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**EFFECTS OF SIX-WEEK TRX TRAINING ON PHYSICAL SKILLS
IN FEMALE SKIER STUDENTS**

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Abstract

In this paper we proposed to examine the effect of six-week TRX Suspension Training on some physical skills like strength, endurance and coordination in upper and lower limbs, endurance of the back/core, stability and balance. The effect of the TRX Suspension Training on physical skills was evaluated using five pre and posttests. The subjects that were analyzed participated in three weekly 45-50 minutes training sessions in a 6 week period.

Descriptive statistic and t-Test at ($\alpha=0.05$) were used to analyze the data obtained from the five subject of the research. The results showed that there was a significant difference in four out of five tests that were used. According to the results, the TRX Suspension Training program produced significant benefits to the subjects that were analyzed by increasing the levels of physical and functional fitness. Suspension training is an effective workout system that demands generating and controlling strength in a dynamic and changing environment.

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1. Introduction

Before you get too deep into a TRX training regimen you may want a little background on exactly how and why Suspension Training and body weight exercise is such an effective way to build total body athleticism. Strength training utilizing suspended bodyweight began more than 150 years ago. Generations of acrobats and gymnasts have used their own bodyweight and gravity as resistance--



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suspended from rings, ropes, and trapeze bars-to generate tremendous, strength and the astonishing physiques that are a hallmark of these athletes.

(<https://www.trxtraining.com/train/functional-suspension-training-and-trx>)

Suspension training exercises may help adjacent muscle groups to work together in a synergistic fashion, or as a single unit. This is one of the primary focal points of any type of functional training. A secondary, albeit apparent feature to suspension training, is the added core stability, balance, and coordination demands seen in almost every exercise.

(<https://www.ncsf.org/enev/articles/articles-supsensiontrainingoverview.aspx>)

A recent study (Mate-Munoz et. al, 2014) shows that TRX training provides the same benefits as conventional weight training. The study shows that TRX Suspension Training helps build strength, increase movement capacity and develop power.

Another article (McGill et. al, 2014) sought to find out the effects of using TRX suspension training straps. The researchers compared pressing exercises done with the TRX to more traditional versions of the exercises. The study showed that instability associated with the labile exercises required greater torso muscle activity than when performed on stable surfaces.

The fitness profiles of alpine skiers differs significantly to their cross country counterparts. A great reliance is placed on anaerobic metabolism - power, power endurance and muscular strength (Andersen, Montgomery, 1988). Even though moderate to high values for aerobic power are recorded in elite downhill skiers (Neumayr et. al, 2003), this may be due to their training rather than a direct result of competing (Andersen RE, Montgomery, 1988; Saibene et al., 1985). Alpine skiers must be able to react quickly to changes in terrain and the course outline requiring agility, balance and co-ordination (Bompa, 1999).

Downhill skiing forces the athlete into a crouched position placing significant strain on the knees. Not surprisingly, elite skiers have strong legs when measured during isometric and isokinetic leg extensions (Neumayr et. al, 2003). Leg strength is also a predictor in downhill and giant slalom events (Andersen, Montgomery, 1988).

2. Methodology

2.1. Participants

The research is of applied nature and semi-experimental. The subjects that were analyzed were university skier students (N=5), female gender, with ages between 19-21. For this study five female skiers were chosen randomly, after which they signed consent forms. We used a recorded sheet to obtain information regarding their health and medical history. Their weight ranged from 58-68 kilograms and their height from 1,69-1,71 centimeters.

2.2. Measurement

The effect of six-week TRX Suspension Training on some physical skills like strength, endurance and coordination in upper and lower limbs, endurance of the back/core, stability and balance was

measured by performing the initial testing and after six-weeks of using the TRX stripes the final testing using five tests. The five subjects that were investigated performed the planned training program.

For the current study we used the following tests: 20 m Multistage Fitness Test (Beep Test), Balance Board Test, Penta Jump (5 consecutive Jumps) single leg - Right leg, Penta Jump (5 consecutive Jumps) single leg - Left leg, Plank test, Relative Bench Press Test.

