Research Paper Physical Education

Combination of Uphill and Downhill Training on Knee Kinematics and Speed Performance

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ABSTRACT

The purpose of the study was to find out the effect of combination of uphill and downhill training on knee kinematics and speed performance among college male students. For this study, twelve men students from Manner Thiumalai Naicker College, Pasumalai, Madurai were selected randomly as subjects. Selected variables knee kinematics (namely angle of knee flexion at foot strike and angle of knee extension at foot strike) and speed performance was tested at the beginning and end of six- week experimental treatment. The collected data was statistically analyzed by using dependent 't' test. It was found that there was significant improvement on speed performance and knee kinematics.

KEYWORDS : knee kinematics, uphill and downhill running

Introduction

Sports training professionals consider resisted speed training as the most efficient sprint training technique on the planet, while other consider it not as effective because of a biomechanical stand point. Different resisted speed strategies include, towing, uphill sprints, sand sprints, and weighted sprints (**Pourciau Brent, 2008**). Running as a form of locomotion has been extensively researched (**Di Prampero, et al., (1993), Paradisis, et al., (2009) and Sraab, et al., (1992)**). In recent years uphill running has attracted interest for several reasons. Firstly, slight (2%) inclines and gradients are frequently evident during endurance races such as the marathon. During competition, slopes can affect kinematic parameters, such as decreased step length and increased step frequency (**Padulo, et al., 2011**) thus increasing the energy cost of running (**Tversenig and Mcmallon, 1992**). Consequently this may affect overall performance. Secondly, sloping surfaces (-7 %) are widely used by coaches in order to improve lower limb muscle strength, thus improving level running performance (**Tversenig and Mcmallon, 1992**). Research has identified that running uphill alters kinematic parameters such as decreased step length and increased step frequency, in which the studied differences continue to progress when further increasing slopes, as studied in medium and high level runners (**Padulo, et al., 2011**). Biomechanical characteristics of human locomotion that is, walking and running at different speeds and slopes have been well documented in literature together with mechanical efficiency (**Cavagna, et al., 1976**). The present study analyzes the effect of combination of uphill and downhill sprint training on kinematic and speed performance of college students.

Objectives

The objective of the study was: to findout the effect of combination of uphill and downhill training on knee kinematics and speed performance.

Methods

To achieve the purpose of the study, twelve men students from Manner Thiumalai Naicker College, Pasumalai, Madurai were selected randomly as subjects. Selected subjects were underwent combination of uphill and downhill training for 6 weeks, 3 sessions per week. All the subjects were tested on knee kinematics (namely angle of knee flexion at foot strike and angle of knee extension at foot strike) prior to and immediately after the training period. Natural uphill and downhill area was used as the training zone, the elevation/slope degree was 6.58 degree. Data were collected during the 100meters trial. Subjects' 100meters trial timing was considered as the speed performance. Subjects' motion were Videotaped at 30 frames per second and two video camera was fixed at a distance of 8m from the outer edge of the 8th lane. One camera was fixed at the 30meters of 100m races and the other at the 80meters of 100m races to observe the knee kinematics. The video was observed with the help of *Quintic* Sports Biomechanics Video Analysis Software (trial version) on knee kinematics namely angle of knee flexion at foot strike and angle of knee extension at foot strike. After repeated observation the angle of the above mentioned parameters was found-out and recorded in degrees. To achieve the purpose of the study paired 't' test was used as a statistical technique. The level of significance was fixed at 0.05 level.

Analysis of Data

Table I

THE SUMMARY OF MEANS AND DEPENDENT 't' TEST FOR THE PRE AND POSTTEST ON SELECTED VARIABLES

Variables		Mean ± SD		't' ratio
		Pre test	Post test	
30meters	Angle of Knee Flexion at Foot Strike	37.36 ±5.36	36.10 ±4.87	4.39*
	Angle of Knee Extension at Foot Strike	143.48 ±10.18	145.48 ±9.29	4.17*
80meters	Angle of Knee Flexion at Foot Strike	39.23 ±5.56	38.23 ±5.39	5.477*
	Angle of Knee Extension at Foot Strike	146.24 ±5.39	147.83 ±5.05	10.09*
Speed Performance		11.43 ±0.36	11.39 ±0.38	4.69*

*Significant t = (11) (0.05) = 2.201

Results

The analysis of the data reveals that there was a significant variance in knee kinematics between the pre and after the experimental periods.

The results of the study indicate that there was a significant improvement in speed performance between the pre and after the experimental periods.

Discussions

As shown in earlier studies, performance in sprint races depends on several factors. According to **Kraaijenhof**, **(1990)**, of there are four factors affecting the 100m run results: body build, neuro-muscular system, biochemical and physiological adaptation to short-term efforts and biomechanics. The biomechanical efficiency is one of the three components (the other two being metabolic system and neuro- logical efficiency) of speed distinguished by **Hunington, (1993)**. **Buczek and Cavanagh, (1990)**, stated that peak knee flexion angle and knee flexion angle were improved due to the influence of slope (-4.74˚ (-8.3%) with 4.5m/s speed) training. In the present research findings also confirmed that combination of uphill and downhill training influence the angle of knee flexion and extension at foot strike. **Paradisis and Cooke (2006)**, confirmed in his experimental study combined uphill–downhill training method was substantially more effective in improving the maximum running speed in experienced sprinters than a traditional horizontal training

method. The present research findings also in line with the view point of **Paradisis and Cooke (2006)**.

Conclusions

From results, it was concluded that Six weeks of regular uphill and downhill sprint training had shown significant improvement in angle of knee flexion and extension at foot strike at 30 and 80 meters of 100meter race.

From this study it was also concluded that Combination of uphill and downhill training had shown significant improvement in 100meters speed performance of college male athletes.

From the results the researcher may concluded that, the combination of uphill and downhill sprint training had shown same result in knee kinematics at 30meters and 80meters of 100meters race, it means that knee kinematics were improved by doing these training.

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