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PLAYGROUND CONDITIONS AND INJURY RISKS: IMPLICATION FOR ETHIOPIAN YOUTH SPORT ACADEMY

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ABSTRACT

This study was aimed to investigate the playground conditions and associated injury risks implications for Ethiopian youth. Cross-sectional study design was employed to investigate playground condition and survey study design was employed to assess injury risks of the players. According to the nature of the problem primary source of data was employed. Purposive sampling technique was employed for the study. The instruments were ground cover (%), sward height (mm), hardness (g), and water infiltration rate (mm/hr.) and also questionnaire talking about the injury profiles. Descriptive statistics was produced for each of the parameters. The SPSS 20 software was used for the statistical analysis. The percentage of grass cover is estimated at < 25%. The mean value of sward height in 9 (nine) test locations were 17.89 mm. The mean values of ground hardiness test in all locations were 4.38 ± 1.47 g. However, the field application efficiency (%) of water infiltration rates in 30 minutes in all locations mean ± SD was 33.64 ± 0.55. Incidences of injury in different types of field the analysis showed the overall incidence of injury between the surfaces during training or match play for the players are severe in sandy and loam bare fields and the analysis also showed that the incidence of injury as a function of body location was severe. Based on the major findings of the study an Ethiopian youth sport academy playground is unsafe for the players. So, to keep the quality of pitch, maintenance during and after the playing season is the most critical factor in providing a playing surface that is fit.
Keywords: *Football pitch, injury, players, playground.*

1. INTRODUCTION

Sports injuries result from a complex interaction of many factors related to both the sporting participant and the environment or context in which they participate (Finch & McGrath, 1997). Environmental sporting ground hazards that have been

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cited as being associated with injury risk include: exposed sprinkler heads and uncovered cricket pitches during the winter season, unevenness of the surface, including potholes, bumps and ridges, debris, rubbish and rubble on the surface, type of surface, e.g. concrete, natural turf, synthetic surfaces, clay-based and sand-based soils, etc, poor grass/turf coverage, e.g. clumping of grass and uneven cover, type of grass, hardness of the surface, traction of the surface and weather conditions (Orchard, 2005; Finch & McGrath, 1997; Donaldson, Hill, Brnabic, Finch, Forero, & Wilson, 2002a.b.c.d).

Some soccer studies from the UK and northern Europe have reported a definite trend towards higher rates of injury at the start of the season with a gradual decline over the course of the season (Hawkins, Hulse, WIlkinson, Hodson, & Gibson, 2001; Ekstrand & Nigg, 1989; Blaser & Aeschlimann, 1992; Lewin, 1989; Hawkins & Fuller, 1999; Ekstrand & Gilquist, 1983).

A search of the international sports science and sports medicine literature published in the past ten years found surprisingly few studies that linked sports injuries to ground conditions. Almost all the studies that did mention such a link were football related. No recent published study was identified on the impact of turf and ground conditions on the risk of injury in football or, indeed, most other activities. Readers interested in the evidence from studies published more than ten years ago are referred to the 2002 review by Orchard.

To date, there has been no published study of the relationship between ground hardness and associated factors with injury risk in Ethiopia. Thus, the researcher was hypothesized that the conditions of Ethiopian youth sport academy playground may or may not associate with injury risks of the trainees. Therefore, the purpose of this study was to examine the playground conditions and injury risks: implication for Ethiopian youth sport academy.

2. METHODS AND MATERIALS

2.1 Study Design and Area

For this study both cross-sectional and survey study design was employed to investigate the playground conditions and injury risks; implication for Ethiopian youth sport academy stationed at the capital of Ethiopia, Addis Ababa.

2.2 Subjects

The subjects of the study were Ethiopian youth sport academy football pitch and the trainees who have football training in Ethiopian youth sport academy were included as a subject of the study. The subjects were selected using purposive sampling technique because of the nature of the problem.

2.3 Instruments

Quantitative data was used to have the necessary information about the existing problem. The data was gathered through direct measurements of playground condition tests such as; ground cover (%), sward height (mm), hardness (g), and water infiltration rate (mm/hr.). And also the data was gathered from the trainees' through questionnaire which talking about the injury profiles.

2.3.1 Ground cover (%): This measurement was taken to assess the botanical composition, which will include the percentages of grass cover at various parts of each field.

2.3.2 Sward height (mm): The sward height is of little value when the density of grass cover is low. The preferable sward height depends to a large extent on the growing conditions. There would be the tolerance in sward height with the current desired height for football around 25mm.

2.3.3 Ground hardness (g): Operationally, the 0.5 kg hammer is raised to a set mark on the shaft and then dropped to the ground from 0.55 m. Results are often expressed as the average of two records and are converted to gravities by a multiplication by 10.

