Original Article

Lower-extremity running-related injuries among 10,000-meter long distance runners in Ethiopia

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ABSTRACT

Despite the popularity and health benefits of running, a popular sporting activity performed by many individuals worldwide, runners are at risk of being injured. Of concern is the lack of evidence-based data and information on Ethiopian 10, 000-meter long-distance runners. The purpose of this study was to establish the incidence and the risk factors associated with lower-extremity running-related injuries amongst 10, 000-meter long distance runners in Ethiopia. A prospective study was used over a period of ten months in eleven running clubs and twelve Youth Athletics Training Programs in Amhara Regional State and Addis Ababa. Participants completed a self-reported questionnaire on 1) demographic characteristics; 2) risk factors associates with running-related injuries and, 3) their injury status. Logistic regression analysis and odds ratio (OR) and its 95% confidence interval (CI) was estimated for the predictor variables**.** The incidence of running-related injury was 62.4%, corresponding to 0.35 injuries per 100 running hours or 3.54 injuries per 1000 running hours. The most commonly injured anatomical site was the knee (33.6%), with a strain the most common type of injury (36.4%). Participants previously injured had an 8.20 higher OR (2.14-31.40). Runners who train respectively 40km-50km (OR = 0.003, 95% CI, 0.000-0.073) and 50km-60km (OR = 0.053, 95% CI, 0.004-0.728) per week and runners that wore running shoes eight to eleven months (OR = 0.033, 95% CI, 0.003-0.392) was significantly associated with a protective benefit against running-related injuries. Runners, coaches, and medical professionals must acknowledge the specific risk factors associated with running-related injuries. The results underscore urgent interventions to ensure that 10 000-meter Ethiopian long distance runners become injury free. **Keywords:** Running injuries; Lower limb; Risk factor; Incidence.

Cite this article as:
Begizew, D.M., Grace, J.M., & van Heerden, H.J. (2019). Lower-extremity running-related injuries among 10,000-meter long distance runners in Ethiopia. *Journal of Human Sport and Exercise*, *14*(2), 358-373. doi:https://doi.org/10.14198/jhse.2019.142.09

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Submitted for publication May 2018
Accepted for publication September 2018
Published June 2019 *(in press November 2018)*
JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

doi:10.14198/jhse.2019.142.09

INTRODUCTION

Sport activities and exercises have a positive effect on physical fitness and reduce the incidence of obesity, cardiovascular disease, and many other interrelated chronic health problems (van Gent et al., 2007; Gallo et al., 2012; Salman, 2014; and Myers et al., 2015). Participating in sports activities, however, can result in injuries (Gallo et al., 2012; Misra, 2014 and Salman, 2014). According to data from Swedish emergency departments, sports injuries account for 110,400 (16%) of all recorded injuries (688,300) (Salman, 2014). The U.S. Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS) indicated that in 2012; more than 1.9 million individuals suffered a sports-related injury that was treated in hospital emergency departments (Misra, 2014).

Running is a natural and popular sporting activity performed by many individuals worldwide. Compared to other sports, it is easy to participate in, requires minimal facilities and equipment, with many individuals now participating in long-distance running (van Gent et al., 2007; Gallo et al., 2012). Despite its popularity and health benefits, runners are also at risk of being injured, with an estimated 37% to 56% runners being likely to sustain running-related injuries annually (Gallo et al., 2012).

Sports studies have reported on the incidence of running injuries occurring in long-distance runners during training and competition, with the causative risk factors having also been recorded. These international studies among others include for example van Gent et al. (2007) who in their systematic review concluded that the incidence of lower extremity running injuries in long distance running varies from 19.4% to 79.3%. Taunton et al. (2003) too mentioned that of those sports participants who reported injuries across all training clinics, 29.5% were related to running. Depending on the specificity of the group of runners concerned (competitive athletes; average recreational joggers; males and females) and on different circumstances, these rates vary (van Mechelen, 1992). Ellapen et al. (2013) describe the mechanisms contributing to musculoskeletal running injuries as poor training habits, inadequate rehabilitation of previous injuries, high weekly mileage and incorrect shoes, which are referred to as the extrinsic risk factors. The intrinsic risk factors are those related to each runner, such as age, gender, previous injury, and training experiences (Taunton et al., 2003).

