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# Effect of 8 weeks of barefoot training on physical fitness parameters in amateur football players

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**Abstract**
**AIM:** To find out Effect of 8 weeks of Barefoot Training on Selected Physical Fitness Parameters in Amateur Football Players.
**Purpose:** To determine if 8 weeks of barefoot training will improve agility and sprinting performance in amateur football player between age 18-25.
**Study Design:** Randomised Control Trail.
**Procedure:** Ethical approval was taken from the committee. Total 36 subjects met with inclusion criteria and divided randomly in two groups, control group and experimental group. The experimental group performed the training activities in barefoot while the control group performed with shoe-on. All the subjects participated in two tests, Arrowhead agility test and 100m sprinting test.
**Result:** the data collected was statistically analysed by Paired T-test and Unpaired T-Test and result showed statistically insignificant improvement in agility and sprinting performance ($p>0.05$).
**Conclusion:** Study concludes that barefoot training is more effective in improving agility and sprinting performance

**Keywords:** Amateur football players, Agility, 100m sprint, barefoot training

## Introduction
Football is the most common sport in the world, with the basic aim of the game is to kick the ball with the foot to score the goal in the time frame of 90 minutes The game involves total 18 players in the team i.e. 10 players and 1 goalkeeper on pitch with the company of 7 players as substitutes. The pitch dimensions vary from each ground, but generally are 120 yards long and 75 yards wide [1].
Physical fitness is operationalized as a set of measurable health- and skill-related attributes including cardiorespiratory fitness (CRF), muscular strength and endurance, body composition, flexibility, balance, agility, coordination, reaction time, and power [2].
Agility being the most important component in football and is the ability to maintain or control body position while quickly changing direction during a series of movements. Agility is thought to be a supplemented by motor programming through neuromuscular conditioning and neural adaptation of muscle spindles, Golgi-tendon organs, and joint proprioceptors [3, 4, 5, 6].
In order to perform best on field, the players need to have best fitness components, and those who are lacking it are more prone to injuries. Unfortunately, research on sports injuries show high injury incidence rates for football. Injury incidence rates of 20.4 to 36.9 injuries per 1000 match hours and 2.4 to 3.9 injuries per 1000 training hours have been reported in male amateur football players [7].
Most common lower limb injuries in football [8-16] Muscle strain 31%, Hamstring strain 37%, Adductor strain 23%, Quadriceps strain 19% Gastrocnemius strain 13%, Anterior Cruciate Ligament Sprain 4%,Ankle sprain 36% Meniscal tear 1%, Overuse Injuries 34%.
Thus it is an important to minimise this epidemiological rate of injuries by improving the physical conditioning of the football players. Thus agility and sprinting being the most important aspects of football are chosen and will be observed in this study.

## 2. Materials and method
After taking the approval from Ethical Committee from our institution, a total 40 players were screened for study out of which 36 of them met with the inclusion crieteria aged

between 18 to 24 who were provided with written consent form were randomised into control group and experimental group with the help of Randomised Control Trials sampling method. The sampling type of study was purposive sampling. The two groups, i.e the control group who completed the training in their regular training shoes (studs) and the experimental group who completed the training barefoot. At the start, 18 players were randomized to control group and 18 players in the experimental group. 4 subjects completed the pre-test evaluations but did not complete the study for the reasons not related to study outcomes, thus leaving only 32 players to complete the study. A total 16 players from control group and 16 players from the experimental group completed the entire study protocol. The inclusion criteria for to participate in the study was : Age between 18 to 24, only males, who are amateur football players, members of the club since past 1 year and training 2 days a week and able to attend required study sessions for the timeframe of 8 weeks. The exclusion criteria were: a repetitive or recent injury, presence of any systemic illness and not medically cleared to participate in any low to high intensity training programs.

The Pre-training test consisted of timely measurement of change in direction ability and speed. The participants were told not to perform any vigorous activity prior to attending pre- and post test as this could affect the outcome of results. The testing consisted of following test: [1] Arrowhead Agility Test [17] to assess agility performance [2], 100m sprint to assess sprint performance.

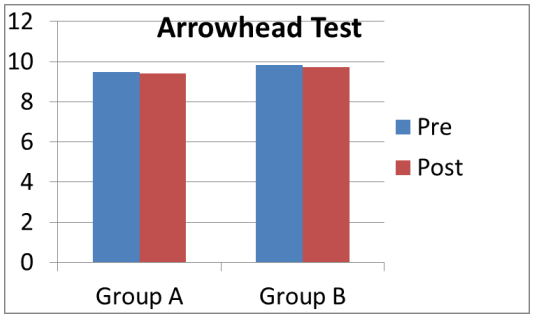
The first test performed was Arrowhead agility test in which player has to sprint 10m to round a marker to right, 5m to round another marker approximately at 45o angle, sprinting approximately 7m to round another marker placed at tip of arrowhead and sprinting back 15m to finish line. The second test performed was 100m Sprinting, to assess speed of player in which player has to run in straight line.

