tests. We believe that progress was due to use of our training. Significantly better results achieved by children in these technical tests confirm the hypothesis of the paper.

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THE EFFECTS OF SOCCER POSITIONS ON BONE STRENGTH

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Abstract

*Purpose***.** Soccer can be classified as an impact loading sport. Because it characterized by various types of running with rapid changes in direction starts, stops, jumping and kicking, resulting in large ground reaction force (GRF) at the skeleton. The aim of this study was to determine the Effect of playing positions on bone mineral density (BMD), bone mineral content (BMC) among Egyptian professional soccer players.

Methods. Data were collected on professional players from three positional Groups (defenders, midfielders, strikers) representing various Egyptian Premier League clubs during the 2011-2012 season. The committee granted ethical approval from the EgyptianFootball Association. 42 players (14 defenders, 16 midfielders, 12 strikers) from three different teams were selected in the study. All subjects were free of any disorders known to affect bone metabolism, such as bone fractures, osteoporosis, diabetes and cardiovascular disease. The participants did not report use of any anti-seizure drugs, alcohol and cortoon consumption, neither smoking cigarette. Regional BMD was measured by a bone densitometer (QDR-1000®, Hologic Inc., and Waltham, Massachusetts, USA) using dual-energy x-ray absorptiometry. The measured regions where lumbar spine (L2, L3, L4) and the femoral regions of the kicking leg, neck (NECK), trochanter (TROCH), ward's triangle (WARDS). The region "lumbar spine" (L2-L4) is defined by the mean value of L2, L3 and L4; the coefficient of variation was < 1.5%.

Results. There was a Significant Difference between Defenders group and the Midfielders group in BMD of Fem Neck for Defenders group. Significant Difference between Defenders group and Strikers group in BMD of Fem Neck for Defenders group. No Significant Difference between Midfielders group and Strikers group in BMD of Fem Neck. Significant Difference between Defenders group and Midfielders group in BMD of Troch for Defenders group.Significant Difference between Defenders group and Strikers group in BMD of Troch for Defenders group. No Significant Difference between Midfielders group and Strikers group in BMD of Troch. No Significant Difference between all groups in BMD of Wards – Tri. Significant Difference between Defenders group and Midfielders group in BMD of L2-L4 for Defenders group.Significant Difference between Defenders group and Strikers group in BMD of L2-L4 for Defenders group. No Significant Difference between Midfielders group and Strikers group in BMD of L2-L4. Significant Difference between Defenders group and Midfielders group at BMC of Fem Neck for Defenders

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group.Significant Difference between Defenders group and Strikers group at BMC of Fem Neck for Defenders group. No Significant Difference between Midfielders group and Strikers group at BMC of Fem Neck. Significant Difference between Defenders group and Midfielders group at BMC of Troch for Defenders group.Significant Difference between Defenders group and Strikers group at BMC of Troch for Defenders group. No Significant Difference between Midfielders group and Strikers group at BMC of Troch. Significant Difference between Defenders group and Midfielders group at BMC of Wards – Tri for Defenders group.Significant Difference between Defenders group and Strikers group at BMC of Wards – Tri for Defenders group. No Significant Difference between Midfielders group and Strikers group at BMC of Wards – Tri. Significant Difference between Defenders group and Midfielders group at BMC of L2-L4 for Defenders group.Significant Difference between Defenders group and Strikers group at BMC of L2-L4 for Defenders group. No Significant Difference between Midfielders group and Strikers group at BMC of L2-L4. No Significant Difference between Defenders group and Midfielders group in LS. Significant Difference between Defenders group and Strikers group in LS for Defenders group. No Significant Difference between Midfielders group and Strikers group in LS. No Significant Difference between Defenders group and Midfielders group in BS. Significant Difference between Defenders group and Strikers group in BS for Defenders group. No Significant Difference between Midfielders group and Strikers group in BS. Significant Difference between Defenders group and Midfielders group in KD for Defenders group.Significant Difference between Defenders group and Strikers group in KD for Defenders group.Significant Difference between Midfielders group and Strikers group in KD for Midfielders group.The high significant correlation between LS and BMD , BMC for Fem Neck (0.643**) (0.721**) .The high significant correlation between BS and BMD , BMC for L2-L4 (0.523**) (0.649**) .The high significant correlation between KD and BMD , BMC for L2-L4 (0.786**) (0.879**)

Conclusions. This analysis has shown that the assessment of bone mineral density , static muscular strength and kicking distance according to field positions among soccer players has very important, and coaches Must be developed and modified their training load according to individual capacity.

