

Unexpected sex differences in an online survey of barefooters

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Abstract

Background: Barefooting is the act of going barefoot in places where people would normally be shod. A barefooting community has been active on the internet for a couple of decades, but there has been no formal attempt to survey them before now.

Methods: I posted a survey of 13 questions online and advertised it on a barefooting forum and via popular barefooting blog. The survey remained open from early April to mid-May 2013.

Results: 250 people (16% female) replied to the survey. Women reported more problems with sensitivity to the ground ($p < .001$) and to a lesser extent to hot and cold temperatures than men did. This was unexpected because it has not been discussed in the online barefooting community.

Conclusions: Women are significantly underrepresented in the online barefooting community. This is probably reflective of fewer female barefooters overall and greater difficulties women appear to have going barefoot, though women may also be less active online.

Background

Barefooting -- going barefoot in environments where it is considered normal to wear shoes -- has increased in popularity in the last few years with the publication of *Born To Run* (McDougall, 2009) and the *New York Magazine* article *You Walk Wrong* (Sternberg, 2008). In April 2013, I posted an online survey of barefooters to get a more accurate portrayal of the nature of barefooters in the English-speaking world than what one would pick up from online discussions. This survey was inspired by the annual Paleo community survey conducted by Naturally Engineered (<http://www.naturallyengineered.com/paleo-community-survey-2012/>). I posted it on my website at <http://www.anemonecerridwen.net/bfsurvey2013.php> on April 7, 2013, and advertised it on a barefooters forum and via a popular barefooter blog. Readers reposted the link to numerous other sites, and by mid-May, there were 243 responses. I posted an initial summary of results online at <http://www.anemonecerridwen.net/bfsurvey2013results.php>. Seven more subjects responded to the survey before I removed the submit button, bringing the total number of respondents to 250.

The initial intent was to post the results online as a curiosity. However, unexpected sex differences spurred me to analyze the data more seriously.

Methods

The survey consisted of 13 questions (listed below with responses) with either drop-down menus or checkboxes, as well as an open comment field and an opportunity to include an email address for notification of results. The raw data (minus comments, since respondents weren't warned I might share the data) is available on request.

I expected that there might be country differences in terms of the kinds of problems people had (e.g. discrimination more common in the US and Canada than Australia or New Zealand, as comes up frequently in online discussions) and that younger respondents might be more fitness-oriented than older respondents. I did not expect sex differences, since they had not been discussed online, except in the occasional complaint by men that barefoot women are discriminated against less in stores and restaurants.

Results and discussion

The survey consisted of 13 questions.

1. How often do you go barefoot ("how often")? Subjects chose one of "never" (1 subject, 0.4%); "less than 25% of the time" (32 subjects, 12.8%); "25-50% of the time" (46 subjects, 18.4%); "50-75% of the time" (57 subjects, 22.8%); "more than 75% of the time" (75 subjects, 30.0%) or "all the time" (38 subjects, 15.2%). One subject did not answer this question. For statistical calculations, I collapsed "never" into "less than 25% of the time".

2. How many years have you been going barefoot ("how long")? Subjects chose one of "less than a year" (32 subjects, 12.8%); "1 to 2 years" (40 subjects, 16.0%); "3 to 5 years" (60 subjects, 24.0%); "6 to 10 years" (31 subjects, 12.4%); "11 to 20 years" (29 subjects, 11.6%); or "more than 20 years" (58 subjects, 23.2%). No subjects skipped this question, though it's possible that the way the database was set up, people were entered as "less than a year" if they did not choose an option. That will be corrected for future surveys.

It is interesting that there are two blips in the distribution - one for barefooters who started in the last 3-5 years (coincident with the release of *Born To Run* and *You Walk Wrong*) and a second blip of barefooters who have been active for more than two decades. Some of these have been barefoot since the hippie era.

