Shoe Preference Based on Subjective Comfort for Walking and Running

Pui Wah Kong, PhD*
Miranda Bagdon, BS*

Background: Subjective comfort of footwear is important for shoe and orthosis design. This study compared shoe preferences between walking and running, using subjective comfort as an outcome tool.

Methods: Forty-one participants walked and ran 20 times each along a runway in three types of footwear (cushioning, lightweight, and stability) and chose the model that they preferred most for walking and running separately based on subjective comfort.

Results: More participants preferred the cushioning model (walking, 34%; running, 41%) or the lightweight model (walking, 44%; running, 41%) over the stability model (walking, 22%; running, 17%). χ² tests revealed no differences between walking and running, runners and nonrunners, and lighter and heavier individuals. Women were more likely (odds ratio = 4.09) to prefer the lightweight model, whereas men preferred the cushioning (odds ratio = 2.05) and stability (odds ratio = 3.19) models. Most participants (71%) chose the same model for both activities.

Conclusions: Shoe preference varies among individuals and is influenced by sex. Most people feel comfortable walking and running in the same shoe model. (J Am Podiatr Med Assoc 100(6): 456-462, 2010)
preferences based on subjective comfort between walking and running. The effects of sex, running experience, and body mass on shoe preference were also explored. Previous studies\textsuperscript{2,4-6} investigating subjective comfort in footwear often used numerical scales to measure comfort level. The strength of this method is that it allows quantitative comparison and that a large number of shoes can be tested in a relatively short time. In practice, however, individuals are unlikely to use such scales to rate different shoes and then make a final decision based on the ranking of the shoes. Instead, people tend to try on several pairs of shoes and then choose only one pair that they prefer the most. The present study, therefore, takes this approach to simulate an actual footwear purchase experience, asking participants to choose one of three pairs of shoes as their preferred model.

**Methods**

Forty-one participants (Table 1) provided informed consent to participate in this study, which was approved by the institutional review board of the University of Texas at El Paso. Each participant filled out a questionnaire about demographics, medical histories, and physical activity patterns. All of the participants were free of recent lower-extremity injury or pain. No participant wore orthoses or other corrective devices.

Three types of footwear designed for different functions—cushioning, lightweight, and stability—were used in this study (Table 2). All of the shoes were made by the same manufacturer (Spira Footwear Inc, El Paso, Texas), which incorporated spring technology (WaveSpring) into the midsole to provide cushioning. The cushioning and lightweight models were neutral shoes aiming to absorb impact from external shock. Neutral shoes are generally designed for individuals with biomechanically efficient gait because these shoes do not have any medial support to correct overpronation. The cushioning model has a tri-springs design, one at the heel and two at the forefoot region. The lightweight model, approximately 3% lighter than the cushioning model, has one heel spring, with forefoot cushioning provided by ethyl vinyl acetate foam. The stability model has a tri-spring design for cushioning and additional shank support in the midsole to aid in torsional stability and rearfoot pronation control.

Each participant’s body mass and height were measured. Afterward, participants were instructed to walk and run at a self-selected speed along a 20-m runway in the three types of footwear. Walking was performed before running, with the order of footwear randomly assigned. Participants walked 20 times and ran 20 times in each footwear and were asked to select the model that they preferred most for walking and running separately based on subjective “feeling” of comfort. Participants were not informed of the function or price of the shoes.

The distribution of preferred shoes among the three footwear models was calculated independently for walking and running. Data are presented as number and percentage of participants. A Pearson $\chi^2$ test was performed to detect differences in shoe preference between walking and running, with all participants as a whole group. With walking and running data combined, $\chi^2$ tests were used to detect differences in shoe preference between men and women, runners (self-reported running activities at least once per week for 15 min) and nonrunners, and individuals of lighter (mass, $<75$ kg) and heavier (mass, $\geq 75$ kg) body mass. Statistical significance was set at $P < .05$ throughout. Odds ratios (ORs) of individual subgroups were calculated should significant differences be detected to indicate the effect size of the differences. The number and percentage of participants choosing the same shoe model for walking and running were also calculated. No statistical analysis was performed on

| Table 1. Descriptive Characteristics of 41 Participants$^a$ |
|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | All (N = 41)    | Men (n = 22)    | Women (n = 19)  | $P$ Value       |
| Age (y)         | 27.4 (9.0)      | 26.4 (3.2)      | 27.4 (10.4)     | .97             |
| Height (cm)     | 168.2 (8.8)     | 173.5 (7.2)     | 162.1 (6.1)     | < .001$^b$      |
| Mass (kg)       | 72.4 (13.4)     | 79.7 (11.4)     | 64.0 (10.3)     | < .001$^b$      |
| BMI (kg/m$^2$)  | 25.5 (3.7)      | 26.4 (3.2)      | 24.4 (4.1)      | .089            |
| Shoe size       | 9.3 (1.7)       | 10.5 (1.3)      | 7.9 (0.9)       | < .001$^b$      |

$^a$Values are expressed as mean (SD).