Injury severity can also be defined based on time loss (Fourchet et al., 2011). According to Salman (2014), the absence of one to seven days was considered as a short-term injury, one week to one-month absence was medium-term damage and for more than one-month absence was long-term damage. Hägglund (2007) considered injury severity as a slight/minimal injury if an athlete was absent for one to three days, minor/mild injury if an athlete was absent for four to seven days, as a moderate injury if an athlete was absent for eight to twenty-eight days, and absence of greater than twenty-eight days regarded as a major/severe injury.

As injuries in sports pose a major challenge to athletes, coaches, and sports clubs, the International Olympic Committee established a research centre to explore and prevent injuries in various sports disciplines (Salman, 2014). Regardless of the fast growth of research, systematic reviews evidencing the risk and protective factors in middle- and the long-distance running-related injuries, were lacking (Hulme et at., 2017). In Africa, sports injuries are poorly documented as noted by LeBrun et al. (2017). Since the 1968 Mexico City Olympic Games, Ethiopia has been acknowledged and recognized for middle and long-distance running events in athletics (Beis et al., 2011 and Wilber & Pitsiladis, 2012). Since then, the Government allocated a substantial budget for the Ethiopian Youth Training Program. The Ethiopian Youth Training Program was led by the Ministry of Youth and Sport, and was designed to fill the gaps of athletes that represent the country in different international tournaments and championships (Gebremeden, 2016).

However, there is a lack of evidence-based data and information on the Ethiopian long-distance runners (Wilber & Pitsiladis, 2012; LeBrun et al., 2017). In the absence of data and information, efforts to address the incidence and associated running-related injury risk factors and prevent further lower extremity running-related injuries, will not be possible. The lives of many runners for whom this activity is a way of earning an income in a resource-constrained country, are consequently affected. To the researchers' knowledge no studies have been conducted that prospectively evaluated the incidence of running-related injuries and associated risk factors in 10, 000-meter long distance running in Ethiopia.

The purpose of this study was therefore to determine the rate of running-related injuries in 10, 000-meter long distance runners, as well as to establish the risk factors associated with lower-extremity running-related injuries.

MATERIALS AND METHODS

Study design

The research was conducted over a period of ten months (September 2016 – June 2017) with participants selected from eleven running clubs and twelve Youth Athletics Training Programs. An "injury" was defined as a lower extremity injury sustained by a runner that resulted from running during competition or training, which required one or more physiotherapy treatments and prevented the athlete from participating in one or more training sessions or competitive event (Fourchet et al., 2011). Injury severity was also defined based on time loss and was classified as minor, moderate, major or severe if the athlete was absent from training/competition for one to three days, four to seven days, one to three weeks, or three to four weeks respectively (Fourchet et al., 2011). The incidence of injury was calculated by expressing the number of injuries per 100 and per 1000 hours of running exposure (van Mechelen et al., 1992).

Study setting

The study was conducted in the eastern section of the Amhara Regional State, these being North Shewa, South and North Wollo administrative Zones, and Addis Ababa city. Due to the hilly nature of the terrain, several Youth Athletics Training Programs have been established in villages that provide effective training for the young participants in Amhara Regional State. The topography of the Amhara region contains much of the highland plateau above 1,500-meters with rugged formations, gorges, and valleys (Ethiopian Government, 2017). Addis Ababa is the capital city of Ethiopia and is located approximately 2, 355 meters above sea level, the city is located at the foot of the 3,000 meters high Entoto mountain (Wilber & Pitsiladis, 2012). Selection of Amhara region and Addis Ababa was purposeful because the researcher was familiar with those regions to observe running-related injuries. Additionally, Addis Ababa was selected because there are several clubs and it was easy to collect and manage the data.

Participants

From the total of 547 male and female 10,000-meter long-distance runners, 229 participants who met the inclusion criteria of competing in 10,000 meters distance running at national and international level and free from injury at the time of registration for the study, were considered for inclusion. The participants were selected proportionally for inclusion from eleven running clubs and twelve Youth Athletics Training Programs in the study.

