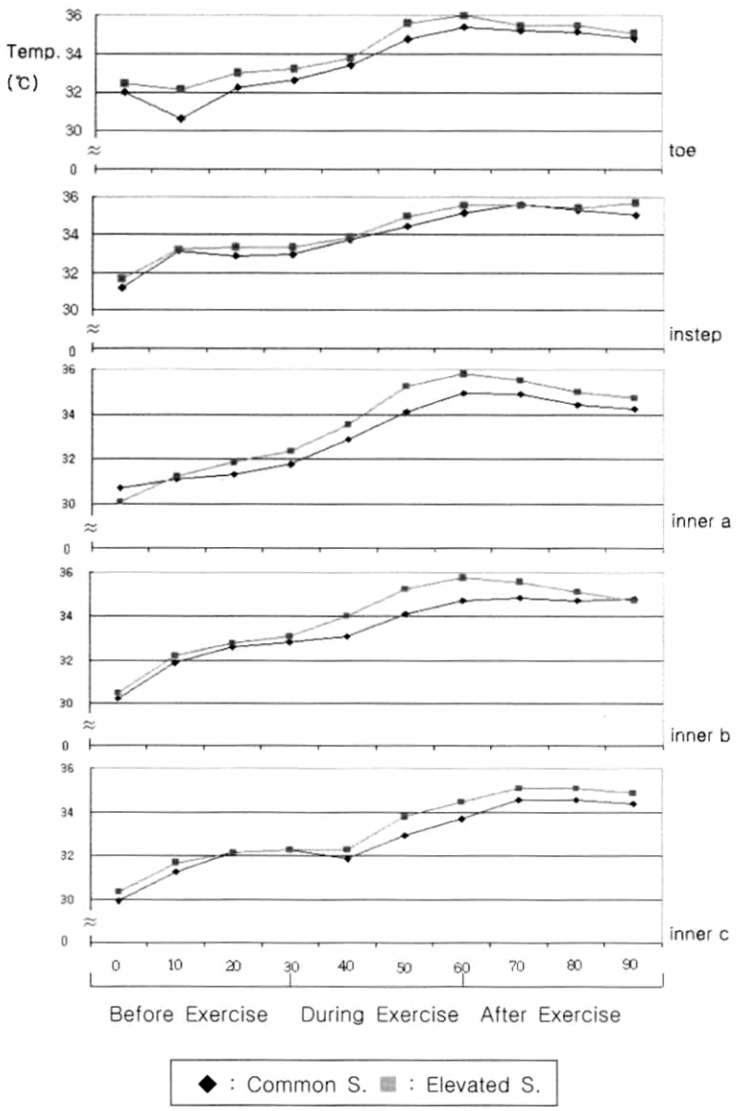
Measurement Areas	Common Shoes		Elevated Shoes		t-value
	Mean	SD	Mean	SD	
Big toe	33.79	2.61	34.41	2.47	-4.322***
Instep	34.24	1.69	34.41	2.00	-1.695
Inner foot a	33.24	2.44	33.88	2.18	-5.597***
Inner foot b	33.71	1.80	34.31	1.75	-6.921***
Inner foot c	33.06	2.05	33.49	2.08	-3.821***
Outer foot a	32.38	2.51	32.65	2.44	-2.008*
Outer foot b	32.26	2.49	32.81	2.23	-4.417***
Outer foot c	32.61	2.77	33.12	2.51	-3.583***