3. Why do you like to or want to go barefoot ("why")? Subjects were instructed to check all that applied among "Cultural reasons" (29 subjects, 11.6%); "Lifestyle reasons" (204 subjects, 81.6%); "Medical/health reasons" (163 subjects, 65.2%); "Religious/spiritual reasons" (55 subjects, 22.0%); and "Other" (72 subjects, 28.8%). Subjects were instructed to describe "other" in the single comment field at the end of the survey if they wished. For 'other' people mentioned being "too lazy to find a new pair of shoes that fit my feet" (1 person), not liking shoes or hating wearing shoes (3 people), shoes hurting their feet (1

person) and comfort (4 people). Two people, both male, said they went barefoot for sexual reasons. I left "Other" responses out of statistical calculations.

4. What are the benefits of going barefoot for you ("benefits")? Subjects were instructed to check all that applied among "Healthier feet" (207 subjects, 82.8%); "Happier feet" (199 subjects, 79.6%); "Improved fitness" (146 subjects, 58.4%); "Enjoy the sensation of going barefoot" (234 subjects, 93.6%); "Feeling closer to the Earth/to God" (119 subjects, 47.6%); "Impressing other people" (25 subjects, 10.0%); "Other" (44 subjects, 17.6%); and "None" (1 subject, 0.4%). For "other", people said "it's practical and efficient", "I generally feel better in myself", "When I am barefoot, I am most open, most integrated into my environment, most free and most comfortable", "I find that going barefoot helps me manage my disability", "I like to be capable" and one person said it improved his jump in volleyball. I left "Other" responses out of statistical calculations.

5. What are some of the problems you have with going barefoot ("problems")? Subjects were instructed to check all that applied among "Weather (too hot!)" (46 subjects, 18.4%); "Weather (too cold!)" (147 subjects, 58.8%); "Ground too rough or dangerous to walk on (glass, thorns, stones etc.)" (67 subjects, 26.8%); "Discrimination (not being allowed to go barefoot in stores, restaurants, on transit, at work, etc.)" (166 subjects, 66.4%); "Negative social attitudes (e.g. negative comments)" (127 subjects, 50.8%); "Other" (15 subjects, 6.0%); and "None" (14 subjects, 5.6%). For "other" one person said "lack of opportunity to properly toughen feet so that it is comfortable" and another mentioned his wife's phobia about him going anywhere barefoot. Another person has a medical condition making it difficult to go outside barefoot in cold weather. I left "Other" responses out of statistical calculations.

6. What is the biggest problem you have with going barefoot ("top problem")? Subjects could choose one of "Weather" (56 subjects, 22.4%); "Ground too rough or dangerous to walk on" (15 subjects, 6.0%); "Discrimination" (73 subjects, 29.2%); "Negative social attitudes" (70 subjects, 28.0%); "Other" (13 subjects, 5.2%); or "None" (19 subjects, 7.6%). Four people did not answer this question. I left "Other" responses out of statistical calculations.

7. If these problems were resolved, would you probably go barefoot more often ("more often")? 231 subjects (92.4%) chose "Yes" and 9 (3.6%) chose "No". Ten subjects (4.0%) did not answer this question.

8. Do you enjoy wearing shoes ("like shoes")? 18 subjects (7.2%) chose "Yes", 226 (90.4%) chose "No" and 6 (2.4%) did not answer the question.

9. How would you describe yourself ("description")? (Or how would you like others to see you?) Subjects were instructed to check all that applied among "Artistic type" (72 subjects, 28.8%); "Athletic" (87 subjects, 34.8%); "Eccentric" (74 subjects, 29.6%); "Hippie" (35 subjects, 14.0%); "Nature lover" (112 subjects, 44.8%); "Normal person" (146 subjects,

58.4%); "Nudist" (31 subjects, 12.4%); "Rural" (43 subjects, 17.2%); and "Other" (23 subjects, 9.2%). I left "Other" responses out of statistical calculations.

10. Sex. 40 subjects (16.0%) indicated they were female, 207 (82.8%) indicated they were male, two (0.8%) chose "other" and one (0.4%) did not answer the question.

