PREFERENCE TEST OF THE WEIGHTED SHOES

Hung-Hsun Lin, Hsuan-Yu Lu and Hung-Ta Chiu

Institute of Physical Education, Health and Leisure Studies, National Cheng Kung University, Tainan, Taiwan

The purpose of this study was to use paired comparison approach to test the weighted shoe preference of the subjects. Forty subjects were recruited to put on five different weighted shoes and choose the preferred one after completing four paired comparisons. During the test, subjects were blind of any information from the shoes. The results showed that thirty-two (80%) out of the forty subjects preferred Shoe D or E, which centre of mass was close to the rear end of the shoe. Significant difference was found in shoe preference between the males and females (χ^2_4=10.500, p=.033), while was not found between the lighters and heaviers (χ^2_4=5.583, p=.233). The mechanism of the gender effect on the preference decision are unclear. The results of the weighted shoe preference test could be applied to athlete training or rehabilitation shoe design to be comfortable for the users.

KEY WORDS: centre of mass, comfort perception, paired comparison

INTRODUCTION: A lot of studies have used different methods, like visual analogue scales (VAS) or preference test, to assess the subjective comfort perception of running shoes (Kong & Bagdon, 2009; Lam, Sterzing & Cheung, 2011; Mündermann, Nigg, Stefanyshyn, & Humble, 2002). Compared to test with VAS, shoe preference test could simulate the real purchase situation. In a study by Kong and Bagdon (2009), shoe preference varied among individuals and was influenced by the sex. The result showed that the females were more likely to prefer the lightweight shoes, while the males preferred the shoes with cushioning or stability.

Shoe mass has been an important characteristic for the running shoe. Although the tendency of the running shoe design becomes lighter and lighter, weight of some footwears in casual or in occupational always are heavier than commercial running shoes. However, there has been few studies to examine the comfort of heavier shoes. A study of preference test for weighted shoes (Huang, Deng & Chiu, 2014) revealed that more male subjects preferred the shoes of which the weight added on the rear end. However, half of the femal subjects preferred the shoes that the weight added equally on the front and rear end. In the previous studies, the subjects should make the preference dicision aomg three shoe models that perhaps confused the final decicion of the subject. Therefore, the purpose of this study was to carry out paired comparison approach to test the weighted shoe preference of the subjects.

METHODS: Forty subjects (Table 1) provided informed consent to participate in this study, which was approved by Human Research Ethics Committee in National Cheng Kung University. All of the subjects were free of lower extremity injury or pain within the testing period. Different weight of curved metal blocks (weight 50,100, 150 and 200 g) were added on the commercial canvas shoes (New Buffalo Inc, Taiwan) by screwing them into the front or rear part of the shoe sole (Figure 1). Five different weighted shoe models (Table 2), with the same total additional weight of 200 g, were used in this study.

Table 1
Physical Characteristics (mean±sd) of the Forty Subjects

	Males (n=20)	Females (n=20)	p Value
Height (cm)	172.1±4.0	163.7±2.9	.225
Mass (kg)	67.4±5.1	57.0±6.1	.604

Figure 1: Shoe E of which with a curved metal block of 200 grams screwed in the rear end.

Table 2
Five Different Weighted Shoes of which with Different Weight (unit: g) at the Front or Rear End

Additional weight	A	B	C	D	E
At the front end	200	150	100	50	0
At the rear end	0	50	100	150	200

After recorded the physical characteristics, the subjects wore a laboratory goggle (Figure 2) taped at the bottom so they could see in all direction, but couldn't see the weighted shoes. The experimenter helped the subjects put on the shoes and tie the shoe to their preference. Each subject had to walk along a 10 m long of walkway in the five weighted shoe models. All subjects put the same socks on to eliminate sock influence on comfort perception. Firstly, the subject tried on Shoe A and Shoe E randomly, then chose the preferred one based on subjective feeling of comfort. If the subject has chosen Shoe A, the Shoe A and Shoe D would be given in the next comparison, otherwise the Shoe B and Shoe E would be given. Each subject should complete four preference decisions and then determine the final preferred one in the five weighted shoes (Figure 3). χ^2 tests were used to detect the difference in shoe preference between the males and females, and the lighters (< 64 kg) and heaviers (≥ 64 kg). Statistical significance was set at $p < .05$.

Figure 2: The goggle taped at the bottom avoids the subject looking in the downward direction.

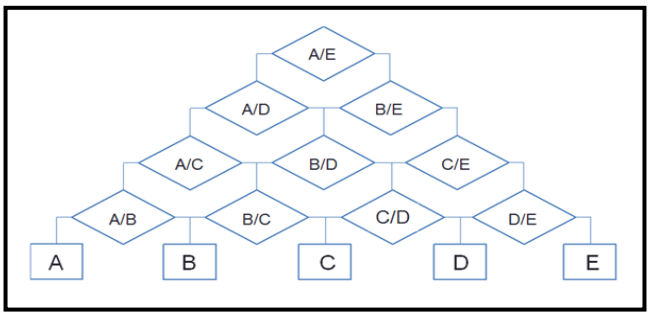

Figure 3: Flow chart of the shoe preference test protocol in this study.