Key words: Bone Mineral Density, Positions, Static Muscular Strength, soccer.

Introduction

Soccer is probably the most popular sport among the male population in the world, At least 200 million licensed players participate in soccer and 20 million soccer games are arranged each year in the world (Witvrouw et al. 2003). Skilled movement must be executed under the situation of match related conditions of restricted space, limited time, physical and mental fatigue and opposing players. Soccer players have to possess moderate to high aerobic and anaerobic power, have good agility and joint flexibility, and be capable of generating high torques during fast movements (Reilly et al. 2000).

Assessment of physical and physiological profiles on soccer players has become important in recent years, in that training load can be decided according to individual capacity.

Research in soccer physiology and medicine has seen notable development in recent years. Investigations of the ideal physiological and anthropometric characteristics of successful soccer players (Bangsbo, Mizuno, 1988; Shephard, 1999) have shown that there has been a notable increase in the overall intensity of the game which can be attributed to the increase in the speed and agility of the players

Bone is a vital tissue with three functions: 1) to provide maximal mechanical competence with minimum weight for locomotion, 2) to protect the internal organs, and 3) to participate in minerals and blood cell homeostasis. Numerous factors such as age, gender, ethnic and body size, nutrition habits and level of physical activity can effect on bone. (Currey, 2002: Morgan et al. 2008)

Osteoporosis is a systemic disease of the skeleton with reduced bone mass and structural deterioration of the bone tissue, resulting in a higher incidence of fractures. Bone structure and bone tissue metabolism are determined by the individual genetic predisposition and the influence of endocrine and mechanical factors. (Aloia et al. 1995; McLeod et al. 1998)

However, it is widely believed that physical activity has an important role in maximizing peak bone mass and reducing subsequent rates of bone loss. Observational epidemiological studies have consistently found that athletes have higher bone mass than people leading lifestyles that are more sedentary. In addition, the amount of load that is exerted on the skeletal tissue appears to be of importance. A number of studies of bone mineral density (BMD) among athletes showed that athletes who participated in "Impact - loading" sports (sports producing ground reaction forces greater than or equal to 3 times the body weight) had greater BMD than athletes who participated in a non-gravitational sport. (Grimston et al. 1993)

The knowledge of the mechanisms of skeletal adaptation to mechanical loading and to metabolic conditions caused by physical activity is essential to prevent osteoporosis. Athlete studies can help to identify potential risks in young people for developing osteoporosis in their later years. (Timo et al. 2010)

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Soccer can be classified as an impact loading sport (Alfredson et al. 1995). Because it characterized by various types of running with rapid changes in direction starts, stops, jumping and kicking; resulting in large ground reaction force (GRF) at the skeleton . (David et al. 2006) demonstrated that weight-bearing sport activities involving rapid directional changes, starts, stops and GRF promotes bone deposition in pre pubertal and post pubertal age .

Soccer players are expected to have different physiological characteristics according to their playing positions (Dunbar, Power, 1995). On the other hand, some authors have reported that soccer players have similar physiological capacities in all playing positions (Capranica et al. 2001; Chamari et al. 2004; Guner et al. 2006).

Data on the impact of soccer on BMD of weight-bearing and non-weight-bearing remain scarce.Most data focused on determining BMD of dominant and non-dominant leg. (Nazarian et al. 2010) Dominant Lower Limb and Non Dominant Lower Limb (Nazarian et al. 2009). Or investigated the influence of two different types of weight-bearing activity on (BMD), bone mineral content (BMC), in late adolescent girls. Moreover, to recognize if female soccer players showed signs of skeletal adaptation

Unfortunately, physical activity and training do not always have positive effects on bone metabolism. Under certain conditions high level sports and even ambitious recreational sports can affect bone mass adversely. Even high levels of training may not help to increase or even lower BMD, when the kind of mechanical loading of the skeleton is inadequate or if other components of bone metabolism (e.g. Nutrition, hormonal balance) is affected. There are a number of athlete studies that describe low BMD especially insports where body weight can be a limiting factor in performance, where high training volumes are common and where the reproductive function can be altered, for example in long-distance running and cycling (Bennell et al. 1996; Voss et al. 1998; Nichols et al. 2003)

Although, Understanding their bone adaptation may assist coaches when preparing different training programs for defenders, midfielders and strikers, showed differences between these positions be established.

