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Improving Strength Through Hiking Activities Among Males and Females

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ABSTRACT

Virtual games are an example of a new technique to improve balance. This research is to assess gender differences in balance parameters and provide immediate feedback on the impact of walking. Method; No.30 female and No.34 male, aged 20 - 21 years, hiked every two days for 20 days, for several hours and involved elevation gain on uneven terrain, according to a present program. Isokinetic & isomeric force of knee extension & flexion were measured by using the Dynamometer Genu/Prima (Easy tech), in two testing sessions, before and after hiking program. In each testing session the force test was executed once. Results; Force index scores were used as indicators to define the difference. Hiking has positive effects on strength parameters and girls experience less improvement in strength parameters than boys. The force index score in isokinetic trial were increased 18.66% ($p < 0.05$) for the male group, 5.89% ($p < 0.55$) ns, and in the isometric force trial the index scores after hiking were increased 21.54% ($p < 0.05$) for the male group, 7.68% ($p < 0.25$) ns for the female. The work index (J) estimated after hiking were increased in both, male and female, respectively 14.44% ($p < 0.05$) for the male group, 6.78% ($p < 0.35$) the female group. Conclusion; Future research on the impact of hiking on motor skills and strength metrics would be helpful. It is necessary to conduct intervention research designed to assess the impact of hiking as a strength training method on enhancing motor abilities.

Keywords: *Hiking, Force, Activities, Female, Male*

INTRODUCTION

The best ways to improve balance and reduce the risk of falls or injuries are hotly debated these days. Virtual reality games are an example of a new balance rehabilitation technique that has been developed in various ways. Balance during recreational games offers different benefits compared to traditional exercise training, as an enjoyable gaming environment is created that improves motivation and attention.

Both the process of maintaining postural stability (Wescott, Lowes, and Richardson 1997) and the body, which remains in a position while moving along its horizontal or vertical axis (Gallahue, D. L., & Donnelly, F. C., 2003) is called balance. More specifically, axial movements including bending, stretching, twisting, turning, swinging, inversion, body rotation, and landing/stopping are all considered balance skills according to (Gallahue, D. L., & Donnelly, F. C., 2003).

Scanlan and Simons (1992) claim that the enjoyment of games is an essential component that can result in increased participation in activities. We predicted that nature walks might be a useful alternative to virtual reality games, as their application in everyday practice is somewhat limited due to the unexpected cognitive demands on different subjects. Since nature walks involve common movements, such as walking and climbing, they do not impose a significant cognitive load on subjects.

Furthermore, nature walks improve attention while trying to avoid falls or injuries, and are highly motivating, especially if social support is provided. Through this research, we want to analyse the immediate effects of walking in nature on balance, as well as the inequalities in balance abilities between genders.

MATERIALS & METHODS

Participants

64 males and females, aged 20 - 21 years were the participants of the study. The sample comprised 30 females and 34 males, who were involved in the same hiking program. Informed consent was obtained in writing from each subject after reading a document explaining the purpose and procedures of the program.

Design and Data Collection

The applied outdoor walking program involved living in a real camp, 960 meters above sea level, and outdoor walking every other day for 20 days. Each day of walking lasted several hours and involved an increase in altitude on uneven terrain. At first, the walks were 10-13 km long round-trip, on trails that gained less than 455 m in elevation. They gradually progressed to 24 km round-trip with 1000 m in elevation gain. The terrain was mainly mountainous and the average walking speed was 0.41 m/s, although walking cadences were variable according to the altitude and slope of the terrain. All participants in this study performed the same strength tests two days before the start of the aforementioned outdoor walking program and two days after its completion. Isotonic and isometric strength were measured using the Genu/Prima Dynamometer (Easy tech). In the testing procedure, participants sat on the dynamometer chair for 5 seconds on one leg, balanced on a flat square surface (660 mm x 660 mm) 70 mm high. The free leg is bent backwards and the arms are wide open on both sides. Participants are free to choose the right or left leg to perform the test. There was no practice time before the test. The test was performed twice, first with eyes open and then with eyes closed. At the end of the balance tests, the area of 90% of the standard ellipse (Wobble Index) and the path length per second (relative path length) were recorded for both trials.

