TEST-RETEST RELIABILITY OF PAIRED PREFERENCE TEST FOR THE WEIGHTED SHOES

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The purpose of this study was to examine the test-retest reliability of paired preference test for the weighted shoes. Forty participants were recruited and instructed to put on the weighted shoes and choose the preferred one after completing four paired comparisons. During the tests, participants were blind of any information from the shoes. All the participants were invited to repeat the same procedure one week after the first session. The results in first session showed that thirty-two (80%) out of the forty participants preferred Shoe D or E, which centre of mass was close to the rear end of the shoe. The greater intra-class correlation coefficient (ICC=0.81) represents the perfect test-retest reliability of the paired preference test. The test protocol designed in this study could apparently reduce the numbers of the paired comparison under the characteristic of the testing shoe varied systematically, for example the weighted shoes used in this study.

KEY WORDS: reliability, comfort perception, paired comparison, weighted shoe

INTRODUCTION: To assess the subjective comfort perception of running shoes has been widely studied in the field of footwear science with visual analogue scales (VASs) or preference test (Kong & Bagdon, 2010; Lam, Sterzing & Cheung, 2011; Mündermann, Nigg, Stefanyshyn, & Humble, 2002). Compared with VAS assessment, shoe preference test that could simulate the real purchase situation showed that the females were more likely to prefer the lightweight shoes, while the males preferred the shoes with cushioning or stability (Kong and Bagdon, 2010). A study of preference test among three pairs of weighted shoes (Huang, Deng & Chiu, 2014) revealed that more participants preferred the shoes of which the weight added on the rear end and there was no different shoe preference distribution between the males and the females. Another study (Lin, Lu & Chiu, 2015) involved the preference test of different five pairs of weighted shoes suggested that difference exactly existed between the males and females with paired comparison approach. The paired preferene test seemed to has been a valid approach to assess the preference among a large amount of shoes models, for example more than five pairs of shoes. Based on the above studies about weighted shoes, most participants have preferred the shoes of which the weight added on the rear end. However, the relibility of paired preference test has been unclear. Therefore, the purpose of this study was to evaluate the test-retest reliablity of paired preference test of weighted shoes.

METHODS: This study was approved by Human Research Ethics Committee in National Cheng Kung University. Written informed consent was obtained from the participant prior to the test. Forty university students (Table1) were recruited in the study. All participants were free of lower extremity injury or pain within the testing period. Curved metal blocks (weight 50,100, 150 and 200 g) were adhensive onto the front or rear of the soles of the commercial canvas shoe (New Buffalo Inc, Taiwan) with the silicon glue and fasten with screws inseparably (Figure 2). Five weighted shoe models, that the total added weight was the same, with different added weight distribution (Table 2) were used in the study.

The participant wore a laboratory goggle (Figure 1) taped at the bottom so could see in all direction, but couldn't see the weighted shoes. The experimenter helped the participant to wear the shoe during the whole testing session. For each paired comparison, the participant had to walk around a 10 m long of straight walkway for a while wearing one of the two pairs of weighted shoe randomly provided by the experimenter, then repeated with the second pair

of shoe. The participant was asked to choose the prefer one between the two pairs of shoes until he or she could exactly percept the properties of two weighted shoes. To eliminate sock influence on comfort perception, participants put on the same socks. Each participant should complete four preference decisions and then determine the final preferred one among the five weighted shoes.

Firstly, the participants wear Shoe A and Shoe E, then choose the preferred one based on their feeling of comfort. If the participant preferred Shoe A, the Shoe A and Shoe D would be given in the next comparison, otherwise the Shoe B and Shoe E would be provided. Flow chart of the shoe preference test protocol is showed in Figure 3. To assess the test-retest reliability, all the participants were invited to repeat the same procedure one week after the first session and finally chose the preferred weighted shoe again.

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

	Males (n=20)	Females (n=20)	p Value
Age (years)	22.0±2.5	21.4±1.9	.249
Height (cm)	173.6±3.1	161.3±3.8	.379
Body mass (kg)	68.0±8.5	55.6±4.2	.139
Foot size (UK size)	8,9	6	N/A

Table 2
Five Different Weighted Shoes of which with Different Weight (unit: g) added 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

Each of the preferred weighted shoe was scored from 1 to 5 (1= Shoe A, 2= Shoe B, 3= Shoe C, 4= Shoe D and 5= Shoe E) in order to calculate the Intra-class correlation coefficients (ICCs) of the scores obtained from the two preference tests. Reliability was considered as slight (>0.0 to ≤0.2), fair (>0.2 to≤0.4), moderate (>0.4 to ≤0.6), substantial (>0.6 to ≤0.8) and almost perfect (>0.8 to ≤1.0) according to Altman (1991) classifications. From the data of the first session, χ^2 tests were used to detect the difference in shoe preference between the males and females. Statistical significance was set at $p < .05$.

Figure 1: The goggle taped at the bottom avoids the participant looking in the downward direction.