Hence, the aim of this study was to determine the Effect of playing positions on bone mineral density (BMD), bone mineral content (BMC) and static muscular strength among Egyptian professional soccer players

Material and methods:

Subjects

Data were collected on professional players from three positional Groups (defenders, midfielders, strikers) representing various Egyptian Premier League clubs during the 2011-2012 season. The committee granted ethical approval from the EgyptianFootball Association. 42 players (14 defenders, 16 midfielders, 12 strikers) from three different teams were selected in the study. All subjects were free of any disorders known to affect bone metabolism, such as bone fractures, osteoporosis, diabetes and cardiovascular disease. The participants did not report use of any anti-seizure drugs, alcohol and cortoon consumption, neither smoking cigarette.

PROCEDURES

Age, height, weight, body mass index and Training experience were recorded. Height was assessed with a standard tape measure on a wall; weight was measured with household scales. Body mass index was calculated (BMI (kg/m^2) = Wt (kg) /(Ht $(m)^2$.

Static strength test (LS) (BS)

A Takei leg and back dynamometer was used to measure the static leg and back strength. The subjects stood on the dynamometer platform and crouched to the desired leg bend position, while strapped around the waist to the dynamometer. At a prescribed time they exerted a maximum force straight upward by extending their legs. They kept their backs straight, head erect and chest high. 3 trials were allowed to the subjects and the best score was taken. Subjects had a rest between the trials (Jensen & Fisher).

BMD measurement

Regional BMD was measured by a bone densitometer (QDR-1000®, Hologic Inc., Waltham, Massachusetts, USA) using dual-energy x-ray absorptiometry. DXA scans are used primarily to evaluate bone mineral density. DXA scans can also be used to measure total body composition and fat content with a high degree of accuracy comparable to hydrostatic weighing with a few important caveats. However, it has been suggested that, while very accurately measuring minerals and lean soft tissue (LST), DXA may provide skewed results as a result of its method of indirectly calculating fat mass by subtracting it from the LST and/or body cell mass (BCM) that DXA actually measures.The measured regions wherethe lumbar spine (L2, L3, L4) and the femoral regions of the kicking leg, neck (NECK), trochanter (TROCH), ward's triangle (WARDS). The region "lumbar spine" (L2-L4) is defined by the mean value of L2, L3 and L4; the coefficient of variation was < 1.5%.

Kicking Distance – Preferred Leg – Very basic test in which the measuring gaugesare set up to cover 6 meters. Set up a 5 meter kicking area where the tested player starts from and then measure and mark out 30 meters and every 5 meters thereafter. The player may not run any further back than the designated 5 meter area. He will have 2 kicks on his preferred leg and will score only with his best kick. Let the ball hit the ground and stand where it bounced to then gauge how far the kick traveled using the 5 meter markers.

Diagram

Statistical analysis:

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All statistical analyses were calculated by the SPSS.V.16 (Statistical Package for the Social Sciences). The results are reported as means and standard deviations (SD). ANOVA analysis was used to compare the variety of the different variables between the three groups for static strength and regional bone. Least Significant Difference Test "LSD" was used to compare group means in variance analysis results that were found statistically significant. Differences in means were considered significant if p, 0.05

RESULTS

Table 1. Anthropometric Characteristics Training experience of the Groups (Mean ± SD)

Group	N	Age [years]	Weight [kg]	Height [cm]	BMI [kg/m^2]	Training experience
Defenders	14	25 ± 1.2	77 ± 2.9	179 ± 3.1	23.5 ± 1.8	14 ± 2.5
Midfielders	16	22 ± 0.9	70 ± 3.1	173 ± 2.2	23.3 ± 2.1	11 ± 2.3
Strikers	12	23 ± 1.4	73 ± 3.2	177 ± 2.8	23.2 ± 1.9	13 ± 1.1

Table 1 shows the age and anthropometric characteristics of the subjects. There were no significant differences were observed in the anthropometric characteristics and Training experience for the subjects in the different groups.

Table 2. Mean ± SD and Least Significant Difference Test "LSD" between three positional Groups (defenders, midfielders, strikers) in BMD, BMC (Fem Neck Troch, Wards – Tri and L2-L4) and static muscular strength for legs and back