2.3.4 Water infiltration rate (mm/hr.): There is a misunderstanding between infiltration and drainage. The field application efficiency (%) is the required irrigation depth (mm), divided by the average applied irrigation depth (mm), and multiplied by 100%.

$$\text{Field application efficiency (\%)} = \frac{\text{Required infiltration pth (mm)}}{\text{Ave. applied infiltration depth (mm)}} \times 100\%$$

2.3.5 The average filtration depth applied (6) is: A (1 to 6).

The required net filtration depth in mm (for sandy loam 20-30 Av. 25mm).
Thus the field application efficiency (%) = 25/ av. filtration x 100% = _____%
It means that the (average) deep percolation losses are av. filtration - 25 = _____ mm.

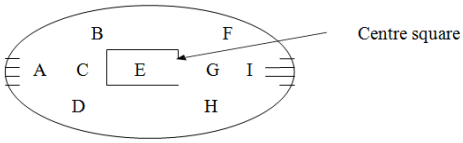
2.4 Method of Data Analysis

Descriptive statistics was produced for each of the parameters. The results were presented in mean, standard deviation, frequency and percent to determine distribution of data. The SPSS 20 software was used for the statistical analysis.

3. RESULTS

Ground assessments were made on the nine locations within each venue in the pattern shown in Figure 1. This pattern of sampling ensured that valid assessment of each venue was provided (in terms of what is known to be valid for elite venue testing). It also ensured that a number of sites along the centerline of the ground were assessed, in line with where most of the football action takes place.

Figure 1: Distribution of sampling locations across the football venue



The below figures 2: a to i, indicates that the Ethiopian youth sport academy football pitch with normative data of the standard the grass cover dimension of the Best Practice Sports Ground Inspection process below the standards. The percentage of grass cover was estimated at < 25%.

Figure: 2. a. Location "A"

b. Location "B"

c. Location "C"

d. Location "D"

e. Location "E"

f. Location "F"

g. Location "G"

h. Location "H"

i. Location "I"

Table 1: The grass cover dimension of the best practice sports ground inspection process

Observation	The percentage of grass cover is estimated at	<25% <50% <75% >75%
	Does the percentage of grass cover present a hazard to players and officials?	Yes/No
	Are there weeds, tussocks or bare patches that could cause stability problems for players?	Yes/No
Analysis	Any YES response to the above observations means problems exist. Review your responses and indicate how significant this aspect of the ground is. Remember that aspects of ground safety can be less than ideal, but still safe for play.	Not significant Very significant
Conclusion	In terms of ground surfaces safety the grass cover of the field is such that conditions for players and officials is	Safe Unsafe

The safety issues relate to bare patches being at a different level to the grassed surface causing an uneven surface and the different traction characteristics as players move from one area to another. Weeds, tussocks and tufts of different grasses can also lead to an undulating and uneven surface. Tripping and jarring injuries are the likely consequences (PQS, 1988).

Table 2: The sward height is of little value when the density of grass cover is low

Sward Height mean ± SD										
Location	A	B	C	D	E	F	G	H	I	
Mean	13	22	0	25	10	20	8	41	22	17.89
N	1	1	1	1	1	1	1	1	1	9
SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.86

As indicated in the above table 2. The mean value of sward height in 9 (nine) test locations were 17.89 mm. The sward heights in the test location A, C, E, and G were below the acceptable range that is <20mm, but in the test location B, D, F and I the sward heights were in the normal range which is between 20 to 40mm.

However, in the test location H the sward heights were above the normal rage which is > 40mm. From the result the researcher understood that, the center part of the field was a bare field, while the side field a little beat had a sward cover with preferable height.

Table 3: Ground hardness test results in different location

Location	1st Drop	2nd Drop	3rd Drop	Average	G (Av X g(10))
A	3mm	5mm	5mm	4mm	40g
B	4mm	5mm	7mm	5.5mm	55g
C	2mm	4mm	7mm	4.5mm	45g
D	7mm	8mm	8mm	7.5mm	75g
E	3mm	4mm	6mm	4.5mm	45g
F	5mm	6mm	8mm	6.5mm	65g
G	2mm	3mm	5mm	3.5mm	35g
H	7mm	8mm	8mm	7.5mm	75g
I	4mm	6mm	6mm	5mm	50g
Mean ± SD				4.38 ± 1.47	53.89 ± 14.74

Operationally, the 0.5 kg hammer is raised to a set mark on the shaft and then dropped to the ground from 0.55 m. The influence of the thatch layer is reduced in the later drops as it is compressed and this further supports the use of the third drop. Results are often expressed as the average of two records and are converted to gravities by a multiplication by 10.