$^b$Significant difference between men and women (P < .05).
these data because the expected frequency per cell was less than five in some cases, and this violated the assumption of the χ² test.

Results

Overall Shoe Preference

For all of the participants as a whole group, the χ² test revealed no difference in shoe preference between walking and running (χ² = 0.569; P = .713). More participants preferred the lightweight shoes for walking, followed by the cushioning shoes (Fig. 1). An equal number of participants chose the lightweight and cushioning models for running. The stability model was the least favorite in both activities.

Influence of Sex, Running Experience, and Body Mass

For the combined data of walking and running, there was a significant association between shoe preference and sex (χ² = 9.683; P = .008). The cushioning model was the most popular among men, and the lightweight model dominated among women for walking and running (Fig. 2). The ORs suggest that men were 2.05 times (walking: OR = 1.94, running: OR = 2.17) more likely to prefer the cushioning model than were women. On the other hand, women were 4.09 times more likely to prefer the lightweight model than were men, with a higher tendency in running (OR = 5.83) than in walking (OR = 2.95). The stability model was the least favorite among women, with only one participant preferring this model for running. Men were overall 3.19 times (walking: OR = 2.00, running: OR = 6.75) more likely to prefer the stability model than were women. No statistical difference in shoe preference was found between runners and non-runners (χ² = 1.929; P = .365) (Fig. 3) or between lighter and heavier individuals (χ² = 0.491; P = .807) (Fig. 4).

Same Model for Walking and Running

Twenty-nine of 41 participants (71%) chose the same footwear model as their preferred shoes for walking and running (Table 3). It seems that more runners (78%) chose the same model for both activities compared with nonrunners (61%), whereas the proportion was similar between men and women and between lighter and heavier individuals.

Table 2. Physical Properties of a Men’s Size 11 Shoe for Three Types of Footwear

<table>
<thead>
<tr>
<th></th>
<th>Cushioning (Spira Volare)</th>
<th>Lightweight (Spira Clarion)</th>
<th>Stability (Spira Genesis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass (g)</td>
<td>391</td>
<td>381</td>
<td>449</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>300</td>
<td>303</td>
<td>300</td>
</tr>
<tr>
<td>Ball width (mm)</td>
<td>111</td>
<td>110</td>
<td>107</td>
</tr>
<tr>
<td>Heel width (mm)</td>
<td>86</td>
<td>85</td>
<td>81</td>
</tr>
<tr>
<td>Shoe height (mm)</td>
<td>118</td>
<td>125</td>
<td>115</td>
</tr>
<tr>
<td>Heel sole thickness (mm)</td>
<td>44</td>
<td>43</td>
<td>42</td>
</tr>
<tr>
<td>Heel spring</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Forefoot springs</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 1. Participants’ shoe preferences among three types of footwear models for walking and running. No difference was found between walking and running (χ² = 0.569; P = .713).
Discussion

This study compared individual shoe preferences based on subjective comfort among three types of footwear for walking and running. Participants in this study can be considered a good representation of the general healthy adult population because they include both sexes and cover a wide range of ages (19–50 years), heights (153.9–187.8 cm), body masses (49.9–98.6 kg), shoe sizes (US women’s size 6 to US men’s size 13), and running experience (sedentary to competitive runners). This participant pool strengthens the generalizability of these results compared with previous studies of footwear comfort, which were often limited to runners, males, or restricted shoe sizes. Other strengths of this study are that participants were blinded to the function and cost of the shoes and that all of the shoes were made by the same manufacturer. This ensures that participants chose their preferred shoe based on sensation rather than on other factors such as brand name and make of the shoes. Overall, more people favored the cushioning or lightweight shoes over the stability shoes. Most participants preferred the same model for walking and running.

