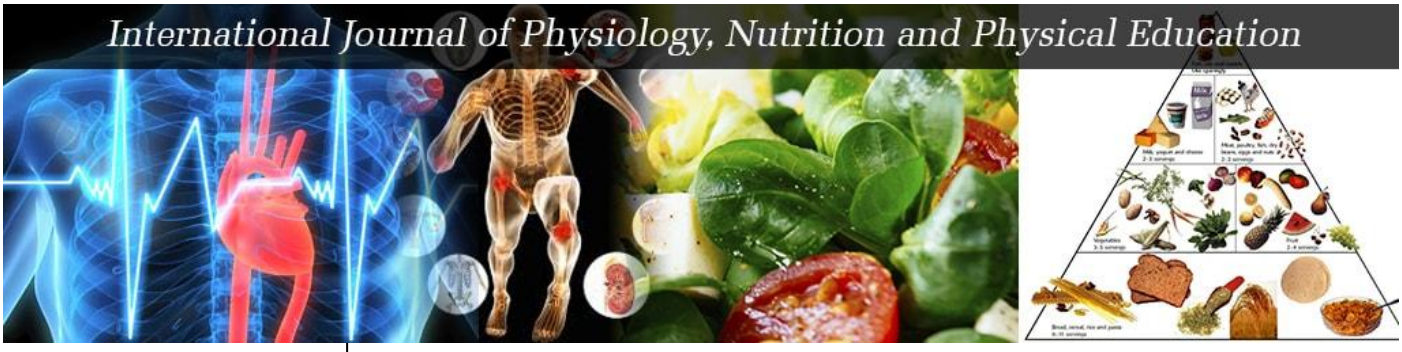

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Comparative analysis among barefoot, shod and shoe spikes running conditions

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Abstract
Purpose: The purpose of the study is to find out the difference among barefoot, shod and shoe spikes running conditions of sprinters in order to provide information about the potential effects of footwear on competitive runners.
Design/methodology/approach: The twenty six (n= 26) male sprinters participated at state/ inter-collegiate level competitions of their age range 17 to 25 years were purposively selected as subjects from Haryana State, India. The acceleration ability by 30m run test, running performance by 200 Mts. race, Explosive leg strength by standing broad jump and force by using formulae (Force= mass X Acceleration) were measured in three different bare foot, shod and with shoe spikes running conditions of sprinters. To calculate the mean difference among different running conditions one way ANOVA and to calculate multiple Comparisons among different running conditions; where difference is exists Tukey HSD test were used.
Findings: A statistical significant mean difference were observed for 200m race and acceleration run ability in different running conditions, whereas, in case of explosive leg strength and force there exists insignificant mean difference among different running conditions i.e., bare foot, shod and shoe spikes running conditions of sprinters.
Conclusion: It is concluded that the athletes performed better with spikes as compared to shod and barefoot running conditions in acceleration run and 200M race, hence sprinters had more explosive strength with shoe spikes as compared to shod and barefoot conditions.
Originality/values: The study provides a succinct introduction to the use of shoe spikes, shod and barefoot running conditions during practices and competitions and makes an innovative contribution by focusing on, how spikes helps in acceleration zone, 200mts running and explosive leg strength.

Keywords: Shoe spikes, barefoot, shod, explosive leg strength, force and sprinters

Introduction
In recent years different shoe and sports manufacturing companies are introducing impressive and effective shoes/spikes for training as well as for competitions but now a days some countries trainers are also emphases upon barefoot and shod training. But in reviewing the research, from the Nike Sport Research Laboratory published an article in which he postulated that the three main needs of the athlete are performance, injury protection, and comfort (Lafortune, 2008) [13] shod and shoe spikes are providing it. In the 1960 Rome Olympic Games, an Ethopian barefoot runner named Abebe Bikila won the Marathon gold with a time 2:15:16. This set the marathon world record, and is considered a respectable time to this day. This was probably one of the first accounts in modern times of someone winning a major competition while running completely without shoes (Christopher McDougall, 2009) [6]. After it Zola Budd is another barefoot runner that won recognition by setting a world record at 5000 m in 1985, finishing at 15:01:83 (Christopher McDougall, 2009) [6]. This is question that many have sought to answer. One recent trend is the interest in barefoot running. There are many voices on the Internet that believe it may be more beneficial to run barefoot than the standard practice of running in cushioned shoes (Barefoot runner, 2012) [1]. Manufactures of bare foot sports shoes currently state that wearing their shoes will stimulate and strengthen muscles in the feet and lower legs, improving general foot health and reducing the risk of injury. Further stimulate neural function important to balance and agility. The shoes would even help you to unleash your optimal running stride.

