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THE EFFECT OF GROUNDING THE HUMAN BODY ON MOOD[1]

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Summary.—Earthing (grounding) refers to bringing the body in contact with the Earth. Health benefits were previously reported, but no study exists about mood. This study was conducted to assess if Earthing improves mood. 40 adult participants were either grounded or sham-grounded (no grounding) for 1 hr. while relaxing in a comfortable recliner chair equipped with a conductive pillow, mat, and patches connecting them to the ground. This pilot project was double-blinded and the Brief Mood Introspection Scale (comprising 4 mood scales) was used. Pleasant and positive moods statistically significantly improved among grounded—but not sham-grounded—participants. It is concluded that the 1-hr. contact with the Earth improved mood more than expected by relaxation alone. More extensive studies are, therefore, warranted.

In modern societies, most people rarely walk barefoot anymore. They wear shoes with synthetic soles that insulate them from the ground, and they live in houses made of wood with carpets made of synthetic insulating materials. People no longer sleep on the ground. Earthing (grounding) involves the basic activity of walking barefoot outdoors and/or working, sleeping, or relaxing indoors in bare skin contact with conductive mats, bed sheets, body bands, and patches that simulates being barefoot outdoors. The Earthing hypothesis states that the Earth's subtle negative electric surface charge equalizes the electric potential of the body with that of the Earth (Oschman, 2007, 2009). The Earth's negative surface charge is composed of a virtually limitless reservoir of free electrons that is constantly replenished by the global atmospheric electrical circuit (Williams & Heckman, 1993; Anisimov, Mareev, & Bakastov, 1999). Published research indicates that such contact may be associated with a broad array of health-related benefits. The benefits include improved sleep, decreased pain, a normalizing effect on cortisol, reduced stress, diminished damage to muscles from moderate or intense exercise, reduction of primary indicators of osteoporosis, and improved glucose regulation, immune response, and blood fluidity. One hypothesis to explain the beneficial effects of Earthing is that a direct earth connection enables both diurnal electrical rhythms and free electrons to flow from the Earth to the body and that the Earth's diurnal electrical rhythms set the biological clocks for hormones that regulate sleep and activity (Oschman, 2007). It was also suggested

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that free electrons from the Earth neutralize the positively charged free radicals that are the hallmark of chronic inflammation (Oschman, Chevalier & Brown, in press). A review of health benefits associated with Earthing was published in Chevalier, Sinatra, Oschman, Sokal, and Sokal (2012).

Recently, a pilot study found improved facial blood flow and enhanced autonomic nervous system regulation of peripheral circulation within 1 hr. of Earthing (Chevalier, 2014). Since many studies show health-related benefits of Earthing (Chevalier, *et al*., 2012) and it is well known that there is a positive relationship between health and mood (Byrne & Byrne, 1993; Salovey, Rothman, Detweiler, & Steward, 2000; Schutte, Malouf, Thorsteinsson, Bhullar, & Rooke, 2006; Kok, Coffey, Cohn, Catalino, Vacharkulksemsuk, Algoe, *et al*., 2013; Ikeda, Schwartz, Peters, Baccarelli, Hoxha, Dioni, *et al*., 2014; Kim, Smith, & Kubzansky, 2014), it was hypothesized that Earthing may have a positive influence on mood. The Brief Mood Introspection Scale (BMIS) was included in that study as a convenient way to measure changes in mood before and after 1 hr. of Earthing, and those mood change results are presented here. The BMIS has four mood scales: Pleasant–Unpleasant, Arousal–Calm, Positive–Tired, and Negative–Relaxed. The overall hypothesis was that there will be a statistically significant improvement in mood shown by self-rating on the BMIS for the Grounded group. It was expected that grounded participants would show a more pleasant mood, more arousal, be more positive and more relaxed, and less negative than the Sham-grounded (Control) group. More specifically:

Hypothesis 1. For the Grounded group, there will be a statistically significant improvement in pleasant mood as shown by the Pleasant–Unpleasant scale.

Hypothesis 2. For the Grounded group, there will be a statistically significant improvement in calmness as shown by the Arousal–Calm scale.

Hypothesis 3. For the Grounded group, there will be a statistically significant improvement in positive mood as shown by the Positive–Tired scale.

