

**Physiological differences between exercise on a
treadmill, an elliptical and the Cardio Cushion
(patent pending)**

Research Findings

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Overview of Project

This project involved the testing of a new piece of cardiovascular exercise equipment, the Cardio Cushion, invented by Paul Toback of Cardio Cushion, LLC. Toback's hypotheses are:

1. The Cardio Cushion will reduce the amount of ground reaction force as compared to a treadmill.
2. The Cardio Cushion will increase the intensity of exercise by causing greater utilization of the vastus lateralis (lower thigh), gastrocnemius lateralis (calf), and gluteus maximus (buttock) muscles when the subject maintains the same cadence as compared to either a treadmill or an elliptical.
3. The Cardio Cushion will allow for a more natural running motion than an elliptical machine.

In order to prove or disprove these hypotheses the purpose of this research project was to acquire the following information:

- 1) The amount of calories expended for an exercise session by measurement of oxygen consumption on the Cardio Cushion as compared to an equivalent session on both a treadmill and an elliptical machine. In addition, the calorie expenditure information for the Cardio Cushion has been used to develop a set of regression equations (see "Regression Formulas" bookmark) to incorporate into the final product to provide information to the end user during their exercise session.
- 2) Quantitative data on the differences in ground reaction forces (vertical linear acceleration) between the three machines.
- 3) Quantitative data on the differences in muscle utilization, particularly the vastus lateralis (lower thigh - one of the four muscle heads of the quadriceps), gluteus maximus (buttocks) and gastrocnemius lateralis (calf) muscles, between the three machines; and
- 4) Qualitative information in the form of a user survey from each subject who participated in the project.

This project was approved by the Benedictine University Institutional Review Board on May 18, 2010 and was recorded as #20100518. Preliminary testing began on June 26, 2010 and was completed on September 3, 2010.

Subject Recruitment

Subjects were recruited from the Benedictine University community as well as from local fitness centers. Subjects were required to be in good health, be between 20 and 65 years of age, and able to exercise at moderate intensity for 60 minutes. A total of 19 subjects completed the initial screening that consisted of a maximal exercise test on the treadmill. One subject withdrew after the initial screening for health reasons. Two subjects did not complete all three of the required exercise bout visits. 16 subjects completed the entire protocol, 8 female and 8 male.

Conclusions

Female and male runners expend similar amount of calories when jumping on the foam surface as they do when exercising on the treadmill or the elliptical.

Walkers of both genders reported that exercise on the air and foam surfaces was more difficult than the treadmill. It is hypothesized that the unstable surface of the Cardio Cushion challenged them to maintain their balance thus increasing the perceived difficulty of the exercise.

Female runners reported that exercise on the foam surface was more difficult than the treadmill. Male runners found that the foam surface was as challenging as the treadmill.

The hypothesis that the CC would reduce the amount of ground reaction force as compared to the treadmill was clearly proven by the data collected. Thus, this is a major selling point for the CC especially with the growing number of middle-aged runners who are finding that years of pounding on harder surfaces is taking a toll on their joints.

Females jumping on the foam surface experienced more utilization of their vastus lateralis muscle as compared to the treadmill and more utilization of their gastroc lateralis muscle as compared to the elliptical.

As previously discussed in the conference calls, it can be said that the CC:

- Causes nearly as much calorie expenditure as the treadmill with the impact of the elliptical.
- Feels more difficult due to the recruitment of stabilizer muscles due to its compliant surface.