Ethical considerations

Permission was secured from the Ethiopian Athletics Federation (EAF) and Ethical approval was obtained from the Biomedical and Research Ethical Review Committee of the University (BREC REF NO: BE372/16).

The participants were provided with information pertaining to the specific aspects of the study. Informed consent was duly obtained prior to the commencement of the study.

Data collection instrument

A self-administered questionnaire was developed after being piloted to ensure validity and reliability. The validity of the questionnaire was also checked by a Biostatistician before the data collection commenced. For the questionnaire items, using the standard cut off point (alpha = 0.05), a Cronbach's Alpha of 0.768 was obtained. The questionnaire comprised three different sections: 1) demographic characteristics; 2) risk factors associates with running-related injuries and, 3) their injury status. The demographic characteristics comprised information regarding the participants' running group (category), sex, age, training experiences and previous injury. The risk factors comprised of training frequency (days/week), training-distance (km/week), competition distance in the running season, competition frequency in the running season, running surface, type of running shoes, age of running shoes (months) and running season. The injury status questions were concerned with injuries sustained during the study period, the injured anatomical site, the type of injury, and the severity of the injury.

Statistical analysis

Data were cleaned, coded and analysed using the Statistical package for Social Science (SPSS) version 20. The rate of injuries was calculated for the categorical variables. Descriptive statistics were used for baseline calculations of the measured variables. The Chi-square test was used to check the association of the risk factors contributing to running-related injuries. Univariate and multivariate logistic regression analysis were used for predicting the running-related injury risk factors. Demographic characteristics and risk factors for running-related injuries were first univariate analysed to see the independent relationship with running-related injuries. Secondly, all variables; sex, previous injury, training frequency (days/week), training-distance (km/week), competition distance in the running season, competition frequency in the running season, running surface, type of footwear, age of running shoes (months) and running season, which independently associated ($p \leq 0.20$) with running-related injuries were entered in a multivariate logistic regression analysis. Finally, logistic regression analysis with a forward likelihood selection method with a *p* value less than 0.05 was used to identify the specific risk factors associated with lower-extremity running-related injuries. The odds ratio (OR) and its 95% confidence interval (CI) were estimated. The level of statistical significance was set at $p \leq 0.05$.

RESULTS

From the results of the study it emanated that the overall lower extremity running-related injury incidence was 62.4%, corresponding to 0.35 injuries per 100 hours of running or 3.54 injuries per 1000 hours of running. The incidence of running-related was 0.52 injuries per 100 running hours of training exposure or 5.17 injuries per 1000 running hours of training exposure and 1.12 injuries per 100 running hours of competition exposure or 11.17 injuries per 1000 running hours of competition exposure.

Demographic characteristics contributing to lower-extremity running-related injuries

The demographic characteristics contributing to lower-extremity running-related injuries are displayed in Table 1; Table 4 explains where significant differences lie between groups. Significant differences were noted between the two groups for sex ($p \leq 0.022$) and previous running injury ($p \leq 0.0001$). It is clear from Table 4 that significant differences are noted for females compared to males regarding sex ($p \leq 0.022$), and for participants previously injured compared to non-previously injured participants ($p \leq 0.0001$).

Running-related injuries were observed for the 17-26-year-old age group (88.1%) compared to the age of greater than 26 years although not significant (11.9%; ($p > 0.05$). Also, no significant differences in running-related injuries between the two groups were noted for running group (category), and running experience (Table 1).

Table 1. Demographic characteristics contributing to lower-extremity running-related injuries

	Running-related injury		
	Non-injured	**Injured**	
Variable	**Number (%) n=86 (37.6)**	**Number (%) n=143 (62.4)**	**Chi- square p-value**
Running Group (category)			
Club participants	50(58.1)	81(56.6)	0.825
Youth Athletics Training Program participant	36(41.9)	62 (43.4)	
Sex			
Female	37(43.0)	84(58.7)	0.022*
Male	49(57.0)	59 (41.3)	
Age (years)			
17-26	79(91.9)	126(88.1)	0.371
> 26	7(8.1)	17(11.9)	
Running Experience (years)			
<	36(41.9)	62(43.4)	
2-5	36(41.9)	47(32.9)	0.264
>5	14(16.3)	34(23.8)	
Previous Running Injury			
Injured	26(30.2)	96(67.1)	0.0001*
Non-Injured	60(69.8)	47(32.9)	