The above table 3 showed that the mean value of ground hardiness test in all locations were 4.38 ± 1.47 g. This indicates that the ground condition of Ethiopian youth sport academy football field was found in low normal ranges. However, according to the 1999, performance quality standards the surface hardness of Ethiopian youth sport academy football field was found in the preferred range.

Table 4: Ranges of ground condition measures for football fields *(Chivers, and Aldous, 2004)*

Performance Indicator	Unacceptably Low	Low normal	Preferred Range	High normal	Unacceptably High
Hardness (g/10)	≤3.0	3.1 to 6.97	7.0 to 8.9	9.0 to 12.0	>12

Table 5: Constant infiltration results (mm/h) of all test locations

SN	Time Elapsed Since Started (min)	Water Dropped in mm									
		A	B	C	D	E	F	G	H	I	
1	0 min	65	65	65	65	65	65	65	65	65	
2	4 min	63	64	62	63	63	64	62	64	63	
3	8 min	61	62	61	61	60	62	61	62	60	
4	11 min	60	61	60	59	58	60	60	60	58	
5	20 min	56	58	56	53	55	56	58	54	56	
6	30 min	49	50	48	50	49	49	47	49	50	
Average		59	60	58.6	58.5	58.3	59.3	58.3	59	58.6	Mean ± SD
Field application efficiency (%)		34	35	33.6	33.5	33.3	34.3	33.3	34	33.6	33.84 ±0.55

The results in the above table 5 showed that the average water infiltration rate in 30 minutes in each test locations were A=59mm, B=60mm, C=58.6mm, D=58.5mm, E=58.3mm, F= 59.3mm, G= 58.3mm, H= 59mm and I= 58.6mm. However, the field application efficiency (%) in each location were A=34, B=35, C=33.6, D=33.5, E=33.3, F= 34.3, G= 33.3, H= 34 and I= 33.6 %, while the total locations mean ± SD were 33.64 ± 0.55. The result showed that Ethiopian youth sport academy football field was absorbs water above the range of constant infiltration rate from the double ring infiltrometer.

Table 6: Incidences of injury in different types of field in frequency and percent

	Natural Grass		**Sandy Bare**		**Loam Bare**	
	Fre.	%	Fre	%	Fre.	%
Slight	18	35.3%	6	11.8%	10	19.6%
Minimal	6	11.8%	4	7.8%	4	7.8%
Moderate	15	29.4%	9	17.6%	10	19.6%
High	8	15.7%	6	11.8%	10	19.6%
Severe	4	7.8%	26	51%	17	33.3%
Total	51	100%	51	100%	51	100%

Incidences of injury players on natural grass, sandy bare field and loam bare field are presented in Table 6 and fig 3 as function of injury severity. On the natural grass field the respondents were respond 35.3% slightly, 11.8% minimal, 29.4% moderate, 15.7% highly and 7.8% severely injured, and in sandy bare field the

respondents were respond that 11.8% slightly, 7.8% minimal, 17.6% moderately, 11.8% highly and 51% of severely injured and also in loam bare field the respondents were respond that 19.6% slightly, 7.8% minimal, 19.6% moderately, 19.6% highly and 33.3% severely injured. This analysis showed the overall incidence of injury between the surfaces during training or match play for the players are severe in sandy and loam bare fields.

Figure 3: Incidences of injury in different types of field in frequency

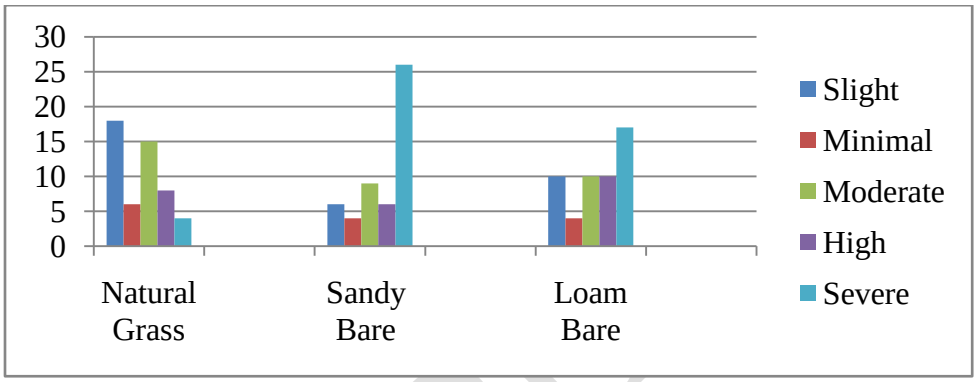


Table 7: The incidence of injury as a function of body location in frequency and percent

