Energy expenditure during the group exercise course BodypumpTM in young healthy individuals

Article *in* The Journal of sports medicine and physical fitness · June 2015

Source: PubMed

4 authors, including:

Antony Karelis
Université du Québec à Montréal
111 PUBLICATIONS **3,114** CITATIONS

J SPORTS MED PHYS FITNESS 2015;55:563-8

Energy expenditure during the group exercise course Bodypump™ in young healthy individuals

M.-P. BERTHIAUME [1], M. LALANDE-GAUTHIER [1], S. CHRONE [2], A. D. KARELIS [1]

[1]Department of Kinanthropology, Université du Québec à Montréal, Montreal, Canada
[2] Énergie Cardio, Montreal, Canada

Aim. **The purpose of the present study was to examine the energy expenditure during the group resistance training exercise course Bodypump™ in young healthy individuals.**
Methods. **The study population consisted of 40 men and women (age: 31.7±5.8 years, body mass index [BMI]: 24±2.6 kg/m²) that performed three 60-min sessions of the group resistance training exercise course Bodypump™. Free living energy expenditure during the course was measured using the portable SenseWear armband. Perceived energy expenditure, perception of effort, fatigue and pleasure were also measured after the course.**
Results. **Mean energy expenditure and intensity during the Bodypump™ course for all participants were 250.3±67.8 kcal or 4.2 kcal/min and 3.5±0.7 METS, respectively. Interestingly, perceived energy expenditure for all participants was significantly higher by ~67% compared to measured energy expenditure (394.1±116 *vs*. 250.3±67.8 kcal, respectively; P<0.05). Moreover, 85% of all individuals reported that the Bodypump™ course was highly enjoyable.**
Conclusion. **Energy expenditure during a 60-min Bodypump™ course appears to be approximately 250 kcal and seems to be performed at a moderate intensity (3.5 METS) in young healthy men and women. These results could have an impact on the amount of physical activity an individual performs as well as the preparation of physical activity programs by kinesiologists.**

KEY WORDS: Kilocalories - Energy metabolism - Resistance training.

The group exercise training course Bodypump™ appears to be a popular physical activity that is practiced around the world.[1] Bodypump™ is a pre-choreographed group exercise course that uses high-repetition resistance training exercises with weights during a 60 minute sequence of 10 music selections. Interestingly, two recent studies have shown the physiological effects of Bodypump™.[2, 3] Oliveira *et al*.[3] showed that one session of Bodypump™ was sufficient to induce improvements in muscle strength in healthy untrained women. However, the metabolic and cardiovascular response during that one session does not appear to achieve improvements in aerobic capacity. Greco *et al*.[2] reported that 12 weeks of Bodypump™ training, in healthy untrained women, significantly improved lower limb muscle strength, which was due to neural and metabolic adaptations in knee extensors.

However, to our knowledge, no well controlled study appears to be currently available on the energy expenditure during a Bodypump™ course, despite a claim that one session of the Bodypump™ course could have an energy expenditure of up to 600 kcal.[1] Knowledge of this energy expenditure may help us better understand the level of physical activity of an individual and as such provide useful information to coaches and/or kinesiologists planning exercise programs. Therefore, to broaden our knowledge in this area, the purpose of the present study was to examine the energy expenditure during the group resistance training exercise course Bodypump™ in young

Corresponding author: A. Karelis, PhD, Department of Kinanthropology, Université du Québec à Montréal, Case postale 8888, succursale Centre-ville, H3C 3P8 Montreal,, Canada.
E-mail: karelis.antony@uqam.ca

healthy individuals using a simple, non-obstructive and accurate method for the measurement of free living energy expenditure (SenseWear armband).

Materials and methods

Subjects

Forty healthy physically active men and women aged between 24-46 years old (mean: 31.7±6 years) were recruited between the months of April and August in three different Énergie Cardio fitness centers in the Montreal area. All participants that showed interest underwent a screening phase by the same investigator (MPB) and if all the inclusion criteria were respected and met, volunteers were invited to participate in the study. To be included in the study, participants had to meet the following criteria: no history of cardiovascular diseases and diabetes, no orthopedic limitations, no medication that could influence metabolism, non-smoker, moderate drinker (less than <2 drinks/day), a body mass index (BMI) of 18.5 to 30 kg/m^2, perform at least 150 minutes of physical activity per week and a minimum of three months of experience in regularly performing (2 times/week) the Bodypump™ course. Women were tested in the follicular phase of the menstrual cycle. All procedures were approved by the Ethics Committee of the Faculty of Science of the Université du Québec à Montréal. All participants were fully informed about the nature, goal, procedures and risks of the study, and gave their informed consent.