$p \leq 0.05$

Anatomical sites, type, and severity of lower-extremity running-related injuries

In accordance with and exhibited in Table 2, the injured anatomical sites were the knee (33.6%), followed by shin (18.9%), ankle (16.1%), foot (12.6%), Achilles/calf (9.8%), thigh (5.6%), and the hip/pelvis (3.5%). The type of injuries indicated that muscular strains (36.4%) were the highest ranked type of injury followed by joint sprains (29.4%), tendonitis (20.3%), contusions (6.3%), fractures (5.6%), and finally, dislocations (2.1%). The severity of running-related injuries was compared to the time lost (not being able to train or compete) due to the injury. Of the injured participants, 32.9% who described their injury as a 'major', were absent 1 to 2 weeks from training and competition because of their running-related injury, followed by 28.7% for 3 to 4 weeks for those participants describing their injury as 'severe', 23.1% for 1 to 3 days for those describing their injury as 'minor', and 15.4% for 4 to 6 days for those of the 'moderate' category (Table 2).

Table 2. Anatomical site, type, and severity of lower-extremity running-related injuries

	Frequency (n)	%
Non-injured	86	37.6
Injured	143	62.4
Total	229	100.0
Anatomical site		
Hip and pelvis	5	3.5
Thigh	8	5.6
Knee	48	33.6
Shin	27	18.9
Achilles/calf	14	9.8
Ankle	23	16.1
Foot	18	12.6
Type of injury		
Fracture	8	5.6
Dislocation/ subluxation	3	2.1
Sprain	42	29.4
Tendonitis	29	20.3
Strain	52	36.4
Contusion	9	6.3

Severity of injury		
Minor (absent 1-3 days)	33	23.1
Moderate (absent 4-7 days)	22	15.4
Major (absent 1-3 weeks)	47	32.9
Severe (absent 3-4 weeks)	41	28.7

Risk factors associated with lower-extremity running-related injuries

Risk factors associated with lower-extremity running-related injuries are shown in Table 3; Table 4 explains where significant differences lie. Significant differences were noted between the two groups for training distance ($p \leq 0.0001$), competition distance in the running season ($p \leq 0.002$), competition frequency in the running season ($p \leq 0.0001$), running surface ($p \leq 0.005$), type of running shoes ($p \leq 0.011$), age of running shoes ($p \leq 0.0001$), and running season ($p \leq 0.012$). Most injured participants (39.9%) had a training schedule of 5 days a week as compared to the training frequency of the rest of the running participants. Nonetheless, the analysis confirms no significant differences ($p>0.05$).

Table 3. Risk factors contributing to lower-extremity running-related injuries

	Running-related injury		
	Non-injured	**Injured**	
Variable	**Number (%) n=86 (37.6)**	**Number (%) n=143 (62.4)**	**Chi-square p-value**
Training frequency (days/week)			
4	25(29.1)	34(23.8)	0.476
5	36(41.9)	57(39.9)	
> 5	25(29.1)	52(36.4)	
Training distance (km/week)			
40-50	31(36)	11(7.7)	0.0001*
50-60	51(59.3)	81(56.6)	
60-70	4(4.7)	51(35.7)	
Competition distance in the running season (km)			0.002*
30-40			

40-50	82(95.3)	113(79)	
	4(4.7)	30(21)	
Competition frequency in the running season			
<2 competition	20(23.3)	5(3.5)	0.0001*
2-3 competition	25(29.1)	64(44.8)	
4-5 competition	8(9.3)	40(28)	
6-7 competition	31(36)	20(14)	
>7 competition	2(2.3)	14(9.8)	
Running surface			
Tartan	12(14)	40(28)	0.005*
Flat	7(8.1)	8(5.6)	
Road/asphalt	24(27.9)	22(15.4)	
Sidewalk	16(18.6)	22(15.4)	
Dirt/sand track	16(18.6)	44(30.8)	
Up- or downhill terrains	11(12.8)	7(4.9)	
Type of running shoes			
Brand running shoes	35(40.7)	37(25.9)	0.011*
Walking shoes	32(37.2)	49(34.3)	
Unstandardized running shoes	19(22.1)	57(39.9)	
Age of running shoes (months)			
< 3	22(25.6)	35(24.5)	0.0001*
4-7	35(40.7)	42(29.4)	
8-11	28(32.6)	28(19.6)	
> 12	1(1.2)	38(26.6)	