11. Age. Subjects could choose from "Under 18 years old" (8 subjects, 3.2%); "18-24 years old" (18 subjects, 7.2%); "25-34 years old" (47 subjects, 18.8%); "35-44 years old" (61 subjects, 24.4%); "45-54 years old" (55 subjects, 22.0%); "55-64 years old" (51 subjects, 20.4%); "65-74 years old" (8 subjects, 3.2%); or "75 years or older" (1 subject, 0.4%). One person did not answer the question. I comined the categories "75 years or older" and "65-74 years old" for statistical calculations.

12. What country do you live in? Subjects were given a drop-down list of countries and territories to choose from. 156 subjects (62.4%) indicated they were from the US, 19 (7.6%) from the UK, 18 (7.2%) from Canada, 8 (3.2%) from Australia and 3 (1.2%) from New Zealand. Other subjects came from Spain (5), Austria (3), Italy (3), Netherlands (3), Russia (3), Germany (2), Norway (2), Portugal (2) and Romania (2). One subject each came from Belarus, Belgium, Bermuda, Bulgaria, Chile, Costa Rica, Denmark, Egypt, France, Greece, Hungary, Mexico, Saudi Arabia, Slovakia, Sweden, Switzerland, Taiwan, and Vanuatu. Three people did not answer this question. For statistical purposes, I grouped subjects into Australia/New Zealand (11 subjects, 4.4%), Canada (18 subjects, 7.2%), UK (19 subjects, 7.6%), Other Europe (35 subjects, 14.0%), United States (156 subjects, 62.4%), and Other (8 subjects, 3.2%).

13. Would you say that where you live is barefoot friendly? Subjects could choose from "1 - not at all"; "2 - a little bit"; "3 - somewhat"; "4 - quite a bit"; or "5 - very barefoot friendly". 245 subjects answered this question and the average score was 2.9.

14. Subjects were given a chance to add open-ended comments if they wished. This is where they could elaborate on "other" responses earlier, and a few did (as described above).

Interactions

I performed chi-square tests of independence for sex, age, country, how long and how often. Expected values were sometimes quite low, but with 250 subjects and no more than 42 cells in any given calculation, results should still be acceptable (Aron, Aron and Coups, 2009).

Sex vs age

There was a tendency for there to be more women in the 18-34 age range, but this did not reach significance ($\chi^2(5,247)=10.80, p=.056$). There was no interaction between sex and country, how long or how often.

Age vs country, how often and how long

There were significant interactions between age and country, how often and how long. There were more subjects under 18 years old than expected from Australia/New Zealand and more than expected in the 18-24 age range from Other Europe (age vs country, $\chi^2(30,246)=57.83, p=.002$). Younger people tended to go barefoot less often than other subjects (age vs how often, $\chi^2(24,248)=37.14, p=.04$). And older subjects have been going barefoot for longer than younger subjects (age vs how long, $\chi^2(30,249)=52.89, p=.006$).

Country vs how often

There aren't any simple trends here. More people than expected go barefoot >75% of the time in the US but many fewer than expected chose "all the time", probably because the US has the most discrimination against barefooters, according to online discussions, and people wear shoes when they do not want to. People from Australia/New Zealand and Other Europe are more likely than expected to go barefoot less often; while people in the US are less likely to go barefoot less than 25% of the time. It appears that barefooters in Australia, New Zealand and Other Europe are less hardcore than those in the US, perhaps because they face less discrimination - the barrier to entry appears to be lower. Canada has more people than expected going barefoot 25-50% of time, perhaps because of wearing footwear in winter. (Country vs how often, $\chi^2(20,246)=43.60, p=.002$).

There was no significant interaction between country and how long, or between how long and how often.

Sex differences

The first surprising finding was that only 16% of respondents were female. It is true that fewer women than men participate in online barefooting discussions, but it was not obvious that the numbers were this skewed. Women on average participated earlier in the survey than men did: out of 250 subjects, the average female position was 110, while the average for male subjects was 128. So extending the survey would not likely have increased female participation, but rather reduced it further. Some online barefooters insist that there are more female barefooters overall, since there is less discrimination against them, and certainly women may be more likely to take their shoes off in public than men are and get away with it (e.g. when they're wearing high heels). And it is possible that there are fewer women online because they are turned off by male-

dominated online discussions rather than because they do not exist. However, Goss and Gross (2012) surveyed 904 shod and barefoot runners online, and while overall, 50.2% of their subjects were female, only 31% (70/226) of the runners who ran in minimalist shoes were female and only 25% (4/16) of the barefoot runners were female. So it appears that this sex difference is probably real and not an artifact of subject recruitment through the online barefooting community.