*: $p < 0.05$ ***: $p < 0.001$

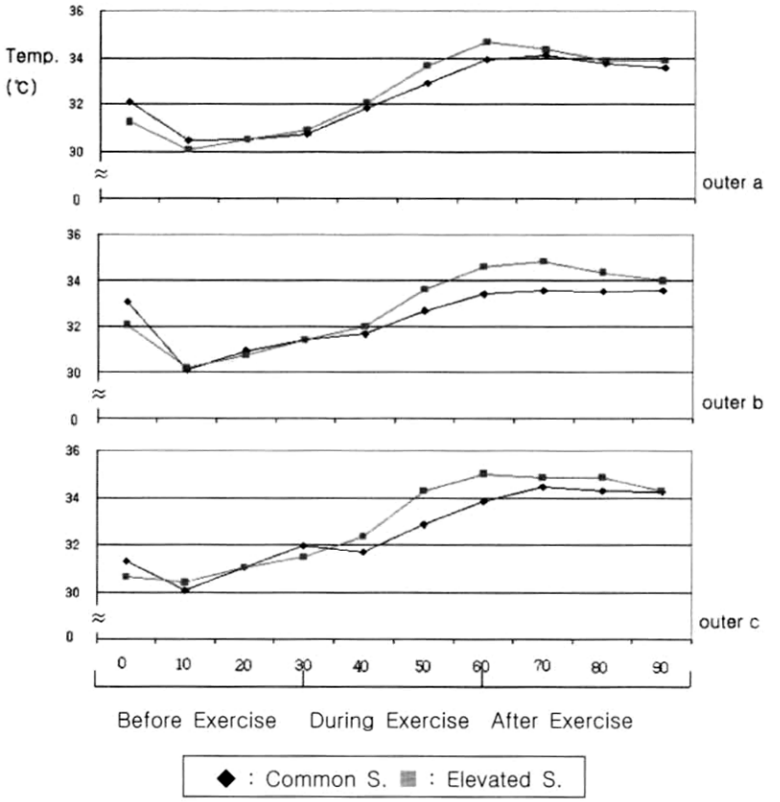
<Table 14> T-test results of temperature-humidity differences before and after experiments

Division	Common Shoes		Elevated Shoes		t-value
	Mean	SD	Mean	SD	
Temperature (℃) *	1.11	0.39	1.70	0.51	-4.536***
Humidity (%)**	18.57	5.70	21.78	3.82	-1.658

*: Temp. difference (After - before) **: Humidity difference (After - before)
*** : p<0.001



<Fig. 5-1> Skin temperature changes in each part



<Fig. 5-2> Skin temperature changes in each part

3) Sweat Rate

Table 15 digests the t-test results of total sweat rate and local sweat rate of the two kinds of shoes. Table 15 depicts the changes of sweat rates. Significance was recognized in both total sweat rate ($p<0.05$) and local sweat rate ($p<0.01$) of the two shoes. In addition, the wearersof elevated shoes produced more sweating than those of common shoes.

4) Fatigue

Table 16 reveals the fatigue t-test results according to the wearing of common shoes and elevated shoes, Table 17 the fatigue t-test results before and after exercise

Higher fatigue degrees were noticed in elevated shoes (significance: $p<0.05$), especially more after exercise than before exercise. However, common shoes didn't hold any difference before and after exercise. A significant difference ($p<0.001$) was seen between the wearers of the two kinds of shoes.

5) Physiological Reaction

Fig. 6-1, 6-2 illustrate the physiological reaction changes following the wearing of common and elevated shoes. Body temperature turned higher in elevated shoes than in common shoes. Elevated shoes revealed the highest

temperature after 20 minutes of exercise, and showed the before-exercise temperature at 30 minutes after exercise. On the contrary, in the case of common shoes, the lowest temperature was shown at 10 minutes after exercise, and the before-exercise temperature at 30 minutes.

Pulse also went higher in elevated shoes. Both shoes had higher heart rates after exercise. In particular, elevated shoes increased rapidly and decreased to remain constant. Common shoes grew up a little and stayed constant.

In maximum blood pressure, common shoes became higher except 30 minutes before exercise, but below 130 within the normal range of blood pressure. While common shoes showed before-exercise pressure at 30 minutes after exercise, elevated shoes maintained lower pressure at 30 minutes after exercise than 30 minutes before exercise. In minimum blood pressure, common shoes turned higher except 20 minutes before exercise and 30 minutes after exercise, but below 85 within the normal range.