Running season			
General preparation	28(32.6)	46(32.2)	0.012*
Specific preparation	37(43)	38(26.6)	
Competition period	21(24.4)	59(41.3)	

$p \leq 0.05$

Significant factors associated with lower-extremity running-related injuries

It is clear from the univariate logistic regression analysis displayed in Table 4 that female participants were 1.89 times more likely to be exposed to running-related injuries as compared to male participants (Odds Ratio (OR) = 1.885, 95% confidence interval (CI) = 1.097-3.240; $p \leq 0.022$). Table 4 indicates that previously injured participants were 4.71 times more likely to be exposed to running-related injuries compared to non-previously injured participants (OR = 4.71; 95% CI, 2.646-8.398; $p \leq 0.0001$). Significant differences are also noted for participants with a training distance of between 40km to 50km per week of training ($p \leq 0.0001$) followed by those participants with a training distance of between 50km to 60km per week ($p \leq 0.0001$).

Table 4 shows that significant differences are noted for participants whose competition distance in the running season is between 30-40km ($p \leq 0.002$) compared to a 40-50km competition distance. Participants partaking in <2 competitions ($p \leq 0.0001$) and between 6-7 competitions per running season ($p \leq 0.003$) were significantly less likely to develop lower-extremity running-related injuries. Significant differences are noted for participants that train on tartan (OR = 5.24; 95% CI, 1.665-16.483; $p \leq 0.005$) and were 5.24 times more likely to be exposed to running-related injuries compared to those that train on other running surfaces. Also, participants that train on dirt/sand track were 4.32 times more likely to be exposed to running-related injuries compared to those that train on other running surfaces (OR = 4.32; 95% CI, 1.428-13.073; $p \leq 0.010$) as indicated in Table 4. Significant differences are also noted for participants who run with branded running shoes ($p \leq 0.003$) compared to walking shoes and unstandardized running shoes. Considering the age of the running shoe, those that ran with their shoes for <3 months ($p \leq 0.002$); between 4-7 months ($p \leq 0.001$) and between 8-11 months ($p \leq 0.001$), were significantly less likely to develop injuries. Finally, as for the running season it is clear from Table 4 that a significant difference is only noted for the general preparation phase ($p \leq 0.003$) compared to the specific preparation phase and competition period.

Table 4 also presents the results of the multivariate logistic regression analysis of the association between the development of lower-extremity running-related injuries and the adjusted risk factors. When adjusting the multiple covariance, previously injured participants were 8.2 times more likely to be exposed to running-related injuries compared to non-previously injured participants (OR = 8.2; 95% CI, 2.143-31.401; $p \leq 0.002$). As shown in Table 4, participants that trains 40-50 kilometer per week was 99.7% less likely to sustain running-related injuries than a training distance of 60-70 kilometers per week (OR = 0.003, 95% CI, 0.000-0.073; $p \leq 0.0001$). Correspondingly, with a training distance of 50-60 kilometer per week, participants were 94.7% less likely to sustain running-related injuries than a training distance of 60-70 kilometers per week (OR = 0.053, 95% CI, 0.004-0.728; $p \leq 0.028$). Furthermore, participants who wore running shoes for 8-11 months were 96.7% less likely to sustain running-related injuries when compared with participants with those who wore their shoes more than 12 months (OR = 0.033, 95% CI, 0.003-0.392; $p \leq 0.007$) (Table 4).