Figure 2: Weighted shoes A、B、C、D and E.

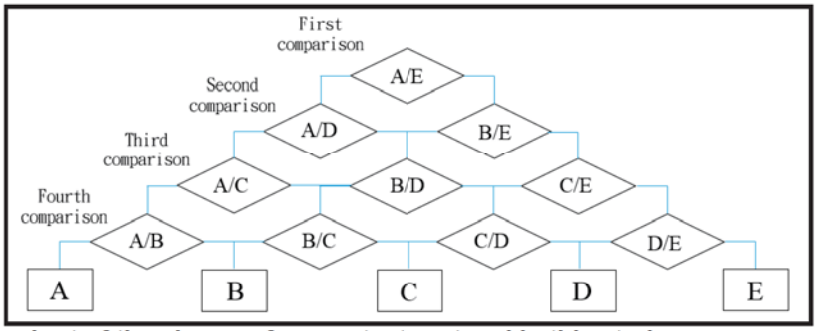

Figure 3: Flow chart of the shoe preference test protocol in this study.

RESULTS: Thirty-two (80%) out of the forty participants preferred Shoe D or E (Table 4). The greater intra-class correlation coefficient (ICC>0.8) of the score obtained from the preferred weighted shoe model was found between the test and retest session. Twenty-nine of (72.5%) of the forty participants made the same preference among the five weighted shoes in the re-test session. Of the five males changed their preferences, two male participant differed their chose at the third comparison, and four at the fourth one. Of the six females differed their final preference, two changed the decision at their second comparison that is earlier than the male participants.

Figure 4 and Figure 5 show the preference decisions made in each paired comparison in the first test session by the male and female participants, respectively. There was no significant difference in shoes preference between the males and females (χ_4^2=2.551, p=.636).

Table 4
Shoe Preference for the males and females in first test and retest session, expressed as the number of person.

Groups	Shoe A	Shoe B	Shoe C	Shoe D	Shoe E
Males (n=20)	1	1	3	7	8
Females (n=20)	0	0	3	6	11
All (n=40)	1	1	6	13	19
Retest of all (n=40)	1	0	3	18	18

DISCUSSION: The greater intra-class correlation coefficient (ICC>0.8) represents the perfect test-retest reliability of the paired preference test. VASs have been suggested to be a reliable measure to assess shoe comfort during running (ündermann, Nigg, Stefanyshyn, & Humble, 2002; Kong, Lim, Ding & Sterzing, 2015). Due to rating the comfort feeling after wearing all the testing shoes, the VAS score given by the participant would be affected under a large number of testing shoe or no control shoe condition. In preference test, participants are asked to indicate their most like one instead of rating. Compared to giving score by VASs, the procedure of preference tests appear simple and mimic the real purchase condition in the shoe stores. The paired preference tests designed in this study comprise several paired comparison, for example four comparisons for the five testing shoe in this study, and seem to solve the problem encountered in VASs assessment. However, a large number of testing shoes certainly increases the numbers of the paired comparison that would spent longer test time to complete the test. Participants wear two different shoe models simultaneously, one on right foot and another one on left foot, might save the testing time (Kong, Lim, Ding & Sterzing, 2015). The so called “head-to-head” comparison is perhaps an alternative method to assess the shoe comfort; nevertheless, it is not adequate for testing the comfort preference of the weighted shoe by wearing different weighted shoe on each foot simultaneously. In present study, the magnitude of weight was added systematically on the front or rear of the testing shoe. The designed protocol in this study could reduce the paired comparison to four times for completing the preference test of the five shoe models.

In retest session, while most participants preferred the same shoe, still eleven participants differed their final preferred shoes. It was worth to mention that only three participants apparently changed their preference shoe models, who preferred Shoe C firstly, but changing their preference to Shoe E or vice versa. The results of the retest session showed that most participants maintained the same decision or changed to prefer the shoes which centre of mass were only shift slightly.

In the paired preference test of weighted shoes from the study of Lin et al.(2015), most participants perferred the shoes which centers of mass are colse to the rear end. The same prefernce tendency was found in our study. Interestingly, the few participants liked the front-weighted shoe (Shoe A or B) most seemed to used to wear heavier footwear, such as boots or work shoes. In addition, the significiant difference for the weighted shoe preference between the males and females was not found in the present study. Both of the two studies recruited forty participants, the fewer perhaps led to the different statistical results for the preference distribution between the male and females.

CONCLUSION: In conclusion, the paired preference test seems to have been a reliable method to assess the comfort of weighted shoe. The test protocol designed in this study could apparently reduce the numbers of the paired comparison under the characteristic of the testing shoe varied systematically, for example the weighted shoes used in this study. There was no significant difference in shoes preference between the males and females. The different result to the finding of the past study could be attributed to the few participants recruited. Future research should recruite more participants to reduce the effect of the individual characteristics, such as the shoe wearing habit, on detection of the different preference between the males and females.

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