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Efficacy of Barefoot Training Versus Shoes-On Training on Agility Among the South Indian Coastal Sprinters

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ABSTRACT

Background: Agility is essential for sprinters especially in the coast to improve their athletic performance as it requires effective change of direction while still maintaining at a high speed. Some form of special education is needed. Barefoot training proponents claim that by strengthening the feet and ankles as well as enhancing proprioception and sensory feedback, they can increase agility on the track. Aim: The objective of this investigation was to compare the effectiveness of barefoot training vs training with shoes on sprinters' agility.

Methodology: A true experimental study was carried out with 75 participants who were sprinters. They were included in this study based on the selection criteria and signed consent form and participants information sheet. All participants divided into three groups on the basis of training i.e, group A (barefoot), group B (shoes-on) and group C (control group). All groups were assessed with speed test and Illinois agility test before initiating training. For intervention 6 – weeks plyometric training protocol has been used. Plyometric training has been given to group A with barefoot, group B with shoes-on and group C performance only their regular drills. This intervention has been carried out for 5 times per week for 6-weeks of training protocol. After 6 weeks all the participants were again assessed. Then pre and post value of speed test and Illinois agility test has been analysed using paired t test and ANOVA test.

Results: The data analysis of this present study shows that there was a significant difference between groups and within groups in both speed test and Illinois agility test.

Conclusion: The analysis between groups indicates that barefoot training group has more significant improvement when compared to shoes-on training group and control group. Hence, the plyometric special education in barefoot shows greater effect in improving the athletic performance of sprinters of the South Indian coast.

1. Introduction

Coastal life is invigorating. The salty air invades your senses, while the sound of waves crashing on the shore brings calmness. Sprinters performance was developed throughout life by means of growth, maturation and training. Male and female sprinters agility had been improved at the age of 18 years by 8%. Specialized training that had given to the athletes could reach peak performance at their young age itself. Traditionally categories for 100 meters sprint may include acceleration, maximal velocity, and deceleration. Whereas key underlying determinant foe 100-m sprint performance were power, technique and sprint-specific endurance [1]. Our body's ability to move rapidly and deftly, change directions, and adjust its position while movement is known as agility. Speed and agility are crucial for bringing an athlete's athletic performance to the next level, regardless of the sport they compete. In addition to improving athletic performance, agility

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training offers numerous other benefits. Whether an athlete wants to improve speed, shorten recovery times, or just balance their movements, agility training is essential for maintaining athletic performance. [2,3]. Exercise that is performed barefoot is done without shoes or with very little covering for the feet. The human body is built to function without outside support for the feet. Stabilizer muscles and connective tissue abruptly contract when we train barefoot. Gains in foot strength aid to enhance body awareness, balance, and alignment. Running athletes who have high proprioception are aware of where their bodies are in space. The plantar surface of the feet has a significant impact on how muscles link and how the body moves. To help the body transfer weight while maintaining stability, proprioceptors help engage the muscles in the feet. The outcomes for the athletes will be better if these proprioceptors are firing [4,5]. Running shoes have inbuilt shock absorbers that can help protect athletes from common injuries related to their type of workout. Choosing the right shoe can help. Numerous ailments might result from wearing the wrong fitness shoes. Poorly fitting shoes can make metatarsalgia, a disorder that causes discomfort in the ball of the foot, worse. The American Orthopaedic Foot & Ankle Society advises that the athlete's choice of shoe should be based on the sport they participate in the most. Choose a suitable athletic shoe if they work out a certain way three times a week or more [6]. To develop muscle power, plyometric exercise training uses the force and speed of various actions. Your physical prowess and range of motion can both be enhanced by plyometric exercise. Exercises that fall under the category of plyometrics include pushups, throwing, running, jumping, and kicking. Although anyone can perform these exercises, athletes frequently use plyometrics as part of their preparation. Plyometric exercises are used by those undergoing physical rehabilitation after an accident or injury to help them regain their physical fitness and function [7,8]. Significant correlation between the Illinois Agility Test and leg power has been conducted. The partial correlation control of the speed demonstrates that the considerable association between IAT and leg power has vanished.. Finally, they have concluded that compare to leg power, IAT has a validity and reliability in correlating more to speed [13]. Comparison of the IAT and the Edgren Sidestep Test and the T-Test has also been demonstrated and shows that the Illinois agility test had a great valid and reliable correlation when compared to other tests. It also says that the IAT can provide assessment tool of high level [14]. Physiological adaptations and biomechanical variations have both been linked to some degree of change over time. Increased mechanical movement, connected with stride frequency, as well as better muscle contractions and ground contacts per minute—all of which have been observed in plyometric exercise—are present in stimulated BT. This enhances athletes' neuromuscular responses to exercise. The study result shows that running has improved because of tendons and muscles recovering elastic energy more successfully. BF runners have been found to have increased plantar flexor involvement, which has a significant effect on ground response force loading [11,17].