Table 4. Significant factors associated with lower-extremity running-related injuries

	Univariate analysis		Multivariate analysis	
Variable	**Univariate odds ratios (ORs) and (95%CI)**	**p-value**	**Multivariate odds ratios (ORs) and (95%CI)**	**p-value**
Sex				
Female	1.885(1.097-3.240)	0.022*	2.880(0.838-9.896)	0.093
Male	1	-	1	-
Previous injury				
Injured	4.714(2.646-8.398)	0.0001*	8.202(2.143-31.401)	0.002*
Non-Injured	1	-	1	-
Trainings distance (km/week)				
40-50	0.028(0.008-0.095)	0.0001*	0.0.003(0.000-0.073)	0.0001*
50-60	0.125(0.042-0.365)	0.0001*	0.053(0.004-0.728)	0.028*
60-70	1		1	-
Competition distance in the running season(km)				
30-40	0.184(0. 062-0.542)	0.002*	0.42(0.001-2.40)	0.124
40-50	1	-	1	-
Competition frequency in the running season				
<2 competitions	0.036(0.006-0.211)	0 0001*	0.627(0.001-50.1)	0.621
2-3 competitions	0.366(0. 077-1.727)	0.204	1.249(0.010-172.78)	0.918
4-5 4-5 competitions	1.714(0.135-3.774)	0.692	0.947(0.008-116.33	0.982
6-7 competitions	0.092(0. 019-0.450)	0.003*	0.154(0.001-22.29)	0.461
>7 competitions	1	-	1	-
Running surface				
Tartan	5.238(1.665-16.483)	0.005*	12.879(0.471-351.9)	0.130
Flat	1.796(0.448-7.197)	0.408	4.627(0.155-137.86)	0.376
Road/asphalt	1.440(0.475-4.372)	0.519	2.597(0.146-46.2)	0.516
Sidewalk	2.161(0.687-6.795)	0.188	3.381(0.162-70.75	0.432
Dirt/sand track	4.321(1.428-13.073)	0.010*	7.723(0.397-150.28)	0.177
Up- or downhill terrains	1	-	1	-
Type of running shoes				
Brand running shoes	0.352(0.176-0.706)	0.003*	0.508(0.186-1.392)	0.188
Walking shoes	0.510(0.258-1.012)	0.054	0.519(0.193-1.395)	0.194
Unstandardized running Shoes	1	-	1	-
Age of running shoes (months)				
< 3	0.42(0.005-0.327)	0.002*	0.172(0.014-2.147)	0.172
4-7	0.032(0.004-0.242)	0.001*	0.100(0.008-1.192)	0.069
8-11	0.26(0.003-0.205)	0.001*	0.033(0.003-0.392)	0.007*
> 12	1	-	1	-

Running season				
General preparation	0.366(0.186-1.717)	0.003*	0.468(0.110-1.198)	0.302
Specific preparation	0.585(0.295-1.160)	0.125	0.299(0.076-1.18)	0.085
Competition period	1	-	1	-

*Note: OR (Odds ratio); CI (Confidence Interval); 1(Regression analysis test reference group); * p ≤ 0.05*

Summarized results of significant risk factors associated with lower-extremity running-related injuries in the Univariate and Multivariate analysis

Table 5 provides a summary of the results of significant risk factors associated with lower-extremity running-related injuries in the Univariate and Multivariate analysis. The results of the multivariate logistic regression analysis show that participants previously injured, participants who train 40km-50km and 50km-60km per week respectively, and wear running shoes that were eight to eleven months old, were associated with running-related injuries. On the other hand, female (sex) participants who were previously injured, who train 40km-50km and 50km-60km per week respectively, competes in 30km-40km distance races in the running season, with a competition frequency of less than 2 and between 6-7 competitions in the running season, run on tartan and a dirt/sand track running surface, wear branded running shoes, wear running shoes that were < 3 months, four to seven, and eight to eleven months old, and the general preparation phase of the running season were all significantly associated with running-related injuries in the Univariate analysis.