6) Psychological Reaction

Table 18 condenses the t-test results of the senses of comfort and moisture resulting from the wearing of common and elevated shoes, while Fig. 7 pinpoints psychological reaction changes.

Significance difference ($p<0.05$) was noticed in the sense of moisture around the foot. The elevated shoes wearers are thought to feel more humidity owing to the heel's pressure and lacking room in the shoes.

As Fig. 7 shows, the foot and body were all comfortable before exercise, but the sense of

<Table 15> T-test results of total/local sweat rates according to shoes

Unit: mg

Division	Common Shoes		Elevated Shoes		t-value
	Mean	SD	Mean	SD	
Total Sweat Rate	424.3	286.1	558.6	294.5	-3.608*
Local Sweat Rate	57.3	14.4	67.2	13.4	-3.375**

*: $p < 0.05$ **: $p < 0.01$

<Table 16> Fatigue t-test results according to shoes

Unit: Hz

Division	Common Shoes		Elevated Shoes		t-value
	Mean	SD	Mean	SD	
Fatigue Degrees	33.32	2.71	34.07	2.94	-4.237***

***: $p < 0.001$

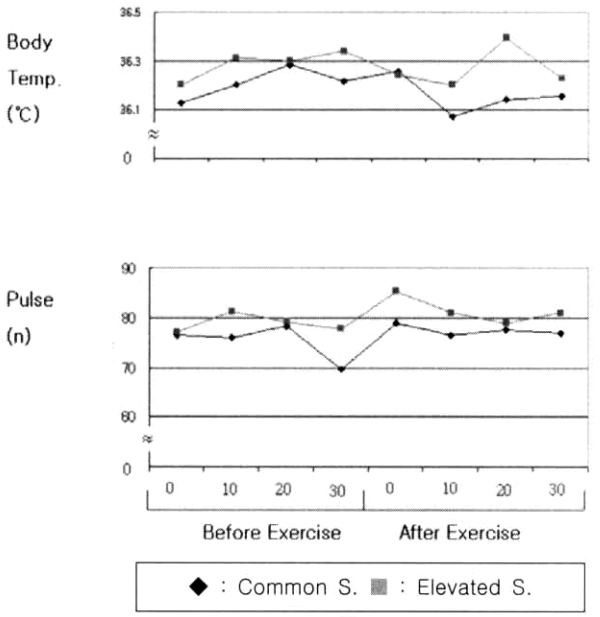
<Table 17> Fatigue t-test results before and after exercise

Unit: Hz

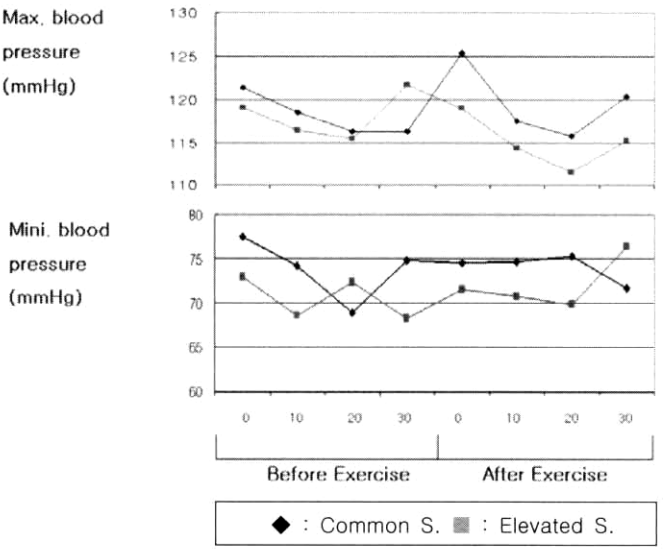
Division	Before Exercise		After Exercise		t-value
	Mean	SD	Mean	SD	
Common Shoes	33.25	2.52	33.39	2.94	-0.701
Elevated Shoes	33.79	2.69	34.36	3.20	-2.248*

* : $p < 0.05$

comfort went lower during exercise. In particular, elevated shoes triggered more discomfort. Both shoes groups started at a little dry state (body) and an indifferent state (foot). During exercise, however, common shoes were changed into 'slightly moist' and elevated shoes 'moist.' That's why elevated shoes wearers felt more dampness.