2. Methodology

A true experimental study was carried out on agility among coastal sprinters. For this study, 75 sprinters were included from Sri Balaji Vidyapeeth University students situated in the coast of Bay of Bengal and they were selected with baseline of criteria. The inclusion criteria may include Sprinters, Age group between above 18-25 years, Male population, Injury free for last 3-6 months and Samples included who pass the agility T – test with the score between 9.5 – 11.5sec and the exclusion criteria are Age above 25 year, Female population, Any cardiac and respiratory related conditions, Severe injury to LE for at least past 3 months and Recent surgery to LE. After selection criteria, 75 participants were recruited in this study. Participants were divided into groups. In this present study samples have been parted into three groups and each group consists of 25 samples. Group A and Group B were the experimental groups whereas Group C acted as the control group. All participants were assessed with Speed test and Illinois Agility test and this has been used as a outcome measure. After pre test assessment intervention had given to all groups. For Group A, plyometric training in barefoot along with regular drills were trained. For Group B, plyometric training in shoes-on along with regular drills were trained. For Group C, only their regular drills were encouraged. Duration for this intervention

was 5 times per week for 6 – week. After completing 6 – weeks of intervention all 75 participants were again reassessed for post test with same outcome i,e. Speed test and Illinois Agility test and were documented.

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Based on the pre test and the results of the post test data, analyses was done

1.1. Training Protocol

6-weeks Plyometric Training Protocol (from Miller MG 2006) [8, 9]

TRAINING WEEK	TRAINING VOLUME (FOOT CONTACT)	PLYOMETRIC DRILL	SETS×REPS
WEEK 1	90	Side to side ankle hops Standing jump and reach Front cone hops	2×15 2×15 5×6
WEEK 2	120	Side to side ankle hops Standing long jump Lateral jump over barrier Double leg hops	2×15 5×6 2×15 5×6
WEEK 3	120	Side to side ankle hops Standing long jump Lateral jump over barrier Double leg jump Lateral cone hops	2×12 4×6 2×12 3×8 2×12
WEEK 4	140	Diagonal cone hops Standing long jump with lateral sprint Lateral cone hops Single leg bounding Lateral jump side leg	4×8 4×8 2×12 4×7 4×6
WEEK 5	140	Diagonal cone hops Standing long jump with lateral sprint Lateral cone hops Single leg bounding Lateral jump side leg	4×8 4×8 2×12 4×7 4×6
WEEK 6	120	Diagonal cone hops Hexagon drills Cone hops with change of direction sprints Double leg hops Lateral jump side leg	2×12 2×12 4×6 3×8 4×6

Fig 1. SIDE TO SIDE HOPS IN BF AND

Fig 2. FRONT CONE HOPS IN BF AND SH

2. STATISTICAL ANALYSIS

The analysis of both the pre- and post-test in the speed test in group A were based on the data collected. The mean and standard deviation of pre test was 5.24±0.449 and post test was 3.90±0.440 respectively. 0.001 was the p-value, and the t-value was 31.66. This demonstrates that the pre- and post-tests differed significantly in table 1. The pre- and post-test analysis of the Illinois Agility test in group A based on the data collected. The average (mean) and the SD of pre test

