

The Effect of Environment on Running Performance and Rating of Perceived Exertion (RPE)

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INTRODUCTION

Our research is aimed to analyze how running surfaces impact performance, in terms of time, and perceived rates of exertion (RPE). The variables of interest are time, heart rate (HR), and RPEs. HR is a measure of the number of times an individual's heart beats per minute; RPE is a subjective measurement of how hard an individual perceives he/she is working. The Borg RPE Scale was utilized throughout this research. This particular scale ranges from 6-20. The increasing numbers on the scale correspond to an increase in how hard an individual perceives they are working. Multiplying the Borg RPE Scale by ten gives a comparative heart rate for the activity level. For example, when multiplying the lowest ranking, six, by ten you get an approximate heart rate of 60bpm, which is an average resting heart rate. So, an individual who perceives they are at minimal exertion would report an RPE of six.

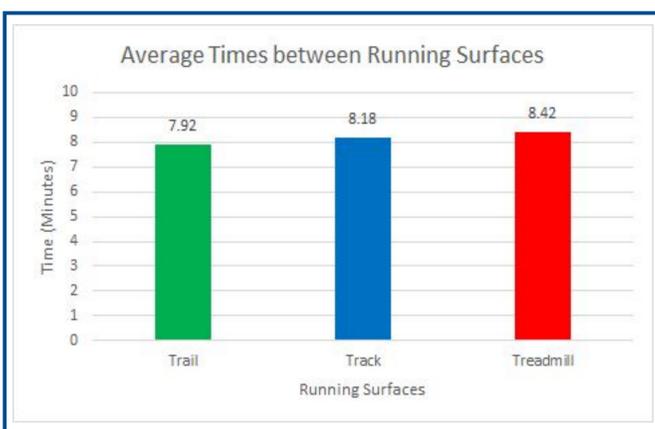
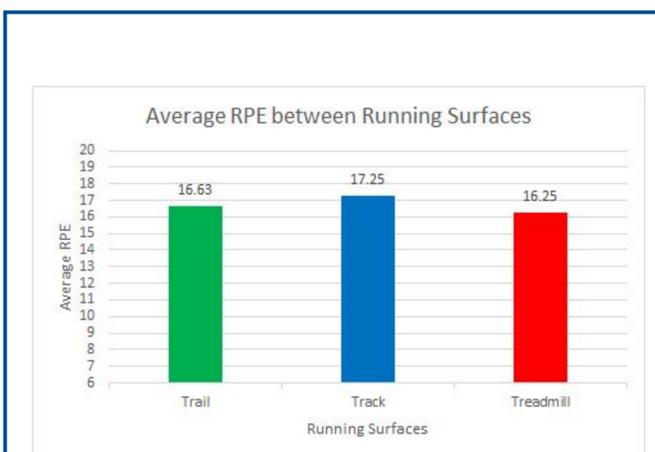
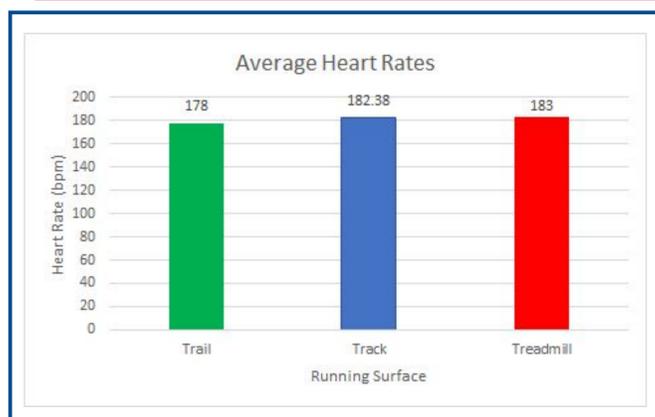
This research is particularly beneficial to college-aged, non-athletes who desire to know what running surface will promote the best performance during their workout. We will investigate the variables of time, HR, and RPE while subjects run on three different running surfaces. Testing on three different running surfaces will enable us to detect possible differences and/or similarities between the three surfaces. We hypothesize that the participants will perform more efficiently and have lower RPEs when running on an outdoor trail compared to the indoor surfaces of a running track and treadmill.

METHODS

Eight non-athlete, college-aged (18-23 years old) males and females, chosen through non-random sampling, will complete three separate one-mile runs on three different running surfaces. An outdoor concrete trail, a treadmill, and an indoor track are the three running surfaces of interest. Subjects will be asked to complete each mile run without knowledge of their time. Subjects will be asked to stretch prior to each run and water intake will be encouraged throughout testing. Testers will be stationed to record heart rate (HR), rating of perceived exertion (RPE), and time of each subject. HR will be recorded prior to starting the mile, at the half-mile mark, and at the one-mile mark. An Apple Watch will be utilized to record HR. RPE will be recorded at every quarter-mile mark with the Borg RPE Scale. Although multiple HRs and RPEs will be recorded, our data analysis will utilize individuals final HR and final stated RPE for each of their one-mile runs. A questionnaire will be utilized to supplement our data analysis.