The impact force has been a major concern for shoe designers and manufacturers, as one of the primary roles for running shoes is to provide shock absorption (Cavanagh 1980; Nigg & Wakeling 2001) [3, 16]. It also depend upon the distance of running events in case of small distance races shoe spikes in middle distance shod and in long races barefoot helps in performance.in another study researcher observed that for improving the athlete performance the total weight of the shoe has been reduced. Hence, racing tracks, shoes and spikes have been developed to help facilitate optimal performance (Cavanagh & Lafortune 1980; Denton 2005) [4, 9]. William (2001) [18] stated "Natural walking is mechanically impossible for any shoe-wearing person. Natural walking and footwear are mechanically incompatible because shoes convert the natural foot into the unnatural which doctors consider normal." In comparison to most running shoes, spikes and racing track surface have less cushioning and a flat, thinner heel to produce a lighter shoe for tournaments and practice/training sessions. While competitive footwear has its time and place, it is assumed that this type of shoe should be used with alertness and awareness of the possible increased injury risks (Denton, 2005) [9]. Present research, "Will be a Guide for Runners that in which conditions we should do training with bare, shod and shoe spikes because we may find spikes uncomfortable at first because of the lack of cushioning, and the sharp spikes located under the ball of our foot. There will be a period of adjustment until they become comfortable, and we may choose to use our regular running shoes for most of our training, and spikes for racing only. It is true a big question arise on the minds of every athletes, coaches, trainers, physical therapists and physicians is whether running barefoot, shod or with shoe spikes are better for athletes or not. In present study we try to find out answer of this question by experimental research. The results of the present study may be helpful for athletes, physical education teachers, coaches and sport trainers.

Material and Methods

For the purpose of the present study, Twenty-six (N=26), Male athletes participated at Inter-Collegiate and State level competitions of their age group of 17-25 years from Haryana were selected as subject in this study. The subjects were purposively selected and tested three times for selected kinematic and kinetic variables in different conditions of running i.e., barefoot, shod and running with spikes. The variables were selected according to the running activities i.e., 200m sprint test to observe bare foot, shod and with shoe spikes running condition effects on athletes, acceleration ability (30 m sprint), explosive leg strength by Standing broad jump and to calculate force (f=Mass X Acceleration) formulae were used. The 400m grassy surface standard track was used for 200m sprint tests. The subjects were used their own routine training shoes, (5 or 7 nails) spikes and complete barefoot. The subjects were belongs to semi rural area and they were used to do running in barefoot, shod and with shoe spikes. The data were analyzed by using ANOVA to observe significant mean difference among bare foot, shod and with spikes running condition of sprinters and to calculate multiple Comparisons, where difference exist Tukey HSD test was used with the help of SPSS (version 11.5) computer software.

Results and Discussion

Table 1.1: Mean, Standard Deviation, Std. Error and One-Way ANOVA of athletes 200 Mts. running ability among Bare Foot, Shod and spikes running conditions. (N=26)

Group 0f 200 Mts. running Conditions	Mean Sec.	S.D.	Std. Error	Source of variance	Sum of Square	DF	Mean Square	F	Sig. P value
200 Mts. run with Bare Foot (Sec.)	26.870	1.509	.296	Between Group	12.960	2	6.480	3.197	.047
200 Mts. run with Shod (Sec.)	26.657	1.373	.269						
				Within Group	152.022	75	2.027		
200 Mts. run with Spikes (Sec.)	25.919	1.385	.272						
Total	26.482	1.464	.16574	Total	164.982	77			