RESULTS: Thirty-two (80%) out of the forty subjects preferred Shoe D or E. All the male subjects peferred the shoe D or E, while the female subjects had not obviously preference

tendency (Table 4). Figure 4 and Figure 5 show the preference decisions made in each paired comparison by the male and female subjects, respectively. Significant Difference was found in shoes preference between the males and females (χ^2_4=10.500, p=.033), while was not found between the lighters and heaviers (χ^2_4=5.583, p=.233).

Table 4
Final Shoe Preference for the Groups, expressed as the number (percentage).

Groups	Shoe A	Shoe B	Shoe C	Shoe D	Shoe E
Male (n=20)	0(0)	0(0)	0(0)	9(45)	11(55)
Female (n=20)	3(15)	1(5)	4(20)	7(35)	5(25)
Lighter (n=20)	1(5)	1(5)	3(15)	10(50)	5(25)
Heavier (n=20)	2(10)	0(0)	1(5)	6(30)	11(55)
All (n=40)	3(7.5)	1(2.5)	4(10)	16(40)	16(40)

Note: The subject which body mass < 64kg was classified into the lighter group. The one which body mass ≥ 64kg was the heavier group.

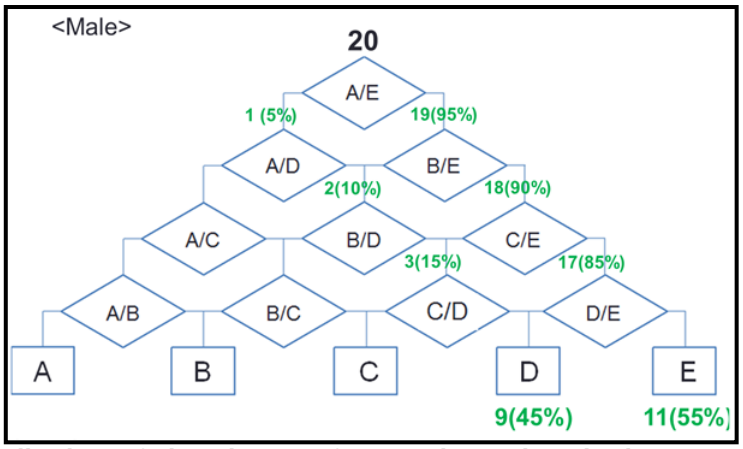

Figure 4: The distribution of the shoe preference in each paired comparison for the male subjects, expressed as number (percentage).

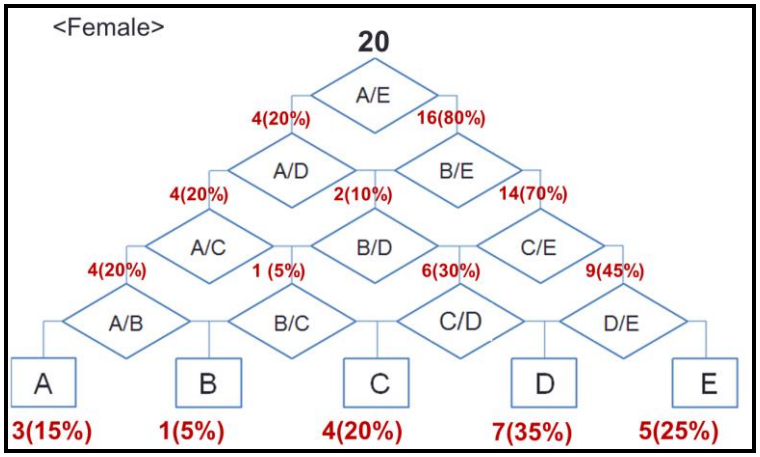

Figure 5: The distribution of the shoe preference in each paired comparison for the female subjects, expressed as number (percentage).

DISCUSSION: This study used the paired comparison approach to test the weighted shoe preference. The results showed that most of the subjects preferred the Shoe D or E, which centre of mass (COM) is at the rearer position of the shoe than the unweighted shoe. In this study, COM position of weighted Shoe C is similar to that of the unweighted shoe. This indicated that most of subjects seemed to prefer the weighted shoe which COM position is at

the rear region. Especially, all the male subjects preferred the shoes which COM position are close to the rear end. The significant shoe preference difference between the males and females in this study also was found in the study of Huang, Deng and Chiu (2014). However, the gender effect on the shoe preference has been unclear. Siginificant difference did not occur between the lighters and heaviers in this study. Therefore, the body weight seemed to be not a significant factor to affect the final shoe preference.

CONCLUSION: From the preference test of the five weighted shoe models by paired comparison approach, most of the subjects have perferred the shoes which centers of mass are colse to the rear end. The shoe preference has been different siginificantly between the males and females. All the male subject peferred the shoes of which the weight added on the rear end, while the females did not. The mechanism of the gender effect on the preference decision are unclear. The results of the weighted shoe preference test could be applied to athlete training or rehabilitation shoes design to be comfortable for the users.

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