The second surprising sex difference was in the problems people experience. There were no sex differences in "why", "benefits" and "description", "top problem", "more often" or "like shoes", but women reported 31% more problems for question 5 than men did (2.90 vs 2.22, $t(245)=3.81$, $p<.001$). What's more, women were 0.8, 0.5 and 1.5 times more likely to report problems with hot weather, cold weather and the ground respectively than men were, with the third difference reaching significance ($\chi(1,247)=13.67$, $p<.001$). This is surprising because I have seen no discussion of these sex differences whatsoever in the online barefooting community. Online discussions tend to focus on discrimination, which affects both sexes equally (68% of women checked this item vs 66% of men). Men checked "attitudes" more often than women did (52% vs 45%), but this did not reach significance.

Interestingly, while there were no statistically significant sex differences in "like shoes", all 40 women checked "no" for this question.

Age differences

Ignoring the "other" selection, the only relationship between age and why, benefits, problems and description is that one subject less than 18 years old indicated he experienced no benefits to going barefoot - the only subject to do so. Similarly, for the top problem, 3 subjects under the age of 18 (out of 7) indicated "none", which was considerably more than expected, but other than that there was no relationship between top problem and age. There was no significant relationship between age and "more often" or "like shoes".

There were significant differences by age in how many items were checked for why ($F(6, 242)=2.74$, $p=.01$), benefits ($F(6, 242)=2.83$, $p=.01$) and description ($F(6, 242)=2.80$, $p=.01$), but not problems. Subjects under the age of 18 chose significantly fewer items than other age groups for these categories, however the only mean difference that reached significance using a Bonferroni correction for $p (.05/21=.002)$ was between less than 18 and 25-34 for why ($t(53)=4.22$), and between less than 18 and 25-34 ($t(53)=3.52$, $p<.001$), 35-44 ($t(67)=3.42$, $p=.001$) and 55-64 ($t(57)=4.31$, $p<.001$) for benefits. Under 18s selected fewer items for problems as well, but it did not reach significance ($F(6, 242)=1.63$, $p=.14$).

Differences by country

There was no relationship between country and why, benefits, description, more often and like shoes, though there was a tendency for subjects from Australia and New Zealand to describe themselves as normal more often and other categories less often on question 9 than people from other countries. There was a significant relationship between country and problem. The observed number of subjects from Other Europe who indicated problems with discrimination was less than half the expected value ($\chi^2(5,247)=11.60, p=.04$). This also held for the top problem, where subjects from Other Europe underreported discrimination as their top problem and subjects from the US overreported it ($\chi^2(5,243)=12.07, p=.03$).

There was no difference between country groups and how many items people checked for why, benefits or description, but there was for problems ($F(5, 241)=3.24, p=.008$), with subjects from Other Europe checking the fewest number of problems on average (1.9), and subjects from Canada checking the most (3.1), presumably due to Canadian weather in addition to discrimination at the same level as in the US. The other country groups ranged from an average of 2.1 to 2.4 items each. The difference between Canada and Other Europe is significant using a Bonferroni *t*-test, with a *p* value of $.05/15=.003$ ($t(51)=3.84, p<.001$). The other country groups do not differ significantly from each other.

There was no significant relationship between country and "more often" or "like shoes".