Measures

Body weight (kg) was measured using an electronic scale (BIM, Balance Industrielles Montréal Inc., Canada) and standing height was measured using a wall stadiometer (Perspective Enterprises, Portage, MI, USA). Both measurements were performed following standard techniques with participants not wearing their shoes. Body mass index (BMI) was calculated as body weight (kg)/height (m^2).

Free living energy expenditure was assessed using the portable SenseWear armband Pro3 (Bodymedia, Pittsburgh, PA). The portable armband uses a 2-axis accelerometer, a heat flux sensor, a galvanic skin response sensor, a skin temperature sensor, and a near-body ambient temperature sensor to capture data. These data as well as body weight, height, handedness and smoking status (smoker or non-smoker) are used to calculate energy expenditure. The armband was placed on the upper right arm (on the triceps at the mid-humerus point) of each volunteer. The net output is a measure of energy expenditure (kcal) utilized by the participant across time. This method of energy expenditure measurement has been validated by several studies and is known to be 92% accurate compared to the gold standard method of doubly labeled water.[4-11] In addition, a test-retest reliability trial (N.=34) for energy expenditure performed in our laboratory showed an intra-class correlation coefficient of 0.97.[12] It should be noted that mean energy expenditure was measured during three different sessions of Bodypump™ within a period of 14 days with the same course instructor, the same version of Bodypump™ and the same weights for all three sessions as well as at the same time of day for each session. Participants were also instructed to maintain their usual eating habits.

Bodypump™ (Less Mills International Ltd) is a prechoreographed group exercise course that uses high-repetitive resistance training exercises with weights during a sequence of music. The 60-min course was based on 10 pre-established music selections that focused on different muscle groups. The first music selection consisted of a warm-up involving exercises that target all major muscle groups. Then, different music selections were associated with the stimulus of different muscle groups in the following order: lower limbs (squats), upper limbs (bench press), upper-mid and lower back (bent-over barbell rows), triceps brachialis (tricep kickbacks), biceps brachialis (bicep curls), lower limbs (lunges), deltoids (shoulder press) and abdominals (crunches). These types of exercises allowed for a complete body workout. The last musical selection was used for cool-down and stretches. Equipment that was used during the course included a 1-step platform, a bar and several weights. Bodypump™ versions 80 and 81 were used in the present study.

All participants completed a questionnaire, which was slightly adapted from a previous study from our laboratory,[13] at the end of their third Bodypump™ session. The following five questions were asked: 1) How would you compare your effort between the Bodypump™ course to an endurance exercise that

you regularly perform? 2) What was your perception of fatigue after the course? 3) What was your perception of energy expended after the course? 4) What was your perception of pleasure after the course? and 5) How many calories did you think you burned during the Bodypump™ course? It should be noted that the participants had a choice of three categories to choose from for the first four questions. As for the fifth question, participants were asked to write down a number.

Statistical analyses

Results are presented as means ± SD. Normality was verified using the Kurtosis-test and found that the measured and perceived energy expenditure data were not normally distributed. Thus, non- parametric tests (Wilcoxon) were used to detect differences between measured energy expenditure and perceived energy expenditure in all participants as well as in men and women. Furthermore, non-parametric tests (Wilcoxon) were also used to detect differences between men and women for all variables. A Chi-square test was performed to analyze differences in perception of effort, fatigue and pleasure in men and women. Pearson correlations were also performed between the number of months of experience and energy expenditure. Statistical analysis was performed using SPSS 20 for Windows (Chicago, IL, USA). Significance was accepted at P<0.05.