The programs Microsoft Excel and SPSS will be utilized to analyze our data. SPSS will be used to compare the three variables (HR, RPE, and time) on each running surface. SPSS will be employed to calculate any correlations or associations between data points and running surfaces, through the use of paired sample T-tests. Subjects' answers to the questionnaire will be compared for any similarities or differences that may enhance our data analysis. This analysis will allow for a better understanding of differences and/or similarities in performance due to running surfaces and gender.

RESULTS



- Our results found that there is no significant difference between the three running surfaces on HR, RPE, and time; all p values were greater than .05
- The average HRs of each surface were relatively close in numerical value; the greatest difference between to surfaces was when comparing trail and treadmill surfaces (difference of 5bpm)
- The average RPEs were within one rating of each other.
- The lowest average running time was on the outdoor trail, still this is not a significant difference
- When asked prior to testing, each subject indicated that their preferred running surface was the outdoor trail.

Subject	What is your preferred running surface?	On which running surface do you think you had the best performance?	How likely are you to change your preferred running surface after seeing your results?	Did you perform best on your preferred running surface?
Female 1	Outdoor	Treadmill	Very likely, will probably change it to track	Yes
Female 2	Outdoor	Treadmill	I will probably run on the track more	No
Female 3	Outdoor	Outdoor	Will continue to run outside	Yes
Female 4	Outdoor	Outdoor	Will stay the same	Yes
Male 1	Outdoor	Outdoor	I will probably run on the trail or outside surfaces more.	Yes
Male 2	Outdoor	Treadmill	Will probably run on the treadmill primarily.	No
Male 3	Outdoor	Outdoor	Unlikely.	Yes
Male 4	Outdoor	Treadmill	Very unlikely.	Yes

CONCLUSION

In the end, statistical analysis found that there is no significant difference between the three running surfaces on individual running performance ($p > .05$). All three variables, HR, RPE and time, were unaffected by the differing running surfaces tested. Insignificant data leads us to believe that an individual will achieve virtually the same performance level when running on any of the three surfaces tested. We must reject our initial hypothesis that a certain trail surface would lead to optimal performance.

Based off of the subject questionnaire, all subjects said that their preferred running surface would be the outdoor trail surface. Half of the subjects thought they had performed their best on the treadmill while the other half thought they performed their best on the trail. There were no preferences for the indoor track. Only 2 of the subjects did not perform their best on their preferred running surfaces. In conclusion, the outdoor surface of the trail was the most popular running surface throughout this study.

DISCUSSION OF RESULTS

There have been many studies that investigate the ways in which we exercise and the personal preferences that people choose to feel the most comfortable while they are exercising. As we can see, there are many ways that people exercise daily and one of the most common means of exercise is to go for a run/jog. While there are many places and surfaces that people can run on, the study under investigation was to determine on which surface, trail, track or treadmill, runners best perform.

Our study investigates college-aged males and females, but this study is applicable to a variety of demographics. This research will allow individuals to look into which running surface is the best for both the quality and the quantity of a workout.

The primary hypothesis of this study was that subjects will perform better on the outdoor trail surface and have lower heart rates and RPE scores compared to on indoor track and treadmill surfaces. The data that was collected between the three surfaces was very similar in certain areas; however, there was no significant difference found across the scope of analysis. In the end, we would encourage individuals to choose a running surface that they feel most comfortable with. Our data suggests that an individual's performance will not be hindered due to differing running surfaces. Psychology plays a role in motivation; we ultimately suggests that individuals run on the surface which they are most motivated by.

REFERENCES

- Borg G.A. Psychophysical bases of perceived exertion. *Medicine and Science in Sports and Exercise*. 1982; 14:377-381.
- Elliott, B. C., & Blanksby, B. A. (1976). A cinematographic analysis of overground and treadmill running by males and females. *Medicine and Science in Sports*,8(2), 84-87. Retrieved March 6, 2019.
- Nigg BM, DeBoer RW, Fischer V. A kinematic comparison of overground and treadmill running. *Med Sci Sports Exerc*. 1995; 27(1):98-105.
- Van Ingen Schenau, G. (1980). Some fundamental aspects of the biomechanics of overground versus treadmill locomotion. *Medicine & Science in Sports & Exercise*,12(4), 257-261. Retrieved March 5, 2019.

ACKNOWLEDGEMENTS

We thank the subjects who volunteered for this study. We would also like to thank Dr. Pu for his guidance in this research.