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was 25.29±2.22and that of the post test was 22.44±1.95 respectively. 0.001 was the p-value, and the t-value was 20.68. This demonstrates that the pre- and the post-tests differed significantly as in table 2. There were statistically significant differences because the level of significance was set at 0.05. The pre- and post-test analysis of the speed test in group B based on the data collected. The mean and standard deviation of pre test was 5.23±0.38 and post test was 4.93±0.30 respectively. 0.001 was the p-value, and the t-value was 10.89. This demonstrates that the pre- and post-tests differed significantly in table 3. There were statistically significant differences because the level of significance was set at 0.05. The pre- and post-test analysis of the Illinois Agility test in group B based on the data collected describe mean and standard deviation of pre test was 25.28±2.187 and post test was 23.88±2.180 respectively. 0.001 was the p-value, and the t-value was 41.67. This demonstrates that the pre- and post-tests differed significantly in table 4. There were statistically significant differences because the level of significance was set at 0.05. The pre- and post-test analysis of the speed test in group C based on the data collected describes mean and standard deviation of pre test was 5.07±0.22 and post test was 5.00±0.19 respectively. 0.001 was the p-value, and the t-value was 6.59. This demonstrates that the pre- and post-tests differed significantly in table 5. There were statistically significant differences because the level of significance was set at 0.05. The pre- and post-test analysis of the Illinois Agility test in group C based on the data collected describes mean and standard deviation of pre test was 26.14±2.42 and post test was 26.02±2.44 respectively. 0.001 was the p-value, and the t-value was 7.06. This demonstrates that the pre- and post-tests differed significantly in table 6. There were statistically significant differences because the level of significance was set at 0.05. Table 7 describe ANOVA analysis between and within all three groups. For Speed test, the sum of square between groups was 18.88,the mean square was 9.44 and F-statistics was 87.31. For Illinois Agility test, the sum of square between groups was 161.55, the mean square was 80.77 and F-statistics was 16.65. This demonstrates that both tests have statistically significant differences (0.001 for both within-group and between-group differences) between groups. Here Alternate Hypothesis has been accepted and N ull Hypothesis has been eliminated.

3. Result Analysis

Table 1: Analysis of Pre-test and Post test through Speed Test of Group A

SPEED TEST	SAMPLE SIZE	MEAN	S.D	T-VALUE	P-VALUE	SIG
PRE_TEST	25	5.24	0.449	31.66	0.001	<0.05
POST_TEST	25	3.9	0.44			

Table 2: Analysis of Pre-test and Post test through Illinois Agility Test of Group A

SPEED TEST	SAMPLE SIZE	MEAN	STANDARD DEVIATION	T-VALUE	P-VALUE	SIG
PRE_TEST	25	5.23	0.38	10.89	0.001	<0.05
POST_TEST	25	4.93	0.3			

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Table 3: Analysis of Pre-test and Post test through Speed Test of Group B

ILLINOIS AGILITY TEST	SAMPLE SIZE	MEAN	STANDARD DEVIATION	T-VALUE	P-VALUE	SIG
PRE_TEST	25	25.29	2.22	20.68	0.001	<0.05
POST_TEST	25	22.44	1.95			

Table 4: Analysis of Pre test and Post test through Illinois Agility Test of Group B

ILLINOIS AGILITY TEST	SAMPLE SIZE	MEAN	STANDARD DEVIATION	T-VALUE	P-VALUE	SIG
PRE_TEST	25	25.28	2.187	41.67	0.001	<0.05
POST_TEST	25	23.88	2.180			

Table 5: Analysis of Pre-test and Post test through Speed Test of Group C

		Sum of Squares	df	Mean Square	F	Sig.
SPEED_POST	Between Groups	18.88	2	9.44	87.31	.001
	Within Groups	7.78	72	.10		
	Total	26.66	74			