Variables	Defenders (D)	Midfielders (M)	Strikers (S)	D-M	D-S	M-S
BMD						
Fem Neck	1.344± 0.03*	1.326± 0.04	1.324± 0.02	S	S	NS
Troch	1.123± 0.02*	1.115± 0.03	1.114± 0.04	S	S	NS
Wards – Tri	1.058± 0.02	1.051± 0.02	1.049± 0.04	NS	NS	NS
L2-L4	1.359± 0.07*	1.232± 0.04	1.240± 0.06	S	S	NS
BMC						
Fem Neck	7.451± 0.57*	7.103± 0.82	7.114± 0.73	S	S	NS
Troch	16.603± 1.02*	16.422± 1.03	16.334± 1.02	S	S	NS
Wards – Tri	1.040± 0.14*	1.035± 0.16	1.036± 0.18	S	S	NS
L2-L4	14.269± 1.04*	14.131± 1.07	14.134± 1.06	S	S	NS
Static Strength						
LS	184.36± 4.77*	180.75± 3.91	178.36± 4.23	NS	S	NS
BS	156.25± 4.53*	153.46± 3.33	151.87± 3.42	NS	S	NS
Kicking distance						
KD	35.00 ± 4.53	32.32 ± 3.15	29.87 ± 5.87	S	S	S

Table 2 shows that:

Significant Difference between Defenders group and Midfielders group in **BMD of Fem** Neck for Defenders group. Significant Difference between Defenders group and Strikers group in **BMD of Fem Neck** for Defenders group. No Significant Difference between Midfielders group and Strikers group in **BMD of Fem Neck**.

Significant Difference between Defenders group and Midfielders group in **BMD of Troch** for Defenders group. Significant Difference between Defenders group and Strikers group in **BMD of Troch** for Defenders group. No Significant Difference between Midfielders group and Strikers group in **BMD of Troch**.

No Significant Difference between all groups in **BMD of Wards – Tri**.

Significant Difference between Defenders group and Midfielders group in BMD of **L_2-L_4**for Defenders group. Significant Difference between Defenders group and Strikers group in **BMD ofL_2-L_4** for Defenders group. No Significant Difference between Midfielders group and Strikers group in **BMD of L_2-L_4.**

Significant Difference between Defenders group and Midfielders group at**BMC of Fem Neck** for Defenders group. Significant Difference between Defenders group and Strikers group at**BMC of Fem Neck** for Defenders group. No Significant Difference between Midfielders group and Strikers group at**BMC of Fem Neck**.

Significant Difference between Defenders group and Midfielders group at**BMC of Troch** for Defenders group. Significant Difference between Defenders group and Strikers group at**BMC of Troch** for Defenders group. No Significant Difference between Midfielders group and Strikers group at**BMC of Troch**.

Significant Difference between Defenders group and Midfielders group at**BMC of Wards – Tri** for Defenders group. Significant Difference between Defenders group and Strikers group at**BMC of Wards – Tri** for Defenders group. No Significant Difference between Midfielders group and Strikers group at**BMC of Wards – Tri.**

Significant Difference between Defenders group and Midfielders group at**BMC of L_2-L_4**for Defenders

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group. Significant Difference between Defenders group and Strikers group at**BMC of L_2-L_4** for Defenders group. No Significant Difference between Midfielders group and Strikers group at**BMC of L_2-L_4.** No Significant Difference between Defenders group and Midfielders group in **LS**. Significant Difference between Defenders group and Strikers group in **LS** for Defenders group.No Significant Difference between Midfielders group and Strikers group in **LS**. No Significant Difference between Defenders group and Midfielders group in **BS.**Significant Difference between Defenders group and Strikers group in **BS** for Defenders group.No Significant Difference between Midfielders group and Strikers group in **BS**. Significant Difference between Defenders group and Midfielders group in **KD**for Defenders group. Significant Difference between Defenders group and Strikers group in **KD** for Defenders group. Significant Difference between Midfielders group and Strikers group in **KD**for Midfielders group.

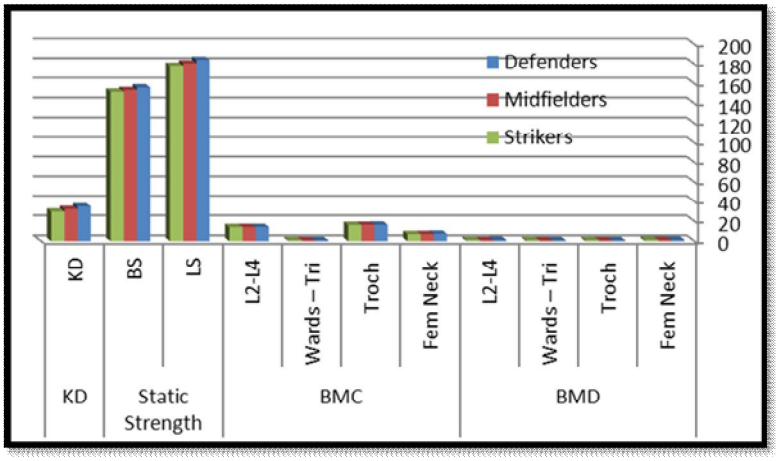

Figure 1 shows the deference's between three positional Groups (defenders, midfielders, strikers) in BMD, BMC (Fem Neck Troch, Wards – Tri and L2-L4) and static muscular strength for legs and back

Table 3.The correlation between static muscular strength inthe legs and back ,Kicking distance and BMD, BMC (Fem Neck Troch, Wards – Tri and L2-L4) .