Table 1.1 shows Mean, standard deviation, std. error and 'F' value of 200 Mts. running ability with bare foot, shod and shoe spikes. The calculated 'F' value of 200 Mts. running is 3.197, which is greater than the required table value at 0.05 level of confidence. Result shows that the 'p' value .047 is less than 0.05 indicates that there exists significant mean difference at least between two groups. Further the mean values of 200Mts running with shoe spikes (25.919) conditions were found less as compared to sprinters run with shod (26.657) and barefoot (26.871) on the other hand mean value of 200 Mts. run with shod (26.657) is less than that of barefoot running (26.871) condition. The 200mts. race time is inversely related to performance of the sprinters, if performance increases the time will decrease, hence it clearly indicates that the 200 Mts. running with shoe spikes better than shod and barefoot, whereas shod runners are performed better than that of barefoot running conditions. It implies that spikes enable the athletes to add traction to run as fast as possible by generating ground reaction force. In case of running with shoe it add sole height of shoe by virtue of this athletes have a wide stride length (longer flight phase); which assist to the basic need of running a race. To find out where the differences exist among different running conditions, we use the Tukey posthoc multiple compression test.

Table 1.2: Tukey Posthoc multiple comparison test of 200Mts. running ability in different conditions. (Dependent Variable: MTS 200)

(I) Group 200 Mts. run	(J) Group 200 Mts. run	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
200 Mts. run with Barefoot	200Mts run with Shod	.214	.395	.851	-.730	1.158
	200Mts run with shoe spikes	.952*	. .395	.048	.007	1.896
200 Mts. run with Shod	200Mts run with Barefoot	.214	.395	.851	-1.158	.730
	200Mts run with shoe spikes	.738	.395	.155	-.207	1.682
200 Mts. run with shoe spikes	200Mts run with Bare foot	.952*	.395	.048	-1.896	-.007
	200Mts run with Shod	.738	.395	.155	-1.682	.207

* The mean difference is significant at the .05 level.

It is obvious from table- 1.2 that there exist significant mean difference (.952) at .05 level of significance of 200 mts. running ability between barefoot and shoe spikes running conditions but there exist insignificance difference (.214) between barefoot and shod running conditions. It also shows that there exists insignificant difference (.738) at .05 level of significance in 200mts. mts. running ability between shod and with shoe spikes running conditions.

Hence it reveals that in case of 200m run ability athletes performed better in shoe spikes running condition as compare to bare foot and shod running conditions it is because runners running with minimalist sole spikes have a narrow stride length (shorter flight phase); and higher strides frequency (faster turnover). In condition of running with spikes complete body leads by upper body; which enables the body's to absorb the shocks and forces, protects the foot from trauma and injuries and generates more ground reaction force without jerk.

Table 2.1: Mean, Standard Deviation, Std. Error and One-Way ANOVA of athletes Explosive Leg Strength among Bare Foot, Shod and spikes conditions. (N=26)

Group Explosive Leg Strength (SBJ)	Mean Sec.	S.D.	Std. Error	Source of variance	Sum of Square	DF	Mean Square	F	Sig. P value
Explosive Leg Strength with Bare Foot	2.517	.128	.0252	Between Group	.112	2	.056	2.757	.070
Explosive Leg Strength with Shod	2.579	.149	.0294	Within Group	1.520	75	.020		
Explosive Leg Strength with Spikes	2.607	.148	.0290						
Total	2.568	.146	.0165	Total	1.632	77			

Table 2.1 clearly shows the Mean, standard deviation, std. error and 'F' value of sprinters explosive strength with bare foot, shod and shoe spikes. The calculated 'F' value of explosive leg strength is 2.757 which is less than the required table value at 0.05 level of confidence. Results indicates that the 'p' value .070 is more than 0.05 indicates that there exists insignificant mean difference among the different running conditions. Further the mean values of explosive leg strength with shoe spikes (2.607) conditions were found more as compare to explosive leg strength with shod (2.579) and barefoot (2.517) conditions on the other hand mean value of explosive leg strength with shod (2.579) is more than that of barefoot (2.517) condition, hence it clearly indicates that the explosive leg strength with shoe spikes followed by shod conditions are performed better than that of bare foot condition.