Hypothesis 4. For the Grounded group, there will be a statistically significant improvement toward greater relaxation and less negativity as shown by the Negative–Relaxed scale.

No improvement in any of the four mood scales was expected for the Control group. Because this study was part of a larger study with limited funding, and also because there are no precedents of measuring the effects of grounding on mood, the closest to measuring mood being a few papers getting subjective information on participants' feeling of well-being and pain level with no statistical analysis (Ober, 2000; Ghaly & Teplitz, 2004),

there was no way to estimate how many participants would be needed to obtain the usual power of 0.8. Consequently, the number of participants was determined according to available resources, and about twice as many participants were put in the experimental group with the goal of maximizing the chances of seeing a small effect.

Method

This study was approved by BioMed IRB of San Diego, California,[2] and was conducted at a single center: Total Thermal Imaging (TTI), La Mesa, California.

Participants

Forty adult participants were recruited from the patient base of Total Thermal Imaging, a chiropractic clinic located in La Mesa, California. They read and signed the informed consent approved by the IRB. Participants were randomly assigned to two groups, with the Grounded group designed to have about twice as many participants as the Sham-grounded (Control) group to maximize the probability of seeing a small effect. The Grounded group had 27 people, and the Sham-grounded group had 13. However, only 19 participants in the first group and 10 in the control group provided properly completed questionnaires for the analyses presented here. The average age of these participants was 53.5 yr. ($SD = 10.4$). Age and sex descriptive statistics are presented in Table 1. Participants were scheduled in the order they signed up to participate. All participants kept the grounding mat and pillow they used during the session as compensation for their participation.

TABLE 1
Age and Sex Distribution of Participants

	Grounded		Sham-grounded		Total
	Women	Men	Women	Men	
n participants	13	6	6	4	29
M age, yr.	52.2	54.5	59.0	47.8	53.5
SD	10.6	12.9	7.21	8.73	10.4

Exclusion criteria were pregnancy; below the age of 18 yr. or above 70 yr.; taking pain, anti-inflammatory medication, sedatives, or prescription sleeping medication (less than 3 days prior to testing); taking psychotropic drugs or diagnosis with mental disorder; recent surgery (less than 3 mo.); documented life-threatening disease (such as cancer or AIDS); consumption of alcohol within 48 hr. of participation; smoking; use of recre-

[2]http://www.biomedirb.com/

ational drugs; previous utilization of Earthing products or similar grounding products; and going barefoot outside more than once a week and for more than half an hour.

Materials

Grounding equipment.—Conductive mats, pillows, and transcutaneous electrical nerve stimulation (TENS) patches were provided by Earthing.com of Palm Springs, California.[3] The grounding mat was about 2.0 × 5.0 ft. (61.0 × 152.4 cm), and was made of rubber with carbon fibers incorporated into the rubber to make it electrically conductive. The pillow was also made of an electrically conductive material and had a cover that was made of cotton woven with silver threads to make it electrically conductive. The TENS patches were commercially available patches (2.0 × 3.75 in.; 5.1 × 9.5 cm).

Grounding Method

Each participant sat in a comfortable recliner chair equipped with a grounding mat, pillow, and four TENS patches that were connected, via conducting wires, to the ground port (third hole) of an electric power outlet. Previous testing confirmed a proper grounding system connected to the ground ports of the clinic. The grounding mat was placed on the back and seat of the chair. The head was grounded by touching the pillow and the four TENS patches were placed in the palms of the hands and on the soles of the feet. The main grounding methods were the grounding pillow and patches. The grounding mat was added by the sponsor, but it was the least important of the three grounding methods since clothing may have prevented direct contact with it. All grounding wires contained a built-in 100 kΩ resistor for surge protection.

Measures

The Brief Mood Introspection Scale (BMIS) is a freeware mood test that determines the intensity of 16 mood adjectives: lively, happy, sad, tired, caring, content, gloomy, jittery, drowsy, grouchy, peppy, nervous, calm, loving, fed up, and active. For each adjective, the respondent circles one of the four ratings best reflecting his present mood state (1: Definitely do not feel, 2: Do not feel, 3: Slightly feel, and 4: Definitely feel). The BMIS has four mood scales, Pleasant–Unpleasant, Arousal–Calm, Positive–Tired, and Negative–Relaxed. This test has been used in many publications; all four mood scales have good factorial validity, and three mood scales have good reliability, except for Arousal–Calm (Mayer & Gaschle, 1988).[4]

[3]www.earthing.com
[4]Details of the scoring method can be found at http://www.unh.edu/personalitylab/lab-meas-proc/xmoodscales.html.