	Ankle		Knee		Adductor		Skin Contusion		Skin Lesion		Hamstring Strain		Foot Cont.	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Slight	4	7.8	5	9.8	3	5.9	11	21.6	5	9.8	13	25.5	19	37.3
Minimal	5	9.8	4	7.8	4	7.8	5	9.8	2	3.9	5	9.8	5	9.8
Moderate	13	25.5	11	21.6	14	27.5	7	13.7	7	13.7	5	9.8	9	17.6
High	8	15.7	9	17.6	7	13.7	4	7.8	7	13.7	3	5.9	4	7.8
Severe	21	41.2	22	43.1	23	45.1	24	47.1	30	58.8	25	49	14	27.5
Total	51	100	51	100	51	100	51	100	51	100	51	100	51	100

The incidence of injury as a function of body location presented in table 4.9. The respondents were responding majority of injuries affected ankle, knee, adductor, skin contusion, skin lesion, hamstring strain and foot contusion. According to the majority of respondents' response that severe injury was happened on their ankle (41.2%), knee (43.1%), adductor (45.1%), skin contusion (47.1%), skin lesion (58.8%), and hamstring strain (49%), while slightly in foot contusion (37.3%). The result was because of repeatedly performing training on poor quality playing

surface. The analysis showed that the incidence of injury as a function of body location was severe.

4. DISCUSSION

This can show that the percentage of grass cover presents a hazard to players, and it can cause stability problems for players. Inspection process ideally, sports grounds should have a 100% grass cover. It should be noted that as the percentage of bare area increases, the associated injury risk potentially increases as well.
Richards and Baker (1992) investigated the effect of sward height on ball roll, and simultaneously measured traction and hardness. They discovered no discernible relationship although initial results (1990) demonstrated a reduction in traction values as grass length increased, while in, this pattern did not continue.
Subsequent research has highlighted that excessive traction can be damaging; causing the foot to become 'locked' into the surface, transferring forces to the ankle and knee (Lees and Nolan, 1998), and it is arguable that the standards need to be revisited to ensure they are appropriate when considering player safety. In support with this, ground hardness might be an important indirect factor in football injuries owing to its influence on running speed and consequent impact force. Although it is recognized that a hard ground provides greater external force directly to the body when a player falls, a harder sports ground also produces faster and quicker movements, probably because of increased traction and less force attenuation (Norton *et al.,* 2001).
For football player, the football pitch is his or her place of work; therefore the pitch must not be a hazard to health. Furthermore, a recent study has shown that football carries a risk of injury 1000 times greater than high-risk industrial occupations and only marginally less than the risk of injury from rugby, which is a contact sport (Hawkins, & Fuller,1999)
Injuries, those that directly influence the player's ability to take part in training and matches (Bahr, 2009). Similar findings of a lower risk of muscle strains and a higher risk of ankle sprains on artificial turf were previously reported by Ekstrand *et al*. (2006), but it may well be that the risk of muscle strain differs in different populations, e.g. in different age groups, different countries or in different playing circumstances. The most common injuries reported in this study of players are similar to those reported by Fuller *et al.* (2007a,b) for non-elite players.

Injuries to the leg are the most frequent sports injuries and it is argued this is a result of the knee and ankle joints being placed under excessive load (Milburn and Barry, 1998), with one study claiming that injuries to the knee and ankle ligaments account for 71% of ball-sport injuries (Heidt *et al.,* 1996). Significant to this research is the proportion of these injuries that can be attributed directly to the surface conditions.

Teams playing on lower quality football pitches might have a different injury pattern. Wounds, burns and friction injuries have been reported to be more frequent when playing on earlier generations of artificial turf pitches (Gaulrapp *et al*., 1999).

5. CONCLUSIONS

Based on the major findings of the study the following points are stated as conclusion. Ethiopian youth sport academy ground surfaces grass cover of the field is unsafe for the players. The central part of the field was a bare field, while the side a little beat had a sward cover with preferable height. The ground hardness condition of Ethiopian youth sport academy football field was found in low normal ranges. The Ethiopian youth sport academy football field was absorbs water above the normal range of constant infiltration rate. The incidences of injury between the surfaces during training or match play for the players are severe in sandy and loam bare fields and injury as a function of selected body location was severe in ankle, knee, adductor, skin contusion, skin lesion, hamstring strain and foot contusion..

Considering the major findings and conclusions of the study, it is important to provide the following recommendations. The quality of pitch maintenance during and after the playing season is the most critical factor in providing a playing surface that is fit. Grounds men should know which management tools adversely affect the quality of the pitch. A yearly assessment of surface is required and the results must be within certain limits and the concerned body should aware that playgrounds must cover with grasses that minimize the risk of injuries for the trainees.

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