ADOLESCENT YOUNG FOOTBALL PLAYERS AND THEIR SOLE ARCH INDICES

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Abstract

Objective: The aim of this study is to find out the difference between sole arch indices of adolescent football players involved in regular training and competitions and age matched non- athletic sport group. Methods: This study was carried out in the sports center of Dubai - Emirates Arabs Unites, between February and May 2008, in juniors (14–16 years) categories, 51 male football players and 54 age school matched controls with the same ages were included in the study. Body mass index and podoscopic sole images of subjects were recorded, and the arc index was calculated for each group. Results: The sole arch index has a difference between football players and controls. The right foot arch index of the control group was 58.24 +/- 22.16 and 56.38 +/- 13.15 in soccer players (p=0.512).The left foot arch index was 55.22 +/- 21.09 in control group and 54.07 +/- 13.11 in players (p=0.881). There was a significant positive correlation between sole arch index and training age in football players (r= -0.350 for right sole arch index p < 0.05, r= -0.326 for left sole arch index, p<0.05). Conclusion: these results have shown that soccer sport cause a specific adaptation of sole arch indices of the right and the left leg of adolescent young soccer players. It is possible that depending of the number of sport age of the player the sole arch indices takes more and more adaptation.

Key words: *footballers, adolescents, sole arch*

Introduction

Pes planus (PP) and pes cavus (PC) are frequent disorders of the foot. It is known that standing still for a long time, bony and neurological problems such as congenital tarsal coalition and cerebral palsy ,trauma inappropriate shoes, generalized ligamentous, laxity, sole disorders in relatives and muscle imbalance all aggravate sole problems, Staheli (1987), Mickelson (2002). Since foot is the contact point during weight bearing and ambulation, the mechanical characteristics of the foot determine the energy transfer into the lower extremity, and therefore it helps to define the pattern of weight bearing and the potential for injury to the lower extremities.

The presence of sole problems is the important intrinsic factor in overuse injuries, American Academy (1991), Kaufmann (1999). However, numerous studies have indicated that there are neutral or even beneficial effects associated with Pes Planus, Staheli (1987), Mickelson (2002). Finally, effects of foot types on injuries or controversial, but the detection and correction of these problems may reduce these injuries. Staheli and al. found that the medial longitudinal arch has an undulating pattern according to age and arch indices (AI). The AI is approximately one (range: 0.7-1.35) at first year of age, reducing to a minimum of 0.6 (range: 0.3-0.9) at 12-14 years of age, before increasing to 0.8 (range 0.3-1.1) at older ages, International Olympic Committee (1990), American Academy (1991), Donaldson (2000). The medial longitudinal arch starts at the weight bearing surface of the calcaneus and ends at the metatarsal heads. It is supported by passive (bone and ligaments) and active structures (muscles).

In a standing position, few intrinsic or extrinsic muscles activity occur and the arch is maintained primarily by passive supporting elements. However, during walking and running the primary supporting elements become muscles. Depending on their insertion, muscles that inserted into the concavity of the medial longitudinal arch, such as posterior tibial peroneus brevis and longus, flexor hallucis longus, flexor digitorium longus and abductor hallucis support the formation of the medial longitudinal arch, Canavagh (1987), Jenner (1998). On the other hand, some other muscles, which inserted into the convexity of the medial longitudinal arch such as extensor hallucis longus and tibialis anterior muscles have depressing effect on this arch, Kapandji (1976), Forriol (1990). Depending on the type of sports, inappropriate development of these muscles may result in some changes of the arch, Giladi (1981), Jungle (2000), Kanatli (2001). Soccer involves a high level of long, high jumping and conflicts activities to appropriate the ball. In addition during the Soccer game (90min), foot muscles are under a heavy load. Therefore, this study is specially age of 14-16 at which sole AI changes dramatically; football training may result in some effects on soles. To the best of our knowledge, no study has been carried out regarding the effects of soccer on the sole arch. Therefore, this study was designed to find out the difference between the sole arch indices of adolescent football players and age matched non –athletic school group.

Methods

Junior level football players (14-16 age, n= 51) along with non-player controls (n=54) were included in this study.

This study was carried out in the central medical sports center in Dubai – UAE, between February and May 2008. To understand the effects of football on sole arch index, we compared the sole AI of junior players with their control. We also tried to find out the correlation between sole AI and training age. The training age of subjects was different, between (5 -7 years) and all subjects had a load of training of 9 hours a week including the game once a week, since the beginning of the soccer career. Compromised body weight and height are measured before breakfast. Subjects were asked to stand still on the podoscope. Both sole images in the Podoscopes were transferred to computer by using video camera. On the stored images, AI was calculated by the division of the narrowest part of the sole to the widest part of the heel, then multiply the ratio by 100 (figure 1). In our preliminary experiment by using same method on 30 foot arch indices, intra-class correlation coefficient of the sole AI was found as 0.974. The significance of the differences between the 2 mean tests was calculated and the Pearson correlation test was used. Significance level was accepted as $p<0.05$.