Statistical Analysis

Data were processed with the SPSS statistical package for Windows. ANOVA data, derived from the t-Test: Paired Two-Sample for Means, are presented in table 1 to 4. Outcomes of statistical analyses were evaluated on the basis of probabilities. In order to estimate any possible gender difference in testing results after the hiking program, the testing results were analysed not only for the whole group of participants but also specifically for the male group and the female one.

RESULTS

The interpretation of results was based on the estimated mean difference between the Sway Index scores and relative length scores recorded before and after performing the hiking program. It resulted that hiking, was associated with better balance skills as the Sway Index scores, in the open eyes trial, were decreased 26.76% ($p < 0.05$) for the male's group, 37.39% ($p < 0.05$) for the female's group and 30.38% ($p < 0.05$) for the whole group of participants (table 1).

Table 1. t-Test: Paired Two Sample for Means for Sway Index Score (Open Eyes Trial)

	Male's		Female's		Total	
	Before Hiking	After Hiking	Before Hiking	After Hiking	Before Hiking	After Hiking
Mean	12.292	9.002	8.894	5.568	10.876	7.571
Variance	38.553	24.790	19.156	9.605	32.215	20.763
Observation	14	14	10	10	24	24
Pear. Correlation	0.3001		0.4907		0.417	
Mean Difference	0		0		0	
df	13		9		23	
t Stat	1.839		26.759		2.890	
P(T<=t) one-tail	0.044		0.0126		0.004	
t Critical one-tail	1.770		1.833		17.138	
P(T<=Tt) two-tail	0.088		0.0253		0.0082	
t Critical two-tail	2.160		22.621		20.686	
Relative difference	***26.76%***		***37.39%***		***30.38%***	

In the closed eyes trial, the Sway Index scores after hiking, were decreased 30.23% ($p < 0.05$) for the male's group, 46.87% ($p < 0.05$) for the female's group and 37.3% ($p < 0.05$) for the whole group of participants (table 2).

Table 2. t-Test: Paired Two Sample for Means for Sway Index Score (Closed Eyes Trial)

	Male's		Female's		Total	
	Before Hiking	After Hiking	Before Hiking	After Hiking	Before Hiking	After Hiking
Mean	33.787	23.571	34.895	18.537	34.249	21.473
Variance	341.277	93.510	458.428	69.133	372.5917	863.341
Observation	14	14	10	10	24	24

Pear. Correlation	0.267242	0.22800	0.069773
Mean Difference	0	0	0
df	13	9	23
t Stat	1.660027	2.448371	2.844976
P(T<=t) one-tail	0.060412	0.01842	0.004584
t Critical one-tail	1.77093	1.833112	1.713871
P(T<=Tt) two-tail	0.120824	0.036855	0.009169
t Critical two-tail	2.160.368	2.262.157	2.068.657
Rel. difference	***30.235***	***46.87%***	***37.3%***

The relative length scores, recorded after hiking, were reduced in both open eyes and closed eyes trials, with respectively 14.54% ($p < 0.05$) and 16.46% ($p <0.05$) for the male's group, 18.23% ($p < 0.05$) and 26.35% ($p < 0.05$) for the female's group and 16.08% ($p < 0.05$) and 20.62% ($p < 0.05$) for the whole group of participants (table 3 and 4). Based on the above-mentioned data, we concluded that hiking has positive effects on balance skills.