Results

Mean energy expenditure and intensity during the Bodypump™ course for all participants were 250.3±67.8 kcal (Figure 1) or 4.2±1.1 kcal/min and 3.5±0.7 METS, respectively (Table I). Perceived energy expenditure for all participants was 394.1±116 kcal (Figure 1, Table I). Percent difference in measured energy expenditure and perceived energy expenditure was 66.7±67.5%. In addition, 6 participants (3 women and 3 men) noted a <10% error between perceived energy expenditure and measured energy expenditure, whereas 10 participants (3 men and 7 women) noted a >100% error between perceived energy expenditure and measured energy expenditure. Furthermore, BMI, mean energy expenditure, mean intensity and perceived energy expenditure were significantly higher in

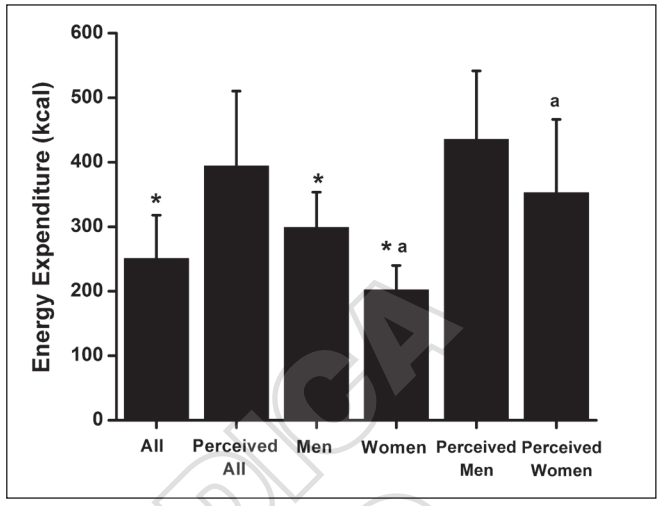

Figure 1.—Differences in energy expenditure in all participants as well as in men and women. Differences in perceived energy expenditure in all participants as well as in men and women. Values are the mean±SD. * Significantly different from perceived energy expenditure (P<0.05). [a]Significantly different from men (P<0.05).

TABLE I.—*Mean energy expenditure and intensity during the Bodypump™ course in men and women.*

	All Participants (N.=40)	Men (N.=20)	Range	Women (N.=20)	Range
Age (yrs)	31.7±5.8	31.3±5.4	24-40	32.2±6.3	24-46
Body Mass Index (kg/m^2)	24.0±2.6	25.3±2.4	21.3-30.2	22.7±2.2*	19.6-28.6
Months of Experience	11.8±13.6	12.8±17	3-83	10.8±9.5	3-48
Energy Expenditure (kcal)	250.3±67.8[a]	298.9±54.9[a]	199-410	201.7±38.1*[a]	143-284
Energy Expenditure (kcal/min)	4.2±1.1	5.0±0.9	3.3-6.8	3.4±0.6*	2.4-4.7
Intensity (METS)	3.5±0.7	3.9±0.6	2.8-4.8	3.2±0.6*	2.2-4.2
Perceived energy expenditure (kcal)	394.1±116.2	435.5±106.0	250-650	352.8±113.6*	200-700
Differences in MEE and PEE (%)	66.7±67.5	49.5±40.6	–17-121	83.9±84.1	0.5-344

Values are means±SD. MEE: measured energy expenditure (kcal); PEE: perceived energy expenditure (kcal). * Significantly different from men (P<0.05). [a] Significantly different from perceived energy expenditure (P<0.05).

men compared to women (Table I). When statistically controlling for BMI, significant differences in energy expenditure between men and women still persisted. No differences in age, months of experience and percent difference in energy expenditure were observed between men and women (Table I). Ranges for mean energy expenditure, mean intensity and perceived energy expenditure were 199-410 kcal or 3.3-6.8 kcal/min, 2.8-4.8 METS, 250-650 kcal, respectively for men and 143-284 kcal or 2.4-4.7 kcal/min, 2.2-4.2 METS, 200-700 kcal, respectively for women (Table I). It should be noted that no significant correlation was observed between the number of months of experience of Bodypump™ with energy expenditure (r=-0.09; P=NS), intensity (r=-0.10; P=NS) and perceived energy expenditure (r=0.10; P=NS).