Results

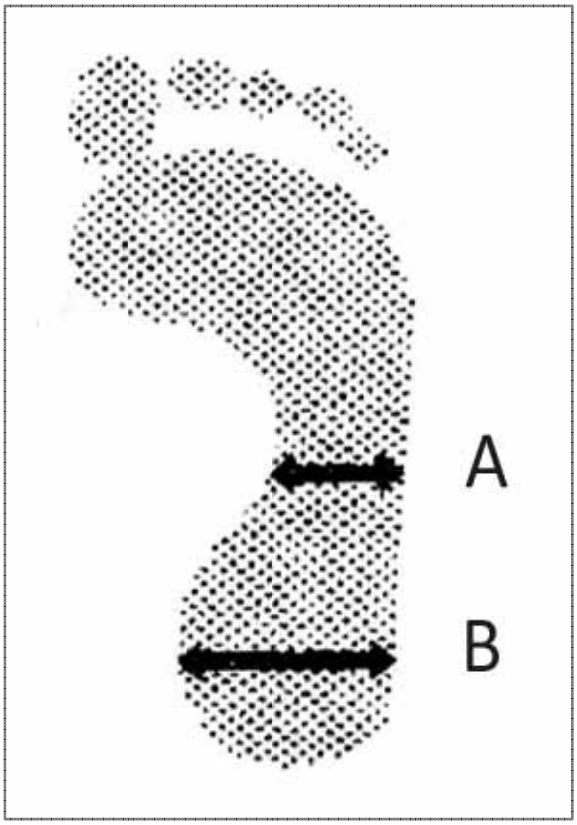

Figure 1. Calculation of sole arch index (AI) by using the formula: AI=A/Bx100. (A-minimum width on mid-foot arch, B-maximum width on heel arch)

The height, weight, age, body mass index (BMI) and arch indexes of both feet of the players and non-player controls are shown on table 1. The height and weight in players were not higher than that of the controls.

Body mass index of both study and control groups were less than 22 and foot sole AI and BMI were different between players and control groups ($p>0.05$). There was a significant correlation between sole AI and training age in players (right sole AI $r=-0.3501$, $p<0.01$; left sole AI $r=-0.326$ $p<0.01$). On the other hand, we could find a significant relation between sole AI and height, weight and BMI ($p>0.05$).

Table 1. Comparison of anthropological features and arch indices (AI) between players and control group.

	PG	±	CG	±	P
Age	15.15	0.54	15.27	0.50	0.29
Height	167.65	8.23	166.34	12.32	0.02
Weight	62.76	12.54	64.89	13.21	0.03
BMI	22.18	1.89	24.32	3.02	0.03
Right foot AI	56.38	13.15	58.24	22.16	0.51
Left foot AI	54.07	13.11	55.22	23.09	0.88

PG = Players (N=51), CG = Control group (N=54), P = probability value, BMI=Body Mass Index

Discussion and conclusion

This study was designed to find out the difference between the sole arch indices of adolescent football players and age matched non-athletic controls. In this study, we used foot print analysis, which has been found high intra-rater reliability. Footprint analysis is a simple, readily available, low cost, reliable and non invasive technique. Therefore, it can be used for screening of the foot problems, Forriol (1990), Kanatli (2001). It is well known that there is a unilateral overhead athlete who may demonstrate an obvious discrepancy with increased external rotation and decreased internal rotation compared with the opposite site. These changes were an important indicator of sport specific adaptation in musculo-skeletal system. Indeed, in longitudinal study, Volkov (1977) has demonstrated that intense regular training (18-30 hours per week) results in flat foot for 10-11 years old children.

Klingele (1993) showed that endurance running and alpine skiing have an increased risk of longitudinal foot arch insufficiency. In our study, there was a difference in sole arch indices of adolescent male Soccer players compared with non-athletic controls, we have found a significant relationship between sole A I and training age (right sole AI $r = -0.3501$ $p<0.01$; left sole AI $r= -0.326$, $p<0.01$). The reason for the discrepancy between our finding and Volkov's study might be the differences of training hours per week for football players in studies. Since our study had a cross–sectional design, we have not strictly established our findings as results of sport specific adaptation. Longitudinal studies started in childhood could better demonstrate the effects of different sports on sole AI. Nevertheless, this study has shown that football sport has specific adaptations in musculo-skeletal system and includes changes in sole AI.

Literature

Cavanagh, P.R., & Rodgers, M.M. (1987). The arch index: a useful measure from footprints. *J. Biomech, 20*: 547-551.