<Fig. 6-1> Body temperature and Pulse reaction changes



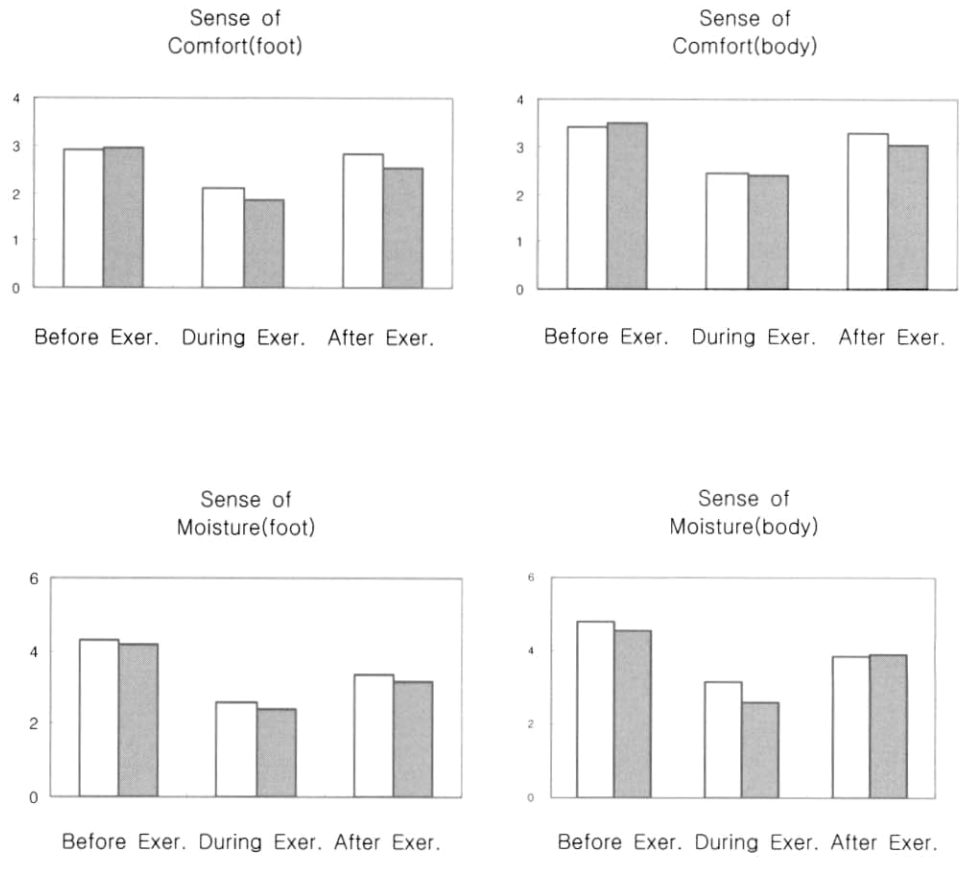
<Fig. 6-2> Maximum blood pressure and Minimum blood pressure reaction changes

<Table 18> T-test results of psychological reaction

Unit: Hz

Division		Common Shoes		Elevated Shoes		t-value
		Mean	SD	Mean	SD	
Sense of Comfort	Foot	3.07	0.71	3.03	0.70	0.597
	Body	2.63	0.66	2.50	0.65	1.693
Sense of Moisture	Foot	4.03	1.09	3.77	1.21	2.543*
	Body	3.51	1.24	3.33	1.24	1.686

*p < 0.05



<Fig. 7> Psychological reaction changes

IV. Conclusion & Suggestion

This research was administered in order to know the effects of heels on the foot by comparing the foot environmental characteristics when common shoes and elevated shoes are worn. First, 157 male adults in their 20s through 40s living in Busan were the inquiry subjects to reveal the shoes-wearing reality of adult males. Second, 7 male adults in their early 20s became the subjects for the experiments of wearing common shoes and elevated shoes.