Shoe Preference Distribution

Some participants preferred each of the three shoe models in walking and running, suggesting that there is no single model that will suit all. Miller et al. reported that some shoes are generally comfortable for most participants, whereas other shoes are comfortable for only a specific group. The cushioning and lightweight models used in the present study were similar in that both were neutral cushioning shoes. The fact that most of the participants preferred either of these shoes suggests that neutral cushioning shoes are generally comfortable for most people. The unpopularity of the stability model may be related to its greater mass, which is 14.8% and 17.8% heavier than the cushioning and lightweight models, respectively. Also, the stability model was narrower in width at the heel and ball of the foot areas (Table 2).

Despite the heavier shoe mass, close to one in five people preferred the stability model. This indicates that the stability model may be comfortable for a specific group, as suggested by Miller et al. Data on demographics, physical characteristics, medical histories, and physical activity patterns did not identify any common features in the small group of individuals who preferred the stability model. The four participants who preferred the stability model for

Figure 2. Comparison of shoe preferences for walking and running between women and men using combined walking and running data (A), walking data alone (B), and running data alone (C). A significant sex-related difference was observed ($\chi^2 = 9.683, P = .008$).
walking and running included two sedentary men, one male distance runner, and one female track runner. Based on self-reported medical histories, the male runner was previously diagnosed as having “high-arched supination,” whereas the female runner was low arched. In general, motion control shoes are recommended for low-arched individuals to control excessive rearfoot motion, whereas cushioning shoes are recommended for high-arched individuals to attenuate impact shock. Similar to motion control shoes, stability shoes also restrict rearfoot motion but to a lesser extent while providing cushioning at the same time. This may explain why the two runners who were prone to excessive supination or pronation preferred the stability model. To confirm this speculation, future investigation is needed to examine the relationships among foot anatomy, gait pattern, and subjective shoe preference.

**Sex-Related Difference in Shoe Preference**

A difference in shoe preference distribution among the three types of footwear was found between men and women, whereas a similar preference was observed between runners and nonrunners and between lighter and heavier individuals. This finding indicates that shoe preference is influenced by sex but not by running experience or body mass. Note that only a sex-related difference was detected despite men being heavier than women (Table 1).

---

**Figure 3.** Comparison of shoe preferences for walking and running between runners (self-reported running activities at least once per week for 15 min) and nonrunners using combined walking and running data (A), walking data alone (B), and running data alone (C). No difference was found between runners and nonrunners ($\chi^2_{2} = 1.929; P = .365$).

**Figure 4.** Comparison of shoe preferences for walking and running between lighter (mass, $<75$ kg) and heavier (mass, $\geq 75$ kg) individuals using combined walking and running data (A), walking data alone (B), and running data alone (C). No difference was found between lighter and heavier subjects ($\chi^2_{2} = 0.491, P = .807$).
and that there were large proportions of male runners (16 of 23) and female nonrunners (12 of 18). Women were more likely to favor the lightweight model than were men, with a more pronounced sex-related difference for running in which 63% of women chose the lightweight shoes compared with only 23% of men. The preference for the lightweight shoes may be related to the shoe mass, which was approximately 3% less than that of the cushioning shoes and 17.8% less than that of the stability shoes. Previous studies have shown that shoes of heavier mass increased energy expenditure during walking and running. The increased metabolic energy cost resulting from carrying extra mass may be relatively larger in women, who are lighter and possess less muscular strength than men. Thus, a lighter shoe mass may be appealing to women because of the reduced energy cost during locomotion.

Whereas women favored the lightweight model, men were more likely to prefer the cushioning and stability shoes, perhaps because of the differences in shoe design or foot anatomy. The cushioning and stability models had a tri-springs design in the shoe sole compared with only one heel spring in the lightweight model. It is possible that the two forefoot springs fit the foot anatomy of men better than that of women. Therapeutic footwear with special sole design has been shown to effectively reduce plantar pressure. Because men are heavier than women, they are more likely to experience higher localized plantar pressure. The tri-springs sole design may provide increased comfort for men by reducing plantar pressure, although one study found no relationship between comfort and plantar pressure distribution. Note that a large proportion of men (walking: eight of nine; running: nine of the 11) who preferred the cushioning model ran regularly. These individuals possibly are accustomed to the impact response that they experience while wearing their own shoes. The cushioning model in this study may more closely match their normal “feeling” of impact compared with the other two models. Although data are not available, it seems reasonable to assume that runners wear cushioning footwear for training.