Table 3.1: Mean, Standard Deviation, Std. Error and One-Way ANOVA of Athletes acceleration run ability among Bare Foot, Shod and shoe spikes running conditions. (N=26)

Group of acceleration run ability Conditions	Mean (Sec.)	S.D.	Std. Error	Source of variance	Sum of Square	DF	Mean Square	F	Significance P value
Acceleration run ability with Bare Foot (Sec.)	4.4227	.18224	.03574	Between Group	.427	2	.213	4.317	.017
Acceleration run ability with Shod (Sec.)	4.4323	.22605	.04433	Within Group	3.709	75	.049		
Acceleration run ability with Spikes (Sec.)	4.2708	.25308	.04963						
Total	4.3753	.23176	.02624	Total	4.136	77			

It is obvious from table 3.1 that Mean, standard deviation, std. error and 'F' value of sprinters acceleration run ability with bare foot, shod and shoe spikes. The calculated 'F' value of acceleration run ability is 4.317, which is greater than the required table value at 0.05 level of confidence. Results shows that the 'p' value .017 is less than 0.05 indicates that there exist significant mean difference at least between two groups. Further the mean values of acceleration run ability of sprinters with shoe spikes (4.271) conditions were found less as compared to sprinters run with barefoot (4.423) and shod (4.432) on the other hand mean value of sprinters acc. ability with barefoot (4.423) is less than that of shod running (4.432) condition. The (30mts. run) acceleration run ability is inversely related to performance of the sprinters, if performance increases the time will decrease, hence it clearly indicates that the sprinters acceleration run ability with shoe spikes followed by barefoot are better than that of shod running conditions.

It is because runners running with flat/minimalist footwear and bare foot have a shorter stride length (Less flight phase); but higher stride frequency (faster turnover) which is main necessity of acceleration run ability; spikes also enables the athletes to generate ground reaction force. To find out where the differences exist among different running conditions, we use the Tukey posthoc multiple compression test.

Table 3.2: Tukey Posthoc multiple compression test of Acceleration run ability in different conditions. (Dependent Variable: MT30)

(I) Group 30	(J) Group 30	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
Acceleration Ability (by 30 Mts. run test)					Lower Bound	Upper Bound
Acceleration run Ability with bare foot	Acceleration run Ability with shod running	-.0096	.0617	.987	-.1571	.1379
	Acceleration run Ability run with spikes	.1519*	.0617	.042	.0044	.2994
Acceleration run Ability with shod running	Acceleration run Ability with bare foot	.0096	.0617	.987	-.1379	.1571
	Acceleration run Ability with spikes	.1615*	.0617	.028	.0141	.3090
Acceleration run Ability with spikes	Acceleration run Ability with bare foot	-.1519*	.0617	.042	-.2994	-.0044
	Acceleration run Ability with shod running	-.1615*	.0617	.028	-.3090	-.0141

* The mean difference is significant at the .05 level.

Table 3.2 clearly indicates that there exist significant mean difference (.1519) at .05 level of significance of acceleration run ability between barefoot and with spikes running conditions but there exist insignificance difference (-.0096) between acceleration run ability between barefoot and shod running conditions. It shows that there exists significant difference (.1615) at .05 level of significance in acceleration run ability between running with shod and with shoe spikes running conditions. It suggests that in case of acceleration run ability spikes and bare foot running conditions are better than that of shod running, hence shoe increase extra mass and height between foot and running surface. In case of spikes and bare foot, spikes add traction to move forward without slipping or jerking foot backwardly and negative heel spikes helps athletes mid to forefoot landing to encourage athlete demand. Runners with spikes get lightest foot covering for safety which provides psychological gain to athletes for avoiding any surface related injury.

Table 4.1: Mean. Standard Deviation, Std. Error and One-Way ANOVA of athletes Force among Bare Foot, Shod and spikes conditions. (N=26)

Group Force=mass X acceleration	Mean Sec.	S.D.	Std. Error	Source of variance	Sum of Square	DF	Mean Square	F	Sig. P value
Force with Bare Foot	25.933	2.985	.585	Between Group	15.175	2	7.587	.850	.431
Force with Shod	25.985	3.048	.598						
Force with Spikes	25.024	2.927	.574	Within Group	669.216	75	8.923		
Total	25.647	2.981	.338	Total	684.391	77			

Table 4.1 clearly shows the Mean, standard deviation, std. error and 'F' value of force with bare foot, shod and shoe spikes. The calculated 'F' value of force is .850 which is less than the required table value at 0.05 level of confidence. Results indicates that the 'p' value .431 is more than 0.05 indicates that there exists insignificant mean difference among the different running conditions. Further the mean values of force with shoe spikes (25.024) conditions were found more as compare to force with shod (25.985) and barefoot (25.933) conditions on the other hand mean value of force with barefoot (25.933) is less than that of shod (25.985) condition. The force is inversely related to performance of the sprinters, if performance increases the time will decrease, hence it clearly indicates that the force with shoe spikes followed by barefoot conditions are performed better than that of shod condition. As we know force (f=ma) is directly based upon mass and acceleration the mass will increase in spikes and shod so it adversely effects upon performance but spikes helps the athletes to generate ground reaction force without jerk and slip and its weight is lesser then the shod in maximum causes.