Subjects were asked to rate their country on how barefoot-friendly it was. On a scale of 1 to 5, with 5 being the most barefoot friendly, the complete listing of ratings from highest to lowest (with count) is: Belgium 5.0(1), Norway 5.0(2), Romania 4.5(2), Netherlands 4.3(3), Denmark 4.0(1), Egypt 4.0(1), Germany 4.0(2), Greece 4.0(1), Sweden 4.0(1), New Zealand 3.7(3), Australia 3.6(8), Austria 3.3(3), Bulgaria 3.0(1), Chile 3.0(1), France 3.0(1), Hungary 3.0(1), Slovakia 3.0(1), Switzerland 3.0(1), Taiwan 3.0(1), United Kingdom 3.0(18), Vanuatu 3.0(1), United States 2.8(153), Canada 2.8(17), Italy 2.7(3), Russia 2.7(3), Spain 2.6(5), Portugal 2.5(2), Costa Rica 2.0(1), Mexico 2.0(1), Belarus 1.0(1), Bermuda 1.0(1) and Saudi Arabia 1.0(1).

I expected that Australia and New Zealand would score higher than Canada and the US, with the UK somewhere in the middle, based on online discussions. However it was surprising that a cluster of Northern European countries were all rated even more highly. It would be interesting to see if this finding would hold with a much larger sample of raters.

Differences by how often

How often vs categories: Subjects who go barefoot "all the time" were more likely to select "none" under problems ($\chi^2(4,249)=28.20, p<.000$) and for their top problem ($\chi^2(4,245)=17.35, p=.002$). There was no significant relationship between how often people went barefoot and why, benefits or description.

There is a significant relationship between how often people go barefoot and how many categories they check for why ($F(4,244)=3.18, p=.01$), benefits ($F(4,244)=3.50, p=.009$), problems ($F(4,244)=6.92, p<.001$) and description ($F(4,244)=5.12, p<.001$). The more often people go barefoot, the more options they tend to check for why, benefits and descriptive categories, but the fewer for problems. Presumably, people are able to go barefoot more often when there are fewer problems, and want to more when there are more benefits and reasons why.

How often vs more often

Of the people who answered this question, fewer of those who go barefoot all the time said they wanted to go barefoot more often than expected by chance ($\chi(4,239)=12.56, p=.01$). But of course that is what you would expect in real life. In reality, most of those who go barefoot all the time would still like to go barefoot more often. Presumably they mean that they would like to go barefoot in more places rather than a greater percentage of the time, since barefooters often must choose between going somewhere in particular or going barefoot.

How often vs like shoes

Most of the people who said they liked shoes go barefoot less than 25% of the time (10 out of the 18 who said yes vs 32 out of the 243 who answered this question: $\chi(4,243)=39.11, p<.000$).

Differences by how long

How long vs categories: There was no significant relationship between how long someone had gone barefoot and why or benefits. However, people who had been going barefoot less often were more likely to say they had problems with hot weather ($\chi(5,250)=11.32, p=.05$). And people who had been going barefoot more often were more likely to consider themselves nudists ($\chi(5,250)=17.21, p=.004$). There was no significant relationship between how long someone had been going barefoot and how many categories they checked.

There were no significant relationship between how long subjects had been going barefoot and what their top problem was, whether they wanted to go barefoot more often or not, or whether or not they liked shoes.

Conclusions

The relationship between how often people go barefoot and whether they like shoes was unexpected, but perhaps not a surprise. The higher rating for some Northern European countries than for Australia and New Zealand was a surprise, but may not hold up with larger sample sizes.

The biggest surprise, however, was both the relative absence of female respondents and their higher sensitivity to the ground and to weather conditions.

Why were there fewer female respondents?

It's possible that women go barefoot just as often as men, but do not participate in online barefooting communities or read barefooter blogs and so did not know about the survey as much.

It is also possible that women simply go barefoot less often. If so, it may be because they enjoy wearing shoes more (though every single one of the women who did participate said they did not like shoes). It may also be because they face more barriers to going barefoot than men do. These barriers may include increased sensitivity to the ground and weather, but they may also include discomfort with going against social norms. The survey did not ask about social norms, but anecdotal evidence suggests that women who know it is possible to go barefoot may still be more uncomfortable with the idea than men are (for example the respondent who mentioned his wife's "phobia" about him going anywhere barefoot). Several men online have mentioned that their wives prefer they wear shoes when going out together, or at least bring shoes with them, because of concern about confrontations. The follow-up survey planned for April 2014 will include "social norms" among the list of problems/barriers people face, and will attempt to recruit friends/family members of barefooters in order to learn more about why people choose to go barefoot or not when they know it's possible.