The testing was incorporated at the start of team's field training sessions, 3 testing sessions were completed separated by 48 hours. The 3 testing sessions involved [1], Arrowhead test first session & 100m sprint first session [2], Arrowhead Test second session & 100m sprint second session [3], Arrowhead test third session & 100m sprint third session. Each testing session lasted for 15-20 minutes in duration and was conducted on natural grass of outdoor football pitch with subjects wearing their own studs.

Prior to the data collection in first session, each subject was informed about consent form and filled with appropriate data required in it. Subjects completed their standardized warm-up before each session that was designed by team's coaching staff, which consisted of 6-7 minutes of jogging, 10-15 minutes of dynamic stretching of lower limb, AROM of all joints, Linear and lateral runs over 20-25m which were progressively increased in intensity and static marching. Participants completed the testing and rotated by numbers provided by the club for each test in ascending order to provide players sufficient recovery period between two tests and made sure that same testing order was followed in next two sessions. A standard metric tape was used to measure all the distances required for Arrowhead Agility test and 100m sprinting. Time for each test was recorded to the nearest 0.001s and the averages were used for data analysis.

## 3. Statistical analysis and results

Statistical analysis was done using the InStat application. The data that was collected during test sessions was entered into MS- Excel sheet. The gathered data was passed through normality test using Shapiro-Wilk Normality Test between pre-test values of both the control group and experimental group. Tests of normality indicated that dependent variables were normally distributed. After passing the normality test, the descriptive statistics were calculated for each variables (mean ± standard deviations [SD]; 95% confidence intervals [95% CI]). The obtained data was analysed using Paired T-Test for intra group, and Unpaired T-Test for Inter group. The control group and experimental group pre and post test data of Arrowhead Agility Test and 100m Sprinting was calculated using Paired T-Test with significance was set at <0.05. As shown in Table ?, the experimental group improved their Arrowhead Agility Test times by –0.09182 ±0.1020 sec, while the control group times were minimally changed by -0.09091 ±0.1672 sec. For the 100m sprint test, the experimental group improved their timing by -0.1136 ±0.2009 sec and control group timing changed by -0.06909 ±0.1442 sec. Proceeding futher, by using Unpaired T-Test for analysing post-test to post-test values in Arrowhead Agility Test, the timings were improved by -0.0009 having significance value >0.05, and for the 100m sprint Test, the difference in timings was -0.0036 having significance value >0.05.




**Graph 1:** Comparison of mean between pre and post training of control and experimental group of arrowhead test

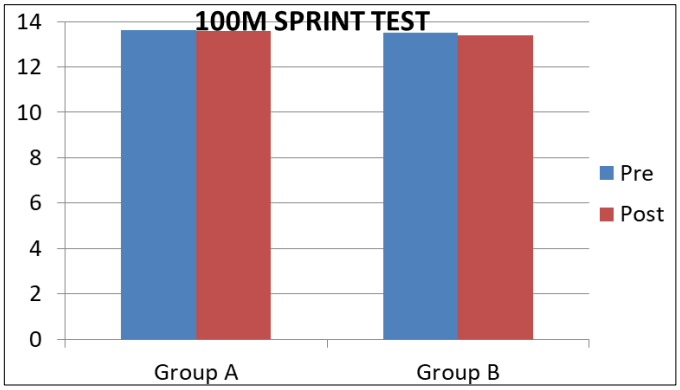
### Graphical interpretation

This graph shows changes in values of arrowhead test compared with pre and post values of Group- A and Group-B, Y-axis shows difference in agility performance and X-axis shows names of the groups

**Graphical Result:** The result obtained from the arrowhead test of experimental group is significant with p=0.0137 and t =2.987 and shows statistically significant than control group

**Table 1:** Paired t-test used in group a and group b for pre and post value for arrowhead test

| Paired T-Test | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **n** | **Mean** | **Std Deviation** | **Mean Difference** | **P-Value** | **T-Ratio** |
| Group A | Pre | 18 | 9.496 | 0.5836 | 0.09091 | 0.1016 | 1.803 |
| | Post | 18 | 9.405 | 0.5411 | | | |
| Group B | Pre | 18 | 9.835 | 0.6890 | 0.09182 | 0.0137 | 2.987 |
| | Post | 18 | 9.743 | 0.6507 | | | |