Procedure

The participants were tested singly. Before coming to the clinic, the participants were given the informed consent to read and sign, and they were screened for exclusion criteria. Upon their arrival to the clinic and prior to the 1 hr. experimental session, each participant answered the questions in the BMIS and was directed to sit in a recliner chair and asked to simply relax (no heavy thinking and no reading). The lights in the room were dimmed to encourage relaxation. The chair was adjusted to a comfortable 30° in respect to the plane of the floor. The back and seat were covered with a grounding mat. A grounding pillow was placed at the head position and stabilized with Styrofoam pads on each side to minimize head movements. One TENS patch was placed on each palm and each sole.

The connector ends of the wires from the patches, pillow, and mat were inserted into the jacks of a connector box next to the chair. The box, in turn, was connected by a single wire to the ground port of an adjacent power outlet. That wire was outfitted with a switch that allowed the patches, pillow, and mat to be connected to the ground when turned on according to a grounding protocol described previously (Chevalier, 2014).

A double-blind procedure prevented the researchers, study coordinators/technicians, and participants from knowing whether a participant was actually grounded or sham-grounded. For that purpose, and to accommodate the fact that the design of the study called for about twice as many grounded participants than sham-grounded participants, three different colored-coded wires connecting the patches, pillow, and mat to the box were utilized. Wires with red and yellow tags permitted grounding; wires with a blue tag did not. At the time a participant came in for a session, the wires' color was randomly selected by the study coordinator and noted for future reference.

As per the protocol described in the facial blood flow study (Chevalier, 2014), the switch was turned on 10 min. after the participant was asked to sit in the chair. Participants randomly assigned to wires with red and yellow tags became grounded. Participants assigned to the blue wires were sham-grounded, meaning that the wires maintained an open electric circuit, and so these participants remained not grounded after the switch was turned on. After 1 hr., the switch was turned off for all sessions (grounded or sham-grounded). Finally, each participant filled out the BMIS a second time.

Statistical Analysis

Statistical calculations were conducted using the NCSS/PASS 2000 Dawson edition statistical package. Since the study uses a test-retest design (the questionnaire was administered before and again after the session) with comparison between means, Student's *t* test was used when the

data followed a normal distribution; otherwise, the Wilcoxon Signed-Rank test for difference in medians with continuity correction (W S-R) was computed. Effect size was calculated using Cohen's *d* (1988). The usual value of $\alpha = .05$ was applied to determine statistical significance. Even though a one-tail distribution could be used to test the author's hypotheses, he decided to be conservative in this pilot project and use a two-tailed distribution because of the small number of participants.

Results

Nineteen grounded participants and 10 sham-grounded participants provided a properly completed BMIS for statistical analyses. The results are summarized in Table 2. Three of the four hypotheses were supported.

Hypothesis 1 was supported. The Grounded group had a significant increase in the Pleasant–Unpleasant mood scale ($p = .02$), indicating a more pleasant mood, and the Control group also had a significant increase

TABLE 2
Brief Mood Introspection Scale Score Results For All Four Mood Scales

Mood Scale	Grounded				Sham-grounded			
	Before	After	Diff.	% Change	Before	After	Diff.	% Change
Pleasant–Unpleasant								
M	50.05	54.95	4.89	9.8	54.30	57.90	3.60	6.6
SD	9.12	6.53	−2.59	−28.4	4.67	3.78	−0.88	−18.9
t test, *p*		0.02				0.05		
Cohen's *d*		0.62				0.85		
Arousal–Calm								
M	27.95	27.89	−0.06	−0.2	27.70	27.40	−0.30	−1.1
SD	3.44	3.60	0.16	4.8	3.37	2.67	−0.69	−20.6
t test, *p*		0.96				0.75		
Cohen's *d*		−0.01				−0.10		
Positive–Tired								
M	20.53	22.79	2.26	11.0	22.20	23.70	1.50	6.8
SD	3.76	3.43	−0.33	−9.0	2.86	2.11	−0.75	−26.2
t test, *p*		0.04				0.11		
Cohen's *d*		0.63				0.60		
Negative–Relaxed								
M	10.53	8.37	−2.16	−20.5	8.50	7.20	−1.30	−15.3
SD	4.48	2.99	−1.49	−33.3	2.27	2.10	−0.18	−7.7
Wilcoxon Signed-Rank test, *p*		0.02				0.09		
Cohen's *d*		−0.57				−0.60		