Table 5. Summary result table of significant risk factors associated with lower-extremity running-related injuries in the Univariate and Multivariate analysis

	Univariate analysis		**Multivariate analysis**	
Variable	**Univariate odds ratios (ORs) and (95%CI)**	**p-value**	**Multivariate odds ratios (ORs) and (95%CI)**	**p-value**
Sex				
Female	1.885(1.097-3.240)	0.022*	-	-
Previous injury				
Injured	4.714(2.646-8.398)	0.0001*	8.202(2.143-31.401)	0.002*
Trainings distance (km/week)				
40-50	0.028(0.008-0.095)	0.0001*	0.0.003(0.000-0.073)	0.0001*
50-60	0.125(0.042-0.365)	0.0001*	0.053(0.004-0.728)	0.028*
Competition distance in the running season (km)				
30-40	0.184(0. 062-0.542)	0.002*	-	-
Competition frequency in the running season				
<2 competitions	0.036(0.006-0.211)	0 0001*	-	-
6-7 competitions	0.092(0. 019-0.450)	0.003*	-	-
Running surface				
Tartan	5.238(1.665-16.483)	0.005*	-	-
Dirt/sand track	4.321(1.428-13.073)	0.010*	-	-
Type of running shoes				
Brand running shoes	0.352(0.176-0.706)	0.003*	-	-

Age of running shoes (months)				
< 3	0.42(0.005-0.327)	0.002*	-	-
4-7	0.032(0.004-0.242)	0.001*	-	-
8-11	0.26(0.003-0.205)	0.001*	0.033(0.003-0.392)	0.007*
Running season				
General preparation	0.366(0.186-1.717)	0.003*	-	-

*Note: OR (Odds ratio); CI (Confidence Interval); * p ≤ 0.05*

DISCUSSION

This research project is the first of its kind to report on the incidence as well as the associated risk factors of lower-extremity running-related injuries in Ethiopian 10,000-meter long distance runners. Although the definition of "an injury" varies among studies that may confound appropriate comparison across studies, the 62.4% (0.62 injuries per athlete) incidence rate of running-related injuries in this study corresponds with the findings by Taunton et al. (2003); van Gent et al. (2007) and Fields et al. (2010) who established an incidence of 19.4%—79.3%. The incidence expressed in exposure time was 3.54 injuries per 1000 running hours. This result was supported by van Mechelen (1992) who found the incidence rates of 2.5 to 12.1 injuries per 1000 hours of running exposure.

From the results it emanated that the most commonly injured anatomical site was the knee, which is consistent with previous studies in long distance runners (Taunton et al., 2003; Ellapen et al., 2013; Rasmussen et al., 2013 and Poppel et al., 2014). In this study, the most common type of injury was a strain (36.4%). This result corroborates the findings of Tyflidis et al. (2012) and Junior et al. (2013) who identified a strain as the most common type of injury (18.6%) and (30%) respectively. Of the injured participants, 32.9% who described their injury as major were absent from training and competition for 1 to 2 weeks. The results resemble those of Fourchet et al. (2011) who classified the severity of the injury as major.

Risk factors related to running-related injuries in the univariate regression analysis

Although sex, competition distance in the running season, the frequency of competition in the running season, running surface, type of running shoe, and running season were significantly associated with running-related injuries in this study, it was found not to contribute significantly to running-related injuries as illustrated by the multivariate regression analysis.

Both Tyflidis et al. (2012) and Saragiotto et al. (2014) explained that there is no association between gender and running injuries in most of the studies. Conversely, van der Worp et al. (2015) reported that women were at a lower risk than men of sustaining running-related injuries. However, Rauh (2006) and Magnuon (2007) indicated that a higher number of women developed injuries compared to men which corroborate the findings of the current study that difference in sex is a risk factor to developing running-related injuries in females. The result indicating that competition distance and competition frequency contributed significantly to injuries in the univariate analysis is in agreement with findings by van Mechelen (1992) found that running to compete and excessive weekly running distance is associated with running-related injuries. However, the multivariate analysis indicating that competition frequency was not significantly considered as a contributing factor to the development of running-related injuries in the present study can be blamed on the complexity of effectively counting the time the participants spent running during their individual competition programs organized by their personal managers. In this study, running surface was found to contribute to developing running-related

injuries which is in agreement with the findings by (Taunton et al., 2003; Tyflidis et al., 2012; van der Worp et al., 2015).