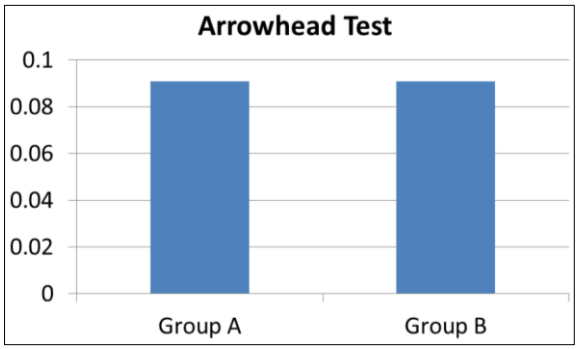

**Graph 2:** Comparison of mean between pre and post training of control and experimental group of 100m sprinting test

**Graphical Interpretation**: This graph shows changes in values of 100m Sprint test compared with pre and post values of Group- A and Group- B, Y-axis shows difference in sprinting performance and X- axis shows names of the groups.

**Graphical result**: The result obtained from the arrowhead test of experimental group is significant with p=0.0901 and t =1.876 and shows statistically non-significant than control group

**Table 2:** Paired t-test used in group a and group b for pre and post value for 100m sprinting

| Paired T-Test | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | n | Mean | Std Deviation | Mean Difference | P Value | T- Ratio |
| Group A | Pre | 18 | 13.636 | 0.6070 | 0.0945 | 0.1431 | 1.589 |
| | Post | 18 | 13.567 | 0.5762 | | | |
| Group B | Pre | 18 | 13.495 | 0.5373 | 0.1136 | 0.0901 | 1.876 |
| | Post | 18 | 13.382 | 0.2009 | | | |



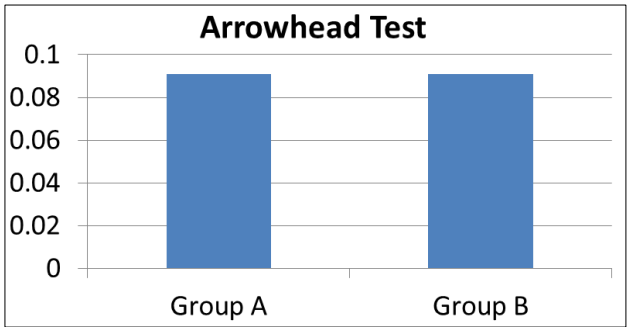

**Graph 3:** Comparison of arrowhead test between control and experimental group

**Graphical interpretation**: This graph shows changes in values of Arrowhead Agility test compared with post values of Group- A and Group- B, Y-axis shows difference in Agility performance and X- axis shows names of the groups.

**Graphical result**: The result obtained from the arrowhead test of experimental group is significant with p=0.9879 and t =0.01539 and shows statistically non-significant than control group.

**Table 3:** Unpaired t-test used in group a and group b for pre and post value for arrowhead

| Unpaired T-Test | | | | | | |
|---|---|---|---|---|---|---|
| | n | Mean | Std Deviation | Mean Difference | P Value | T Ratio |
| Group A | 18 | 0.09091 | 0.1672 | 0.0009 | 0.9879 | 0.01539 |
| Group B | 18 | 0.09082 | 0.1020 | | | |




**Graph 4:** Comparison of 100 mt sprint performance between control and experimental group

**Graphical interpretation:** This graph shows changes in values of 100m Sprint test compared with post values of Group- A and Group- B, Y-axis shows difference in sprinting performance and X- axis shows names of the groups.

**Graphical result**: The result obtained from the arrowhead test of experimental group is significant with p=0.9380 and t =0.07875 and shows statistically non-significant than control group.

**Table 4:** Unpaired t-test used in group a and group b for pre and post value for 100m sprinting

| Unpaired T-Test | | | | | | |
|---|---|---|---|---|---|---|
| | **n** | **Mean** | **Std Deviation** | **Mean Difference** | **P Value** | **T Ratio** |
| Group A | 18 | 0.0690 | 0.1442 | 0.003636 | 0.9380 | 0.07875 |
| Group B | 18 | 0.0654 | 0.5165 | | | |

## 4. Discussion

As proven earlier in time, perfect physical fitness conditioning is key element in sportsman's life. If any impairment is noted in any one or more component of fitness can lead to functional limitations and disability or increased risk of dysfunction [18]. Agility being coined as a rapid whole-body movement with change of velocity or direction in response to a stimulus [19] and straight sprint labelled as sudden outburst of energy as a result of breakdown of phosphocreatine with adenosine triphosphate and breakdown of carbohydrates into pyruvic acid and lactic acid through glycolysis resulting into forward displacement of body in space as a result of concentric and eccentric loading of muscles co-ordinated well with CNS, these both are considered to be most vital components of the game.