Conclusion

From the results of the study concluded that in acceleration run ability the athletes with shoe spike condition perform better as compared to shod and barefoot running conditions and there exist significant mean difference at .05 level of significance, but in and 200mts running ability there exists significant mean difference between shoe spikes and barefoot running condition, whereas mean values shows that runners run with shod performed better as compared to barefoot condition but there exist insignificant difference. Hence in case of explosive leg strength the mean value shows that with shoe spikes athletes were better than that of shod and barefoot athletes but there exist insignificant mean difference among them.

References

1. Barefoot runner. Visited, 2012. 2012-05-23, at http://www.barefootrunner. Com/barefoot-101.
2. Beverly J. Shoes with spikes to race and train in, 2011. www.runnersworld.com.
3. Cavanagh PR. In book: The Running Shoe. Mountain View, Anderson World, 1980.
4. Cavanagh PR, Lafortune MA. Ground reaction forces in distance running. Journal of Biomechanics. 1980; 13(5):397-406.
5. Christensen DL, Nielsen TH, Schwartz A. Herodotos and hemerodromi: Pheippides run from Athens to Sparta in 490 BC from historical and physiological perspectives. Hermes. 2009; 137(2):148-148.
6. Christopher McDougall. Born to Run: A Hidden Tribe, Superathletes, and the Greatest Race the World Has Never Seen, ethnography; Non-fiction American author and journalist, 2009.
7. Clement DB, Taunton JE, Smart GW, Mc Nicol KL. A survey of some overuse running injuries. Phys Sports Medicine. 1981; 1(3):242-246.
8. Cook SD, Kester MA, Brunet ME. Shock absorption characteristics of running shoes. American Journal of Sports Medicine. 1985; 13(4):248-253.
9. Denton JD. Light does not make right. Running Times. 2005; 324:78.
10. DeWit B, De Clercq D, Aerts P. Biomechanical analysis of the stance phase during barefoot and shoe running. Journal of Biomechanics. 2000; 33(3):269-278.
11. Divert C, Mornieux G, Baur H, Mayer F, Belli A. Mechanical comparison of barefoot and shoe running. International Journal of Sports Medicine. 2005; 26(7):593-598.
12. Singh Kuldeep, Mahipal. Comparison of Kinematic and Kinetic Variables of printers Running Barefoot and with Shoe Spikes Journal of Exercise Science & Physiotherapy. 2016; 12(2):100-115. ISSN: 0973- 2020 (Print), ISSN: 2454-6089 (Online).
13. Lafortune Mario. The Role of Research in the Development of Athletic Footwear. Journal of Foot and Ankle Research. 2008; 1(1):110.
14. Lieberman Daniel E. What We Can Learn About Running from Barefoot Running: An Evolutionary Medical Perspective. Department of Human Evolutionary Biology, Harvard University, Cambridge MA; American College of Sports Medicine. 2012; 40(2):70.
15. Mahipal, Singh Kuldeep. Barefoot Running V's Shod Running IOSR Journal of Sports and Physical Education (IOSR-JSPE). 2016; 3(6):17-20. E-ISSN: 2347-6737, p-

ISSN: 2347-6745.
16. Nigg BM, Wakeling JM. Impact forces and muscle tuning: a new paradigm. Exercise and Sports Science Review. 2001; 29:37-41.
17. Weyand PG, Sternlight DB, Bellizzi MJ, Wright S. Faster top running speeds are achieved with greater ground forces not more rapid leg movements. Journal of Applied Physiology. 2000; 89(5):1991-1999.
18. William A, Rossi DPM. Footwear: The Primary Cause of Foot Disorders. Podiatry Management. 2001; 2:129-138.