($p = .05$). Cohen's d showed a medium effect size for the Grounded group ($d = 0.62$) and a large effect size for the Sham-grounded group ($d = 0.85$).

Hypothesis 2 was not supported. Both groups had non-significant changes in the Arousal–Calm mood scale (ps = .96 and .75), indicating no significant change in arousal/calmness after the grounding session or after the sham-grounding session. Cohen's d showed a small size effect for both the Grounded and Sham-grounded group (ds = –0.01 and –0.10).

Hypothesis 3 was supported. The Grounded group had a significant increase ($p = .04$) in the Positive–Tired mood scale, while the Control group clearly did not ($p = .11$). Cohen's d shows medium size effects for both groups ($d = 0.63$ and 0.60).

Hypothesis 4 was supported. Since the data distributions were not normal for both the Grounded group and the Sham-grounded group after the session, Wilcoxon Signed-Rank tests for difference in medians with continuity correction were used. The results presented in Table 2 show that the Grounded group had a significant decrease ($p = .02$) in the Negative–Relaxed mood scale, becoming less negative and more relaxed, while the Control group did not (ps = .09). For this mood scale also, Cohen's d showed medium size effects for both groups (ds = –0.57 and –0.59).

Discussion

This study assessed whether grounding the body is associated with improvements in mood after 1 hr. Since there is no research that could be used to estimate the effect size and power on the effects of Earthing on mood, and because of limited resources, it was decided to design a pilot study with 40 participants as a first approach to determine the appropriate number of participants for future studies. It was also decided to use about twice the number of grounded participants versus the number of controls (sham-grounded participants) to increase the likelihood of seeing a small effect. The effect size was computed using Cohen's d and showed moderate ($0.5 \leq d < 0.8$) to large ($d > 0.8$) effect sizes for all mood scales except for the Arousal–Calm mood scale. It is also to be noted that the effect size was comparable between the Grounded group and the Sham-grounded group. These observations indicate that the decision to put more participants into the Grounded group did not influence the effect sizes appreciably.

The Grounded group showed a significant increase in the Pleasant–Unpleasant mood scale, indicating a more pleasant experience (supporting Hypothesis 1); a significant increase in the Positive–Tired mood scale, meaning feeling less tired and more positive (supporting Hypothesis 3); and a significant decrease in the Negative–Relaxed mood scale, becoming less negative and more relaxed (supporting Hypothesis 4). For the Sham-grounded group, the change in scores on the Pleasant–Unpleasant scale was significant, while for the other three tests there were no significant

changes. Neither group had a significant change in the Arousal–Calm mood scale, and so Hypothesis 2 was not supported.

Combining the results of these mood scales, it is apparent that the Grounded group had a more pleasant experience, felt more positive, less negative, and more relaxed than the control group. These results are similar to prior studies on grounding that show decreased stress (Ober, 2000; Ghaly & Teplitz, 2004; Chevalier, Mori, & Oschman, 2006; Chevalier, 2010; Chevalier & Sinatra, 2011), improved sleep (Ober, 2000; Ghaly & Teplitz, 2004), and normalization of cortisol levels (Ghaly & Teplitz, 2004).

Conclusion

It is well-known that there is a positive relationship between mood and health (Kok, *et al*., 2013; Ikeda, *et al*., 2014; Kim, *et al*., 2014). This pilot study showed that grounding improves measurements of mood within 1 hr., suggesting a potential positive effect on health. However, limitation in the number of participants and mood testing methods limit the validity of this result. Therefore, a larger study, better controlled, with more extensive psychological and physiological tests is warranted to assess the suggested effects. If these effects are found, then it is possible that grounding may be a simple way to improve mood states and help mitigate common detrimental effects of negative moods on health and psychological state, such as anxiety, stress, and depression.

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