The purpose of this study was to find out effect of a 8-week barefoot training program in Amateur football players in and across city between the age of 18-25 years and to explore its effect on agility and sprinting capacity of players. The duration of time that a football player must train to achieve improvement in agility and sprinting capacity through barefoot training is still unknown. From a physiological and psychological point of view, 4 to 6 weeks of medium to high intensity training is an optimal length of time for the CNS to be stressed without excessive stress or fatigue [20] as agility being closely related to adaptations in CNS, a 8 weeks study duration was planned. We chose Arrowhead Agility Test and 100m Sprinting to assess agility performance and sprinting performance. The result of this study showed that there were statistically non-significant changes ($p>0.05$) in agility performance as well as 100m sprinting performance after completion of 8 week barefoot training protocol in experimental group, but the results in agility performance were clinically significant. These clinically significant changes observed in agility performance of pre and post-test were result of either neural adaptations or better motor recruitment pattern and increased proprioceptive feedback. In past studies, it has been proven that betterment in agility are result of enhanced motor unit recruitment pattern and neural adaptations of muscle spindles, golgi-tendon organs and joint proprioceptors along with neuromuscular conditioning [4, 5, 6]. Neural adaptations normally occur when athletes react or respond as a result of improvement in co-ordination between CNS signals and proprioceptive feedback [4]. However, it is not confirmed that neural adaptations takes place through synchronous firing of motor neurons or better facilitation of neural impulses to spinal cord [6]. Therefore, more studies are required to determine neural adaptations as a result of barefoot training. In our study, the football players who underwent barefoot training, were able to improve their timing on Arrowhead Agility Test significantly, thus we found a positive relationship between barefoot training & improvement in agility performance.

Although, the improvements were not significant statistically, because of shorter duration of study or maybe because of our small sample size that might have affected our potential to detect significant changes between two groups. It is possible that it may take months or years or perhaps, a training protocol which is more intense or longer in duration to observe statistically significant changes. Our protocol was designed of 8 weeks in attempt to define a minimum amount of time needed to observe effects of barefoot training program. The football players participating in the study had no previous barefoot training experience and injury to these players was a big concern for us as there are no strong evidence that barefoot training will have more or less injuries to the players, thus protocol was shorter in duration. A higher intensity program might need to be in longer in duration to allow the players to increase the intensity of training gradually without risk of injuries.

On the other hand, the effect of barefoot training showed no statistically as well as clinically significant changes on sprinting performance but this does not mean that these changes do not occur. In past studies, researchers had proven that there is direct relation between barefoot training and better conditioning of plantar flexors specifically medial gastrocnemius [22] and other small and large muscles that are crossing ankle joint [21]. Also, previously it has been proven that when training barefoot, the power absorption and generation is larger at ankle joint when compared to shod shoes [23, 24]. As mentioned before, the duration of time that a football player must train to obtain improvements in agility performance and sprinting performance is still unknown, thus players needs to train for longer duration, to observe clinically as well as statistically significant changes in sprinting performance.

In the start we hypothesized that football players participated in the study will have improved agility and sprinting performance after implementation of 8 week program, but statistics proved that changes are not significant ($p>0.05$). This is important information to those football players who are thinking to add barefoot training, that this 8 weeks of short duration barefoot training may not provide them notable changes or the injury prevention that they are in need of in order to maintain good form on pitch as well as to maintain the best physical conditioning. Apart from this, there is also a possibility that benefit of barefoot training is just not related to increased agility or speed or increased strength, dynamic balance or improved stability, but instead maybe it is related to the global biomechanical changes that occur in running gait when one is barefoot.

## 5. Conclusion

The conclusion drawn from the data analysis was that the experimental group showed clinical significant changes but

failed to achieve statistically significant improvements in agility performance and sprinting performance after the implementation of 8 weeks of barefoot training program.

**7. Clinical implications**

Study can be used on regular basis as a fitness program
It can save time of athlete and coach.

**8. Limitations**

Limited sample size
Fitness components were limited such as strength, power, aerobic and anaerobic capacities were not included.
Foot deformities such as Pes cavus and Pes planus were not taken into consideration.

**9. Recommendations**

The same study can be done with longer duration of study to observe significant improvements. Also a separate study can be conducted which will only include players with foot deformities such as pes cavus or pes planus and observe the effect of barefoot training program on agility and sprinting performance. Also other physical fitness components such as strength, power, proprioception, aerobic and unaerobic capacities could also be included.

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