Table II shows the perception of effort, fatigue, energy expended and pleasure after the Bodypump™ course in all participants as well as in men and women. Briefly, 45% of all participants reported that the Bodypump™ course was more strenuous when compared to a regularly practiced endurance exercise. Fifteen percent of all participants reported that they were highly fatigued after the course. Fifty percent reported a high energy expended and 85% reported a high level of pleasure. Furthermore, perception of fatigue was significantly different in men when compared to women. That is, 70% of women reported that they were moderately fatigue after the course compared to 40% of men and that 0% of women reported that they were highly fatigue after the course compared to 30% of men. No other differences in perceptions between men and women were noted.

Discussion

The purpose of the present study was to examine the energy expenditure during the group resistance training exercise course Bodypump™ in young healthy individuals using a simple, non-obstructive and accurate method for the measurement of free living energy expenditure (SenseWear armband). Results of the present study show that mean energy expenditure during the Bodypump™ course seems to be ~299 kcal or 5.0 kcal/min in men (range: 199-410 kcal) and ~202 kcal or 3.4 kcal/min in women (range: 143-284 kcal). Therefore, these results are not in line with the claim of Les Mills International Limited which reported an energy expenditure of up to 600 kcal per session. The differences in the results may be explained by the method used for the measurement of energy expenditure, sample size, different populations and level of experience in the Bodypump™ course. It should be noted that we used a simple, non-obstructive and validated method for the measurement of energy expenditure in a well

TABLE II.—*Perception of effort, fatigue and pleasure after the Bodypump™ course in men and women.*

	All Participants (N.=40)	Men (N.=20)	Women (N.=20)
Comparison of effort between Bodypump™ to an endurance exercise			
Less strenuous (%)	32.5	25.0	40.0
Comparable (%)	22.5	20.0	25.0
More strenuous (%)	45.0	55.0	35.0
Perception of fatigue			
Slightly fatigue (%)	30.0	30.0	30.0
Moderately fatigue (%)	55.0	40.0	70.0*
Highly fatigue (%)	15.0	30.0	0.0*
Perception of energy expended			
Low (%)	2.5	5.0	0.0
Medium (%)	47.5	35.0	60.0
High (%)	50.0	60.0	40.0
Perception of pleasure			
Low (%)	2.5	5.0	0.0
Medium (%)	12.5	15.0	10.0
High (%)	85.0	80.0	90.0

* Significantly different from men (P<0.05).

controlled study that was performed during actual group courses making it representative. Indeed, further research is needed to confirm our results. In addition, mean intensity was 3.9 and 3.2 METS in men and women respectively, which represents a moderate intensity according the American College of Sports Medicine (ASCM) (moderate: 3-6 METS).[14] Furthermore, if the Bodypump™ course were to be performed 5 times per week, this would satisfy the recommendations of the ACSM.[14] Finally, by comparison, the level of intensity that is exerted from the Bodypump™ course could be equivalent to that of walking at 4.8 km/h.[15]

Interestingly, perceived energy expenditure was significantly overestimated by ~50% in men (~435 kcal; range: 250-650) and by ~84% in women (~353 kcal; range: 200-700) after the Bodypump™ course. This could suggest that women may have a tendency to overestimate energy expenditure during group exercise more than men. Furthermore, the mechanism that could explain these overestimations in energy expenditure in men and women is poorly understood. Potential mechanisms may be the lack of knowledge in the field of exercise science from the participants and/or course instructors. Taken together, it seems that unless energy expenditure is quantified, the perception of energy expenditure of the individual appears not be accurate during the Bodypump™ course. It would be interesting to investigate if overestimating energy expenditure during a specific exercise may potential affect the amount of physical activity an individual performs during the week.

It should be noted that 80% of men and 90% of women reported that the Bodypump™ course was highly enjoyable. Thus, health professionals in the field of physical activity may want to consider in recommending this type of exercise. Moreover, 45% of all participants reported that the Bodypump™ course was more strenuous when compared to a regularly practice endurance exercise and 50% reported a high perception of energy expended after the course. In addition, no differences in perception of effort, energy expended and pleasure were observed after the Bodypump™ course between men and women. However, perception of fatigue was significantly different in men when compared to women. That is, 70% of women reported that they were moderately fatigue after the course compared to 40% of men and that 0% of women reported that they were highly fatigue after the course compared to 30% of men. It would be interesting to examine if differences in perception of fatigue exist between men and women in other types of exercises and how this could potential affect the amount of physical activity an individual performs.

