Effects of Playing Surfaces on Volumetric Bone Mineral Density in Adolescent Male Soccer Players

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Abstract

It has been well recognized that impact loading in sporting activity is highly associated with bone accretion. Recently, Carmona et al.[1] showed that bone mass accretion was similar bone in prepubescent soccer players independently of the playing surface (artificial turf vs. non-grass ground surface). However, the osteogenic effects on volumetric bone mineral density (vBMD) generated by four different playing surfaces of the same sport are unknown. **PURPOSE**: to investigate the effects over a soccer season in vBMD of male soccer players by playing surface. **METHODS**: A total of 71 male soccer players (12.7±0.6 y) volunteered to participate in the study. 26 participants were training and playing on 2nd generation artificial turf, 16 on a 3rd generation artificial turf, 10 on a non-grass ground surface and 19 on natural grass (NG). vBMD, at 4 and 38% of the non-dominant tibia, was measured before and after season by peripheral quantitative computed tomography (Stratec XCT-2000 L pQCT scanner). Analysis of variance for repeated measures×2 (time) were performed to determine the effects of playing surface on vBMD controlling for pubertal status. Effect size were calculated according to the methods proposed by Cohen (small (f=0.1), medium (f=0.2), or large (f=0.4)). **RESULTS**: A group by time interaction was found for vBMD at 38% of the distal tibia (p=0.029 and f=0.38). When pairwise comparisons were carried out, NG showed group by time interactions compared to 2nd generation artificial turf (782 to 804 mg/cm^3 vs. 790 to 798 mg/cm^3; p=0.007 and f=0.50), and to 3rd generation artificial turf (782 to 804 mg/cm^3 vs. 784 to 788 mg/cm^3; p=0.027 and f=0.35). **CONCLUSION**: Soccer players training and playing in NG pitch showed better values in vBMD acquisition than those on 2nd and 3rd generation artificial turf. Despite previous studies presented no differences on bone mass accretion independently of the playing surface. Our results suggest that NG is the most recommended playing surface to improve vBMD in the non-dominant tibia.

Methods

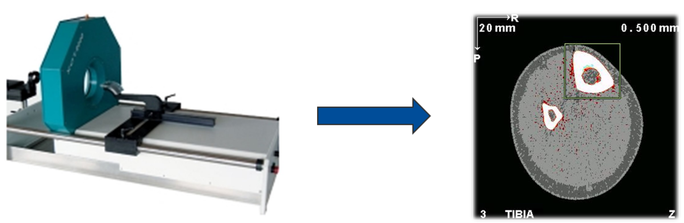
Participants: A total of 71 male soccer players (12.7±0.6 y) volunteered to participate in the study. 26 participants were training and playing on 2nd generation artificial turf, 16 on 3rd generation artificial turf, 10 on soil ground and 19 on natural grass (NG) during a whole seasson.

Bone mass: vBMD, at 4 and 38% of the non-dominant tibia, was measured before and after season by peripheral quantitative computed tomography (Stratec XCT-2000 L pQCT scanner).

Statistical Analysis: Analysis of variance for repeated measures×2 (time) were performed to determine the effects of playing surface on vBMD controlling for pubertal status. Effect size were calculated according to the methods proposed by Cohen (small (f=0.1), medium (f=0.2), or large (f=0.4)).

Figure 1. Groups and playing surfaces.

Figure 2. Peripheral computed tomography (38% of the tibia).



Introduction

It has been well recognized that impact loading in sporting activity is highly associated with bone accretion. Recently, Carmona et al.[1] showed that bone mass accretion was similar bone in prepubescent soccer players independently of the playing surface (artificial turf vs. non-grass ground surface). However, the osteogenic effects on volumetric bone mineral density (vBMD) generated by four different playing surfaces of the same sport are unknown.

The purpose of this study was to investigate the effects over a soccer season in vBMD of male soccer players by playing surface.

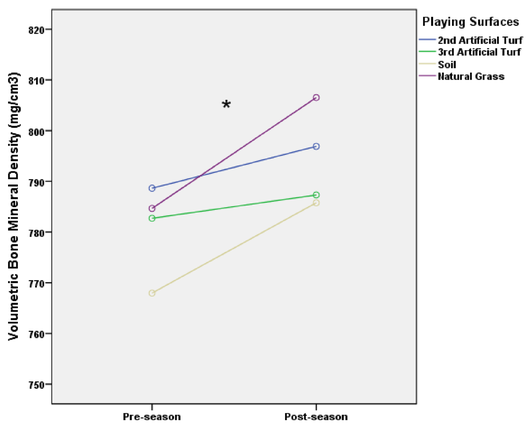
Results

Table 1. Descriptive characteristics of the participants.

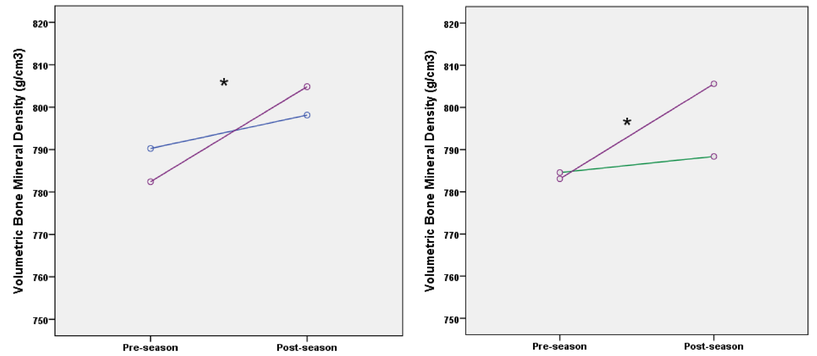
	2nd Artificial Turf (n=26)	3rd Artificial Turf (n=16)	Soil (n=10)	Natural Grass (n=19)
Age (y)	12.9±0.6	12.9±0.6	12.3±0.3[a,b]	12.7±0.6[a,b]
Weight (kg)	44.8±10.4	51.0±11.8	42.9±8.6	44.5±8.8
Height (cm)	154.9±8.4	157.4±9.9	148.7±7.9	153.7±7.6
BMI (kg/cm^2)	18.4±2.6	20.3±3.1	19.5±4.3	18.0±1.9
Tanner Stage (I/II/III/IV/V)	0/2/9/11/4	0/2/5/8/1	1/1/4/4/0	0/5/10/3/1

BMI: Body mass index.
a: different from 2nd Artificial Turf, b: different from 3rd Artificial Turf

A group by time interaction was found for vBMD at 38% of the distal tibia (p=0.029 and f=0.38).



When pairwise comparisons were carried out, NG showed group by time interactions compared to 2nd generation artificial turf (782 to 804 mg/cm^3 vs. 790 to 798 mg/cm^3; p=0.007 and f=0.50), and to 3rd generation artificial turf (782 to 804 mg/cm^3 vs. 784 to 788 mg/cm^3; p=0.027 and f=0.35).



Summary and Conclusion

Soccer players training and playing in NG pitch showed better values in vBMD acquisition than those on 2nd and 3rd generation artificial turf. Despite previous studies presented no differences on bone mass accretion independently of the playing surface. Our results suggest that NG is the most recommended playing surface to improve vBMD in the non-dominant tibia.

References

1. Carmona MP et al. (2014) Int J Sports Med 35(1):55-61

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