Table 6: Analysis of Pre-test and Post test through Illinois Agility Test of Group C

SPEED TEST	SAMPLE SIZE	MEAN	STANDARD DEVIATION	T-VALUE	P-VALUE	SIG
PRE_TEST	25	5.07	0.22	6.59	0.001	<0.05
POST_TEST	25	5.00	0.19			

Table 7: Analysis of ANOVA between and within groups

ILLINOIS AGILITY TEST	SAMPLE SIZE	MEAN	STANDARD DEVIATION	T-VALUE	P-VALUE	SIG
PRE_TEST	25	26.14	2.42	7.06	0.001	<0.05
POST_TEST	25	26.02	2.44			

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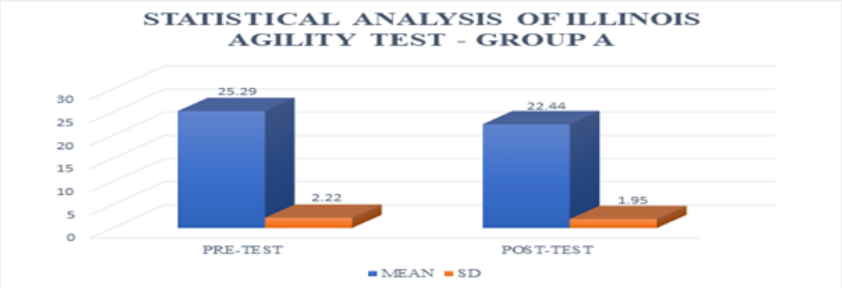
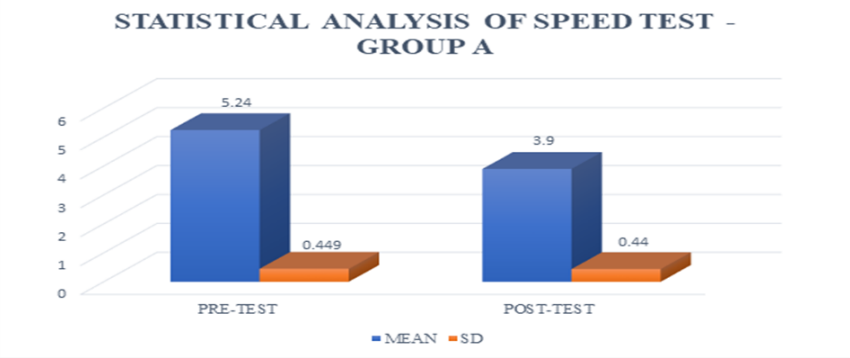
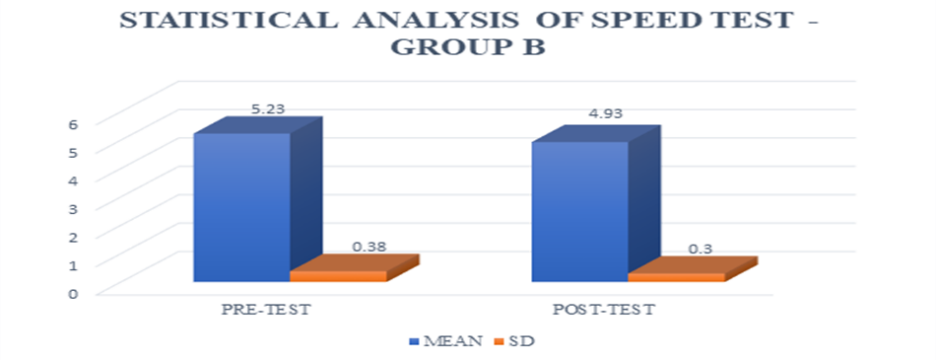
Graph 1: Statistical Analysis of Speed Test through Group A