Based on the OR, the differences in shoe preference between men and women were more pronounced in running than in walking. Because ground reaction forces and loading rates during running are higher than those during walking, footwear cushioning may play a more important role in attenuating impact shock during running. Furthermore, the ankle joint moves through a larger range of motion during running compared with walking. The higher need for cushioning and rearfoot motion control, together with the higher metabolic energy cost during running, may have influenced shoe preference, leading to a greater difference between men and women.

**Is Shoe Preference Activity Dependent?**

Most of the present participants preferred the same shoe model for walking and running. This suggests that it may not be necessary to purchase separate pairs of shoes to walk and run comfortably. These results are in apparent disagreement with the conclusion by Miller et al that shoe comfort depends on activity (standing/walking/running). Their conclusion was drawn on the basis that the average comfort rating of the three tested shoes decreased from standing to walking to running. In fact, the ranking of comfort level among the three shoes in their study were similar regardless of activity, with the same shoe model receiving the highest comfort rating in standing, walking, and running. The fact that one particular shoe model was favored for all activities in the study by Miller et al parallels our observation that most people prefer the same shoe model for walking and running. Thus for most individuals, purchasing a shoe model that one feels comfortable with while walking is likely to

---

*Table 3. Participants Choosing the Same Shoe Model for Walking and Running*

<table>
<thead>
<tr>
<th>Group</th>
<th>Cushioning</th>
<th>Lightweight</th>
<th>Stability</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women (n = 19)</td>
<td>3 (16)</td>
<td>10 (53)</td>
<td>1 (5)</td>
<td>14 (74)</td>
</tr>
<tr>
<td>Men (n = 22)</td>
<td>8 (36)</td>
<td>4 (18)</td>
<td>3 (14)</td>
<td>15 (68)</td>
</tr>
<tr>
<td>Runners (n = 23)</td>
<td>8 (35)</td>
<td>8 (35)</td>
<td>2 (9)</td>
<td>18 (78)</td>
</tr>
<tr>
<td>Nonrunners (n = 18)</td>
<td>3 (17)</td>
<td>6 (33)</td>
<td>2 (11)</td>
<td>11 (61)</td>
</tr>
<tr>
<td>Lighter (n = 21)</td>
<td>5 (24)</td>
<td>8 (38)</td>
<td>2 (10)</td>
<td>15 (71)</td>
</tr>
<tr>
<td>Heavier (n = 20)</td>
<td>6 (30)</td>
<td>6 (30)</td>
<td>2 (20)</td>
<td>14 (70)</td>
</tr>
<tr>
<td>Total (N = 41)</td>
<td>11 (27)</td>
<td>14 (34)</td>
<td>4 (10)</td>
<td>29 (71)</td>
</tr>
</tbody>
</table>

*Data are expressed as number (percentage).*
also provide comfort during running and vice versa. Yet, approximately one in four participants preferred a different shoe model between walking and running. This tendency does not seem to be influenced by sex or body mass but may be related to running experience because more nonrunners chose a different shoe model for walking and running (Table 3). From the available data, we cannot identify specific characteristics that can differentiate between participants who preferred the same model and those who preferred different models for walking and running independently.

**Limitations**

In the present study, we did not test the mechanical properties of the shoes used. Mechanical variables would allow us to better differentiate the footwear type rather than rely solely on the information provided by the manufacturer. In addition, detailed foot anatomical information and gait patterns would be useful in identifying specific features among each subgroup of individuals and their possible relationship with shoe preference. This could serve as a useful reference for manufacturers to design footwear targeting specific subgroups. Although all of the shoes were made by the same manufacturer, there were slight differences in the visual appearance among models, and this could have influenced our results so that they may not be based solely on comfort. Finally, the walking experiment was systematically performed before the running experiment such that walking comfort may have biased the participant’s selection of the running shoes. Future studies should consider blinding the shoe appearance and randomizing the order of activities tested in addition to the order of footwear models.

**Conclusions**

Overall, more people preferred the cushioning or lightweight shoes over the stability shoes for walking and running. Shoe preference varies among individuals and is influenced by sex. For most individuals, purchasing a shoe model that one feels comfortable with while walking is likely to also provide comfort during running and vice versa.

**Acknowledgment:** Darla Smith, PhD, for her contribution in experimental design; Norma Candela-ría, Efren Herrera, and Dayanand Kiran for their help in data collection; and Stephen Burns, PhD, for his advice on improving this manuscript.

**Financial Disclosure:** Financial support for this study was provided by Spira Footwear Inc. Spira Footwear Inc was not involved in the design of the study or in the preparation of this manuscript.

**Conflict of Interest:** None reported.

**References**