Donaldson, L. (2000). Sport and exercise: the public health challenge. *Br. J Sports Med*, *34*, 409-415.

Forriol, F., & Pascual, J. (1990). Footprint analysis between three and seventeen years of age. *Foot ankle, 1*: 101-104.

Giladi, M., Milgrom, C., Stein, M., Zimkin, A., & Kashtan, H. (1985). The low arch a protective factor in stress fractures. A prospective study of 295 military recruits. *Orthop Rev, 14*: 709-712.

Jenner, J.R., & Emerson, M.S. (1998). Sports injuries. *In: (Eds.) Maddison, P.J., Isenberg, D.A., Woo, P., Glass, D.N. Editors. Oxford textbook of Rheumatology, 2nd ed. Oxford (UK),* pp. 1785.

Jungle, A., Chomiak, J., & Dvorak, J. (2000). Incidence of football injuries in youth players: comparison of players from two European regions. *The American journal of sports Medicine, 28*(5), 47-50.

Kaufman, K.R., Brodine, S.K., Shafer, R.A., Johnson, C.W., & Cullison, T.R. (1999). The effect of foot structure and range of motion on musculoskeletal overuse injuries. *Am J sports Med, 27*: 586-594.

Kanatli, U., Yetkin, H., & Cila, E. (2001). Footprint and radiographic analysis of the feet. *J pediatr orthop, 21*: 225-228.

Klingele, J., Hoppeler, H., & Biedert, R. (1993). Statistical deviations in high performance athletes. *Schweiz Z Sportmed, 41*: 556-561.

Kapandji, I.A. (1976). *The physiology of the joints, In: Lower limb, 2.* Edinburgh (UK): Churchill L.

Michelson, J.D., Durant, D.M., & McFarland, E. (2002). The injury risk associated with pes planus in athletes. *Foot Ankle Int, 23*: 629-632.

Staheli, L.T., Chew, D.E., & Corbett, M. (1987). The longitudinal arch A survey and eight hundred and eighty –two feet in normal children and adults. *J bone Joint surg,* 69(A), 427-428.

Sachithanandam, V,, Joseph, B. (1995). The influence of footwear on the prevalence of flat foot. A survey of 1846 skeletally mature pearsons. *J Bone Joint Surg (Br), 77*: 255-257.

Volkov, B.M. (1977). Influence of considerable athletic training on the foot condition of young athletes at a boarding school with a cross–section of sports. *Arkh Anat Gistol Embriol, 72*: 32-34.

* * * (1991). Athletic training and sports medicine. *In: the knee .2nd ed. United States of America, 1991. American Academy of orthopedic surgeons*, pp.354-357.

* * * (1990). International Olympic Committee. Injuries to the musculoskeletal System. *In: IOC Medical commission. Alberta Canada : Hurford Enterprises Ltd*, pp.281-361.

NOGOMETAŠI ADOLESCENTI I POJAVE U NJIHOVOM SVODU STOPALA

Sažetak

Svrha: Cilj ovog istraživanja je pronalaženje razlika u pojavama svoda stopala između adolescenata igrača nogometa uključenih u regularni trening i natjecanje i skupine nesportaša istog uzrasta. Metode: Istraživanje je provedeno u sportskom centru Dubai – Ujedinjeni Arapski Emirati, između veljače i svibnja 2008, s uzrasnom kategorijom juniora (14-16 godina), sa 51 muškim nogometašem i kontrolnom skupinom od 54 ispitanika istog uzrasta koji se ne bave sportom. Indeks tjelesne mase i podoskopske slike ispitanika su snimljeni, te je izračunat 'indeks svoda' za svaku skupinu. Rezultati: Indeks svoda u tretirane dvije skupine je bio različit. Indeks svoda desnog stopala u kontrolnoj skupini bio je 58.24 +/- 22.16 dok je bio 56.38 +/- 13.15 kod nogometaša (p=0.512). Indeks svoda lijevog stopala bio je 55.22 +/- 21.09 u kontrolnoj skupini a 54.07 +/- 13.11 kod nogometaša (p=0.881). Postoji značajna pozitivna korelacija između indeksa svoda i trenažnog uzrasta kod nogometaša az desno stopalo (p < 0.05, r = -0.350) kao I za lijevo stopalo (p < 0.05, r = -0.326). Zaključak: Ovi rezultati su pokazali da nogomet izaziva specifičnu adaptaciju svoda stopala lijeve i desne noge mladih adolescenata nogometaša. Moguće je i da, u ovisnosti o sportskom stažu sportaša, svod stopala doživljava daljnje adaptacije.

Ključne riječi: *nogometaši, adolescenti, svod stopala*

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