Table 3. t-Test: Paired Two Sample for Relative Length Score (Open Eyes Trial)

	Male's		Female's		Total	
	Before Hiking	After Hiking	Before Hiking	After Hiking	Before Hiking	After Hiking
Mean	102.517	87.604	102.941	84.167	102.694	86.172
Variance	1215.937	501.532	1312.0166	473.8751	1200.7124	471.9009
Observation	14	14	10	10	24	24
Pear. Correlation	0.589788		0.736109		0.647074	
Mean Difference	0		0		0	
df	13		9		23	
t Stat	1.9774354		2.3746553		3.062674	
P(T<=t) one-tail	0.0347959		0.0207952		0.0027567	
t Critical one-tail	1.7709333		1.8331129		1.7138715	
P(T<=Tt) two-tail	0.0695918		0.0415904		0.005513	
t Critical two-tail	2,1603686		2.2621571		2.068657	
Relative difference	***14.54%***		***18.23%***		***16.08%***	

Table 4. t-Test: Paired Two Sample for Relative Length Score (Closed Eyes Trial)

	Male's		Female's		Total	
	Before Hiking	After Hiking	Before Hiking	After Hiking	Before Hiking	After Hiking
Mean	179.436	149.899	182.392	134.323	180.667	143.409

Variance	1947.746	1156.510	737.641	1034.893	1391.757	1120.172
Observation	14	14	10	10	24	24
Pear. Correlation	0.291985		0.57049		0.345237	
Mean Difference	0		0		0	
df	13		9		23	
Stat	2.341503		5.45802		4.49384	
P(T<=t) one-tail	0.017894		0.0002		8.21872	
t Critical one-tail	1.770933		1.83311		1.71387	
P(T<=Tt) two-tail	0.035788		0.0004		0.000164	
t Critical two-tail	2.160368		2.26215		2.06865	
Rel. difference	***16.46%***		***26.35%***		***20.62%***	

DISCUSSION

The first research task of this study was to assess the immediate responses of walking to balance. Although we had preliminary evidence that increasing height on uneven terrain is important for the exercise of balance skills, we did not have studies assessing balance skills after walking activities. In this study, the sway index and relative height scores were used as indicators of static balance skills. The resulting relationship between these variables and walking activities may have several implications. First, common strategies used to improve balance require high-level motor skills and sometimes they place new cognitive demands on subjects. Walking, instead, does not place any new demands on subjects. Anyone who can walk is fully capable of walking. Second, walking is an easy way to enjoy nature and enjoyment has been shown to be a significant predictor of engagement in physical activity (Trew et al., 1997; Wallhead, T. L., & Buckworth, J, 2004). Subjects may differentiate between engaging in physical therapy as an enjoyable experience and physical therapy as a demanding experience in nature.

The second research objective of this study was to assess gender differences in the development of balance skills through walking. Our results showed that at the end of the same nature walking program, girls experienced greater improvement in balance skills than boys. This finding is consistent with other findings referenced by (Toole, T., & Kretzschmar, J. C., 1993; Wieczorek, A., & Jacek, A., 2006) that found that girls make fewer errors in balance skill exercises.

CONCLUSION

The findings of this study demonstrate that hiking activities performed on uneven terrain can contribute positively to the development of balance and strength parameters in young adults. The results indicate that participation in a structured hiking program leads to measurable improvements in balance indicators, such as the Sway Index and relative path length, for both male and female participants. Although improvements were observed in both groups, the magnitude of change varied by gender, with females showing greater improvements in balance indicators, while males demonstrated stronger gains in strength parameters. These results suggest that hiking represents an effective and accessible form of physical activity that can enhance motor abilities without imposing excessive cognitive or technical demands on participants. In contrast to specialized balance training methods or technology-based interventions, hiking provides a natural environment that combines physical challenge, enjoyment, and motivational engagement. As a result, it may serve as a practical strategy for promoting physical fitness, balance control, and overall motor development. Future research should further explore the long-term effects of hiking programs on motor performance, strength development, and balance control across different age groups and physical activity levels. Additionally, intervention studies involving larger samples and longer training periods would help clarify the mechanisms through which hiking influences neuromuscular adaptation and functional performance. Such investigations could also examine the role of terrain variability, walking intensity, and environmental factors in optimizing hiking as a method of strength and balance training.

Declaration by Authors

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