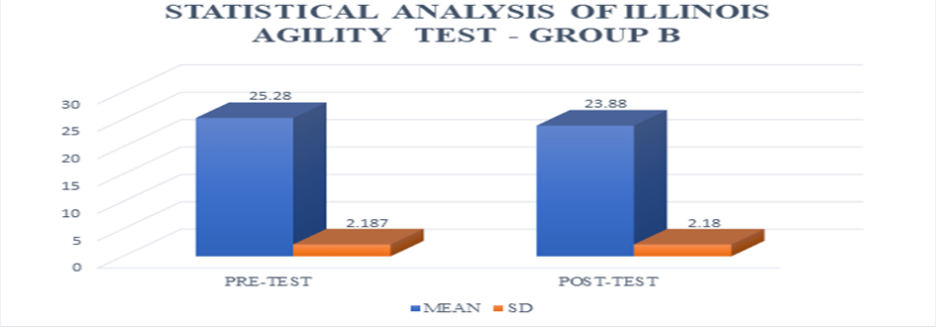
Graph 2: Statistical Analysis of Illinois Agility Test through Group A



Graph 3: Statistical Analysis of Speed Test through Group B



Graph 4: Statistical Analysis of Illinois Agility Test through Group B



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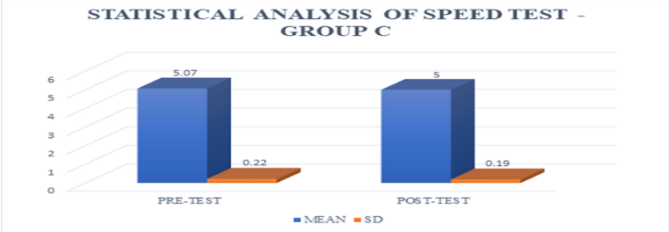
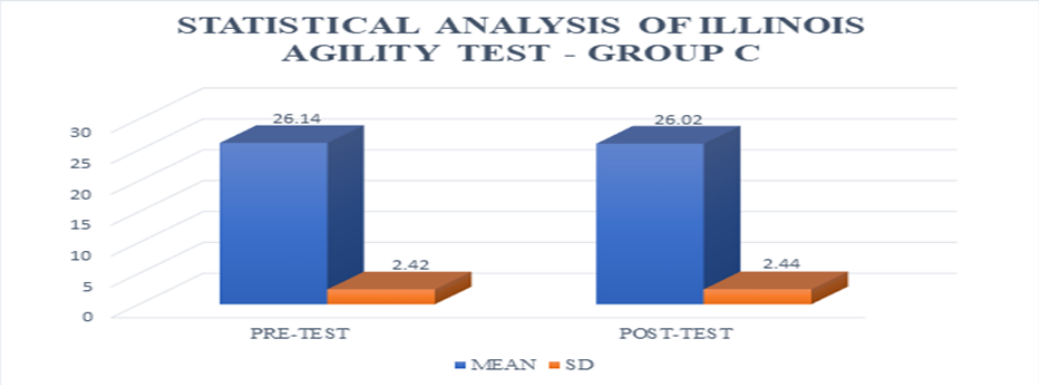
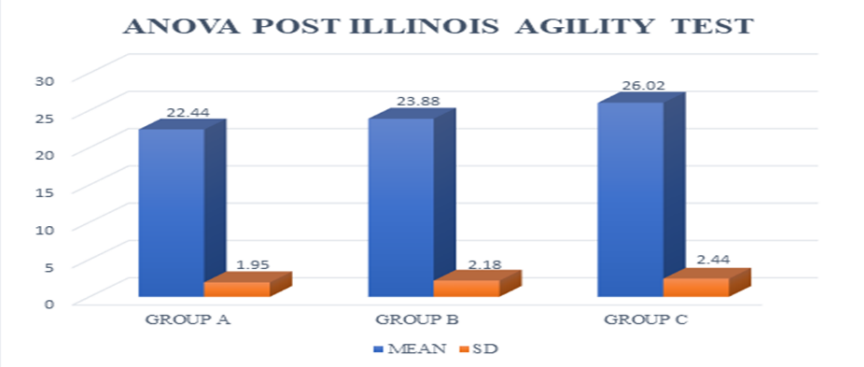
Graph 5: Statistical Analysis of Speed Test through Group C