1. Inquiry Results of Shoes-Wearing Reality

(1) Common-shoes wearers were in the order: 20s (43.9%) > 30s (24.8%) > 40s (8.3%). Elevated-shoes wearers were mostly 20s (12.1%), followed by 30s (8.3%) and 40s (2.5%). Significance ($p<0.01$) was seen among the wearers' job groups: students (22.3%), office (21.7%), and professional (15.3%) for Common-shoes; professional (12.1%), office (4.5%), and self-employed (3.2%) for Elevated-shoes.

(2) The inquiry of the shoes-wearing reality revealed that 22.9% (36 men) of the subjects were wearing elevated shoes and that 38.0% (46 men) of Common-shoes were willing to wear elevated shoes sometime. In all, 52.2% (82 people) of 157 subjects were for elevated shoes.

(3) Elevated-shoes (83.0%) felt more uncomfortable than Common-shoes (51.2%).

(4) A significant difference ($P<0.001$) appeared between the groups in the reasons of discomfort. The greatest reason was 'hard soles' (42.6%) for Common-shoes and 'improper heel height' (36.7%) for Elevated-shoes.

(5) Elevated-shoes favored the heel height of 5㎝~6㎝ (44.4%), 3~5㎝ (41.7%), 6~8㎝ (8.3%), and 8~10㎝ (5.6%). Thus 58.3% preferred the height of 5㎝ and more.

(6) Among the wearing effects of elevated shoes were 'looking taller' (66.7%), 'no height complex & more confidence' (30.6%), and 'higher work efficiency' (2.8%). In sum, 97.3% of the male subjects believed in great positive effects by wearing elevated shoes.

As above findings tell, even though common shoes are worn more at present, elevated shoes are likely to be worn more and more in the future.

2. Shoes-Wearing Experiment Results

(1) In foot skin temperature, significant differences between the two groups were admitted in outer foot a ($p<0.05$) and other areas ($p<0.001$), except in the instep. Elevated shoes had bigger skin temperature, while the order of temperature was the instep, the big toe, inner foot a/b/c and outer foot a/b/c.

(2) Significant difference ($p<0.001$) was revealed in the shoes-inside temperature only, where Elevated-shoes turned higher than Common-shoes.

(3) Significant difference was accepted in total sweat rate ($p<0.05$) and local sweat rate ($p<0.01$). Elevated-shoes appeared higher in both rates.

(4) Significant difference ($p<0.001$) between Common-shoes and Elevated-shoes was recognized in fatigue degrees after wearing, whereas significance ($p<0.05$) in Elevated-shoes was approved in fatigue before and after exercise. So Elevated-shoes experienced more

fatigue, especially after exercise.

(5) In physiological responses, Elevated-shoes was higher in pulse, but there was no clear group difference in body temperature and blood pressure. In psychological responses, significance ($p<0.01$) between the groups was granted in the sense of moisture. That is, wearing elevated shoes caused more sense of humidity.

In conclusion, wearing elevated shoes, compared with common shoes, brought about high foot skin temperature, high temperature and humidity inside shoes, and considerable effects on sweat rates and fatigue degrees.

These results seem to present some problems in the aspect of foot comfort as the culture of wearing elevated shoes is expected to spread among the male consumers. Therefore, for the production of no-discomfort elevated shoes, there should be the development of proper models and materials for elevated shoes only.

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Received 20 July 2007, Accepted 20 September 2007.