Are women more sensitive to the ground/weather conditions?

If women are more sensitive to the ground and possibly also weather conditions, this would make it harder for them to take up barefooting, even if they wanted to. There is an initial sensitivity that most people experience when they take up barefooting for the first time, or begin it again after a long winter wearing boots, that typically takes a week to wear off (Frazine, 1993). After that, sensitivity to the substrate may vary widely. Natural substrates (soil, rock, roots) are generally easy underfoot (though not always) but gravels may be rough, particularly the gravels made from crushed stones that are often used on urban trails, on the first portions of wilderness trails where erosion and traffic are greatest, and on sidewalks in winter to increase traction (and which can persist for months after winter is over). These surfaces may prevent the more sensitive barefooter from being active outdoors as much as they'd like.

But are women's feet more sensitive? Evidence is mixed. Sensory processing sensitivity in general varies widely in the population. The higher general reactivity that some people are born with is equally common in both sexes at birth, yet at the same time women score higher on a scale of sensory-processing sensitivity than men do, possibly due to social role expectations rather than true differences in sensitivity (Aron and Aron, 1997). At the same time, there are sex-specific differences in perception. Males tend to score better on

dynamic visual acuity tasks, while females tend to be more sensitive to sound, scent and touch (though females are less accurate at two-point discrimination tasks) (Halpern, 2012; Hamilton, 2008). In a recent twin study of children age 11-36 months, researchers found no sex differences in auditory defensiveness but significantly more extreme tactile defensiveness in girls (Goldsmith et al., 2006). Experimental pain research often finds greater sensitivity to cold, heat, and pressure pain in women, and women tend to experience more pain-related medical conditions than men do (Fillingim et al., 2009; Racine et al., 2012).¹

So it's possible that women have more tactile sensitivity in their feet than men do, but it's also possible that women are more comfortable admitting their sensitivities. Certainly, online barefooting communities appear to be much more comfortable talking about attitudes and discrimination than sensitivity.

Very few studies of feet that look at tactile sensitivity, proprioception or balance report the presence or absence of sex differences. I recommend that future research in these areas look for sex differences. If women have greater tactile sensitivity, that may affect proprioception, which in turn may affect the reasons for balance problems in older people (e.g. reduced proprioception versus weaker feet/ankles), which will in turn affect the most useful solutions.

In addition, lack of awareness of possibly greater sensitivity in women's feet (or even in anyone's feet) may lead barefoot hiking or running group organizers to choose routes that may be too hard for more sensitive people, making it even harder for those people to transition to barefooting. Lack of awareness may even bias the choice of trail surfaces in urban park systems towards surfaces that are too coarse or sharp for some barefooters, pushing them onto the grass or out of the park.

Women have more problems with shoes and more problems with their feet than men do, even when they try to wear sensible shoes (Menz et al., 2011; American Podiatric Medical Association, 2009, no date). Going barefoot is one effective solution for both preventing foot problems and allowing feet to recover from them (see Howell, 2010 for a summary of the research), and many barefooters have found improved foot health even when they were not expecting it. So if women have a harder time going barefoot than men do, this compounds the foot problems they already have. No one should be forced to go barefoot, but no one should be forced to wear shoes, either, outside environments where safety shoes (i.e. steel toes) are a genuine requirement. And certainly women should not be forced into shoes more than men are.

¹ There are also ethnic differences in experimental pain response (Rahim-Williams et al., 2012). Ethnicity was not taken into account in this survey but perhaps it should be in the future.

If barefooting is to be a viable solution (one of many) for healthy feet in the future, it needs to be equally accessible, rather than just for tougher people.

Competing interests

I have been barefoot full time for four years at the time of writing, have been active in the *Society for Barefoot Living* at one point, and wish to support barefooting.

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