Graph 6: Statistical Analysis of Illinois Agility Test through Group C



Graph 7: Statistical Analysis of ANOVA Post Speed Test between groups



4. Discussion

For groups A, B, and C, the descriptive analysis indicates the mean as well as the standard deviation of the speed test and the Illinois agility test. This shows that the average time for each group has a 95% confidence interval. It also suggests that, when compared to group C, the mean time for both group A and group B has been reduced, and this indicates that plyometric training performance in barefoot was more effective when compared to shoes-on training and routine drills. In this study, ANOVA analysis has been used to interpret the values between groups and within groups. The result of the speed and Illinois agility tests shows that the mean difference between groups is significant, and the level of significance is 0.001, which denotes that the mean values of all three groups were statistically significant. Overall, the result analysis of this study indicates that there was a significant difference between all groups in both the speed and Illinois agility tests. This indicates that the athletic performance of sprinters has improved significantly. The experimental group is compared to the control group using Dunnett's multiple comparison test. On the speed test, group A and group C's mean differences are significantly different (p 0.001), whereas group B and group C's mean differences are not significantly different (p = 0.66). In the Illinois agility test, there was a significant mean difference

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between groups A and C (p 0.001), and there was also a significant mean difference between groups B and C (p = 0.002). According to a study, the connective tissues conserve mechanical energy during the eccentric period of contact, and the recovery of the elastic characteristics during the concentric phase lowers energy consumption. [11]. Minimal shoes (MSH) have a greater peak plantar flexor and eccentric ankle power when compared to running shoes. The MSG and running shoes have the same ground reaction force, while going barefoot has a greater effect. The strike index (SI) was greater in barefoot and MSH, so the GRF may also have a great effect in that it includes more anterior foot strike in the ankle joint when compared to shoes. During weight acceptance, the moment arm is greater in barefoot, which improves eccentric plantar flexors. Following ankle, knee, and hip flexion eccentric muscle contractions, shock waves are transmitted through the lower extremity. Thus, barefoot training has a greater plantar flexor involvement, which may improve GRF loading when compared to shoe training. When compared to shoes on runners, the loading rate was higher in barefoot runners. This study concludes that barefoot training and MSH training are more effective in improving the athletes' agility and can also improve their athletic performance due to the biomechanical changes that occur during this training period [12]. A study which determines that 6-weeks PT protocol on agility, demonstrate that this training protocol has a greater benefit on agility. They added that it helps athletes' strength and endurance during physical exercise, as well as breaking up the monotony of training. [10]. Recommended for, BT should also be evaluated by other outcomes, such as aerobic evaluation tools and other agility assessment tools among athletes. The limitations in the present study may include a smaller number of participants and a shorter duration and number of weeks of the PT protocol for sprinters. Overall, group A has a greater significant mean difference when compared to other groups, and this shows that BT in plyometric exercise has a greater effect on improving agility and athletic performance when compared to SH training group and the control group among coastal sprinters.

5. Conclusion

Barefoot training can be immensely helpful for coastal sprinters. Running barefoot on the beach improves balance and stability by strengthening the muscles in your feet and lower legs. It also aids in the development of proper running form by encouraging a midfoot strike and reducing joint impact. Here, we saw that barefoot training has improved as a mode of special education, notably with agility, which improves the athletes' sports performance. Those who trained in bare feet considerably improved on the Illinois agility test and speed test, according to the results of the Kolmogorov-Smirnov and Shapiro-Wilk normality test and ANOVA. These findings suggested that the sprinters' barefoot plyometric training had a higher impact on improving their athletic performance. Hence, the current finding suggests that barefoot training is a good strategy for improving sprinters' athleticism and agility.

Conflict of Interest: NONE

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