2.3. Procedure

The TRX Suspension Training program consisted of 3 sessions/week in a period of 6 weeks and was supervised by two university lecturers with a PhD in the domain of Physical education and Sport. We used 8 exercises made in 3 series. The subjects trained for each exercise for 30 sec. with 10 sec. break between repetitions. After the 4th exercise they had a rest interval of 45 sec. The training duration was 50-60 minutes including the preparation for the specific effort. The amount of training pressure was gradually increased in every week. The exercises that we used involved the training of upper and lower body, core strengthening, coordination and stability by using the following exercises: trx squats, trx frontal and lateral lunges, trx crossing balance lunges, trx squat jumps, trx planks - lateral and frontal, trx low rows, trx chest presses, trx biceps curls, trx triceps press, trx power pull, trx standing rollout, trx hip drop, trx mountain climber, trx hamstring runner, trx atomic push-up, trx sprinter start, trx hamstring curl, trx hip press. The intensity of each exercise was modified by selecting stance, choosing body angles and workout procedure. Before any physical activity, it was necessary to warm up sufficiently. The warm-up served as an adaptation of the whole body to a physical strain and strenuous performance.

2.4. Statistical Analysis

To prove the efficiency of the TRX Suspension Training program we used a paired t-test with $\alpha=0.05$. Statistics were analyzed using SPSS ver. 16.

2.5. Research hypothesis

We started from the assumption that by using a well developed TRX Suspension Training program upon female skier students we can influence the general and specific physical abilities, enhances the nervous system's ability to effectively coordinate movement at higher levels and build strong motor patterns, increase stabilization and functional muscle mass.

3. Results

In table 1 we present the findings of the research. The data indicate by comparison that the TRX Suspension Training program determined significant increase in strength, endurance and coordination in upper and lower limbs, endurance of the back/core, stability and balance.

Table 1. Results obtained by the subjects submitted to the research

Variables	Pre-test	Post-test	significance*
	Mean/Standard deviation		
20 m Multistage Fitness Test (Beep Test) (number of shuttles)	7,6±0,547	10,74±0,798	6,885*
Balance Board Test (number of counts, 1 count = 0,3 sec.)	82±8,366	100±7,071	3,665*
Penta Jump (5 consecutive Jumps) single leg - Right leg (meters)	7,84±0,594	9,88±0,878	4,312*
Penta Jump (5 consecutive Jumps) single leg - Left leg (meters)	7,62±0,554	9,44±0,873	3,956*
Plank test (minutes)	2,2±0,57	4,4±1,14	3,533*
Relative Bench Press Test (number of reps with 75% bodyweight)	2,8±0,836	4±0,707	2,459

4. Discussions and Conclusion

The main finding of the research is that the exercises from the TRX Suspension Training program improved physical abilities namely strength, endurance in the upper and lower limbs, coordination, anaerobic and aerobic effort, endurance of the back/core by stabilizing muscles, balance and stability.

Statistical analysis of the data obtained in the current study showed that the 6 week TRX Suspension Training made 3 times/week caused significant increase of all the parameters that were targeted.

Regarding the aerobic and anaerobic effort we can state that the values registered by the five subjects understudy in the post-test are better than the ones obtained in the initial testing, the mean increased from 7,6 to 10,74 and the $t=6,885$ which means that there are significant differences between the to testing periods.

The results obtained at the Balance board test show that the female skier students increased their skills, the mean grew from 82 to 100 counts.

At the Penta Jump – right and left leg we can see that the mean increased from the value of 7,84 to 9,88 regarding the right leg and from 7,62 to 9,44 for the left leg, which means that the subjects improved their strength in the lower limbs.

The data obtained at Plank test, which shows the endurance of the back/core stabilizing muscles, prove that the students obtained better values, the mean registered in the initial testing was 2,2 compared with the value of 4,4 registered at the final testing. The paired T-test for the pre and post-test show a significant difference between the obtained values $\alpha < 0.05$, which means that the subjects improved their core muscle strength.

Research findings from the Relative Bench Press Test indicate that there is no significant difference in the final testing, although the mean increased from 2,8 to 4.

In conclusion, the TRX Suspension Training program that was used in the research produced significant benefits on the physical skills. According to the results obtained in this study we can state that

TRX exercises used for a 6 week period can positively influence the physical abilities of female skier students.

Every movement you produce while using TRX is demanding for your body in terms of stability and direct forces that later translate into better performance in sports and life in general.

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