Limitations of the study

There are several limitations in the present study. First, our cohort is composed of young healthy men and women with a minimum of 3 months of experience in performing the Bodypump™ course. Thus, our findings are limited to this population. Second, the characteristics of the cohort reflect strict inclusion criteria.

In conclusion, the present study indicates that energy expenditure during a 60-min Bodypump™ course appears to be approximately 250 kcal and seems to be performed at a moderate intensity (3.5 METS) in young healthy men and women. Furthermore, perceived energy expenditure was significantly overestimated by ~67% by the participants. Moreover, both men and women reported that the Bodypump™ course was a highly enjoyable form of physical activity. Finally, this study could have implications for the planning of physical activity intervention programs by kinesiologists.

References

1. Les Mills International Limited. [Accessed 2015 April 27]. Available at: http://w3.lesmills.com/global/en/classes/bodypump/about-bodypump/.
2. Greco CC, Oliveira AS, Pereira MP, Figueira TR, Ruas VD, Goncalves M *et al*. Improvements in metabolic and neuromuscular fitness after 12-week bodypump(R) training. J Strength Cond Res 2011;25:3422-31.
3. Oliveira AS, Greco CC, Pereira MP, Figueira TR, de Araujo Ruas VD, Goncalves M *et al*. Physiological and neuromuscular profile during a bodypump session: acute responses during a high-resistance training session. J Strength Cond Res 2009;23:579-86.
4. Drenowatz C, Eisenmann JC. Validation of the SenseWear Armband at high intensity exercise. Eur J Appl Physiol 2011;111:883-7.
5. Johannsen DL, Calabro MA, Stewart J, Franke W, Rood JC, Welk GJ. Accuracy of armband monitors for measuring daily energy expenditure in healthy adults. Med Sci Sports Exerc 2010;42:2134-40.
6. Mackey DC, Manini TM, Schoeller DA, Koster A, Glynn NW, Goodpaster BH *et al*. Validation of an armband to measure daily energy expenditure in older adults. J Gerontol A Biol Sci Med Sci 2011;66:1108-13.

7. Mignault D, St-Onge M, Karelis AD, Allison DB, Rabasa-Lhoret R. Evaluation of the Portable HealthWear Armband: a device to measure total daily energy expenditure in free-living type 2 diabetic individuals. Diabetes Care 2005;28:225-7.
8. Ryan J,Gormley J. An evaluation of energy expenditure estimation by three activity monitors. European Journal of Sport Science 2013;1-8.
9. St-Onge M, Mignault D, Allison DB, Rabasa-Lhoret R. Evaluation of a portable device to measure daily energy expenditure in free-living adults. Am J Clin Nutr 2007;85:742-9.
10. Welk GJ, McClain JJ, Eisenmann JC, Wickel EE. Field validation of the MTI Actigraph and BodyMedia armband monitor using the IDEEA monitor. Obesity (Silver Spring) 2007;15:918-28.
11. Wetten AA, Batterham M, Tan SY, Tapsell L. Relative validity of three accelerometer models for estimating energy expenditure during light activity. J Phys Act Health 2014;11:638-47.
12. Brazeau AS, Karelis AD, Mignault D, Lacroix MJ, Prud'homme D, Rabasa-Lhoret R. Test-retest reliability of a portable monitor to assess energy expenditure. Appl Physiol Nutr Metab 2011;36:339-43.
13. Frappier J, Toupin I, Levy JJ, Aubertin-Leheudre M, Karelis AD. Energy expenditure during sexual activity in young healthy couples. PLoS One 2013;8:e79342.
14. Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA *et al*. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. Circulation 2007;116:1081-93.
15. Ainsworth BE, Haskell WL, Herrmann SD, Meckes N, Bassett DR, Jr., Tudor-Locke C *et al*. 2011 Compendium of Physical Activities: a second update of codes and MET values. Med Sci Sports Exerc 2011;43:1575-81.

Funding.—This study was supported by start-up funds from the Université du Québec à Montreal.

Acknowledgments.—The authors would like to thank Énergie Cardio and Jennifer Pelletier for their support. They would also like to thank all of the participants and course instructors.

Conflicts of interest.—A.D. Karelis was supported by the Fond de la Recherche en Santé du Québec (FRSQ).

Received on June 11, 2013.
Accepted for publication on January 13, 2014.