The results of the univariate analysis indicated that the type of running shoe protected runners against developing running-related injuries corresponds with findings by Pecina and Bojanic (2004) who state that the type of athletes' running shoes is important, as it is used to support stability by controlling foot and ankle motion to decrease the effect of ground contact. Surprisingly however in the multivariate analysis branded running shoes were not a significant protective factor against injuries compared to walking shoes and unstandardized running shoes. It is recommended that the finding that branded running shoes were not a significant protective factor against developing running-related injuries be analysed in more depth in future research projects. In agreement to the findings of the current study in the univariate analysis, Rauh and Macera (2010) and Tyflidis et al. (2012) found that the running season is a significant predictor of developing running-related injuries and more specifically the development of injuries were higher during the competition period of the running season compared to the general preparation phase.

Risk factors related to running-related injuries in the multivariate regression analysis

The results of the multivariate logistic regression analysis show that participants previously injured have a higher odds ratio of experiencing an injury. Conversely, participants who train 40km-50km and 50km-60km per week respectively, and wear their running shoes that were eight to eleven months old, were associated with a protective benefit against running-related injury.

In this study, previous injury was the most significant predictor of sustaining a lower-extremity running-related injury. This finding resembles the results of studies by Fields et al. (2010), Jacobsson et al. (2013) and Sargoite et al. (2014) that reported on the significant relationship between a history of previous running-related injuries as the main risk factor for developing a running-related injury. From these results a cautious interpretation can be made that it seems that the injured participants in this study never fully recovered from a previous injury.

The current study found that training-distance as a risk factor, was significantly associated with running-related injuries. A positive association between a weekly training distance and running-related injuries were previously reported the higher the weekly training distance, the greater the risk for developing a running-related injury (Ristolainen et al., 2014; Ellapen et al., 2013; Nielsen et al., 2013). The present findings support an association between an increased training distance and sustaining running-related injuries. More specifically, weekly training distances of 40-50 km/week and 50- 60 km/week were less likely associated with running-related injuries compared to a weekly training distance of 60-70 km/week. Taunton et al. (2003) showed that the age of the running shoe is associated with running-related injuries. The results of the current study more specifically indicate that running shoes that have been used for with 8-11 months have a protective benefit to decrease the risk of developing running-related injuries compared to shoes worn for <3 months; 4-7 months and >12 months, respectively.

CONCLUSION

This research has added to the body of knowledge on the incidence as well as the risk factors associated with lower-extremity running-related injuries in Ethiopian 10,000-meter long distance runners. The incidence of running-related injuries was 62.4% (0.62 injuries per athlete) corresponding to 0.35 per 100 hours of running or 3.54 per 1000 hours of running exposure. It was also evident that the most commonly injured anatomical site was the knee (33.6%), with a strain the most common type of injury (36.4%). Of the injured

participants, 32.9% who described their injury as major were absent from training and competition for 1 to 2 weeks. Moreover, participants previously injured have a higher odds ratio of experiencing an injury, runners who train 40km-50km and 50km-60km per week, and wearing running shoes for eight to eleven months was significantly associated with a protective benefit against running-related injuries.

The incidence rate of and risk factors associated with running-related injuries amongst Ethiopian 10,000-meter long distance runners is worrying considering that up till now no evidence-based data and information on Ethiopian long-distance runners were available. Hence, in the absence of evidence-based data no efforts were made by coaches, administrators and athletes to address the incidence and associated running-related injury risk factors to prevent lower extremity running-related injuries.Acknowledging the specific risk factors associated with running-related injuries in this study will ensure that runners, coaches, and physiotherapists play a vital role in preventing such injuries. The presence of associations between determinants and running-related injuries suggests that advice/education of 10 000-meter long distance runners may still be necessary. Runners should pay extra attention to fully recover from their previous injury, avoid participating a training distance greater than 60 km/week, and wearing a running shoe more than eleven-month-old. In addition, competition distance, competition frequency, training surface, type of footwear, and the running season, were all significantly associated with running-related injuries, and runners therefore should take note of these risk factors to prevent injuries. The results of this study underscore urgent interventions by coaches, runners, medical professionals and the technical sport experts to ensure that 10 000-meter Ethiopian long distance runners become injury free.

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