Variables	BMD				BMC			
	Fem Neck	Troch	Wards – tri	L2-L4	Fem Neck	Troch	Wards – tri	L2-L4
LS	0.643**	0.432**	0.332*	0.421**	0.721**	0.432**	0.365*	0.535**
BS	0.507**	0.331**	0.215	0.523**	0.622**	0.541**	0.332*	0.649**
KD	0.721**	0.655**	0.209	0.786**	0.821**	0.701**	0.613**	0.879**

*R with 0.05 = 0.304
**R with 0.01 = 0.393

Table 3:shows that:

The high significant correlation between LS and BMD , BMC for Fem Neck (0.643**) (0.721**)
The high significant correlation between BS and BMD , BMC for L2-L4 (0.523**) (0.649**)
The high significant correlation between KD and BMD , BMC for L2-L4 (0.786**) (0.879**)

Table 4.The correlation between Kicking distance and static muscular strength for legs and back .

Variables	BS	LS
KD	0.752**	0.652**

Table 4:shows that:
The high significant correlation between KD and BS (0.752**

Discussion

Each sport is characterized by its unique physical and physiological demands in different age groups and positions thatare of importance to assess the elite performers to understand the demands of the sports at different stages of development

Soccer involves intermittent high-intensity activitieslike running at different intensities, suddenaccelerations and stops, rapid changes in direction,jumps, kicking and punting that result in significantground reaction forces on the skeleton. Therefore, soccer can be classified as an impact

loading sport (Alfredson et al. 1995) involvingosteogenic activities (Wittich et al. 1998). Moreover, soccer practice induces positiveadaptation of the bone tissue (Vincente-Rodriguez et al. 2004).

The results of Table (1) showeda different levels of BMD in football players according to different places to play, and this is due to that each position playing is characterized by the capabilities of its own to distinguish them from the rest of the other positions, where the defense players must be to have the ability to jump and hitting the ball by head to prevent a goal as well as their ability to conduct the tackling quickly and also their participation in the attack and the exploitation of their machine.

Midfielders and strikers also engaged in significantly more of the 'other' type movements (jumping, landing, diving, sliding, slowing down, falling and getting up) with strikers performing the most of the three positions. As identified by Bangsbo (1997), extra physiological costs are created through on the ball and other movement activities. In terms of the latter, strikers and defenders fall to the ground most in match play with defenders required to get-up quickly more times suggesting this is another area important for physical preparation.

These positions also perform the most jumping which supports the findings of Bangsbo (1994) and Reilly et al. (2003) with defenders performing significantly more backward jumping. However, it also appears to be important for midfielders to have the ability to jump vertically.

Adding to, defenders were also observed to perform significantly more diving with feet first which may be related to attempts to intercept passes or block shots and crosses rather than making tackles as there were no differences seen in the number of tackles made by all positions. Defenders may also need to be the physically strongest players as they were found to perform the most physical contact at high intensity. Efficacy in pushing and pulling activities in the upper body as well as having abilities to withstand being pushed and pulled is desirable. In addition, strikers were also observed to have higher levels of stopping at high intensity as well as swerving and slowing more rapidly. These activities produce shearing forces on the lower limbs and appropriate strength training and rehabilitation practices must be adopted and emphasized (Besier et al., 2001). In similar respect, defenders should also have sufficient body strength in order to compete with the strikers.

It is clearly also a correlation function between the distance kicking and BMD of the spine and legs and muscle strength of the spine and legs, and this explains the role of force employment in the kicks, and notes over defenders in the distance kicking and this is attributed to the defenders need to deflect the ball to the farthest possible distance from their goal compared to Attackers and midfielders.

In terms of directions travelled, the midfielders were also found to perform the most directly forward movements with defenders engaged in the highest amount of backwards and lateral movements. This is similar to previous findings of Rienzi et al. (2000). The majority of diagonal and arc movements were performed in forward directions with midfielders and strikers performing more than defenders, which suggest these, are important directions in order to manipulate and create space or to evade a marker and be in a position to receive a pass from a teammate.

In conclusion, this analysis has shown that the assessment of bone mineral density , static muscular strength and kicking distance according to field positions among soccer players has very important, and coaches Must be developed and modified their training load according to individual capacity.

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