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Annals of Biological Research, 2013, 4 (5):46-50
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

The effects of injury prevention programs on anthropometric factors in professional male soccer players

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ABSTRACT

Anthropometric factors such as body mass index (BMI), waist to hip ratio (WHR), wiast and hip circumference are indices for predicting of health problems such as obesity and cardiovascular risk. This aim of this study was to investigate the effects of injury prevention warm-up programs on anthropometric factors measures of professional male soccer players. The young soccer players (U21 old-years-age) soccer player assigned into the 11+, HarmoKnee(HK) and control groups. The anthropometric factors carried out were: weight, BMI, waist circumference, hip circumference and WHR. The results showed significant differences between the 11+ (p=0.049) and HK (p=0.019) compared to the control group in waist circumferences. Significant difference was found between the 11+ (p=0.03) compared to the control group in WHR. It concluded that the 11+ is more beneficial than HK for improving WHR. This data can be useful for coaches and trainer and clubs for designing and using the best prevention program.

Keywords: Injury prevention programs, BMI, WHR, Anthropometric

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INTRODUCTION

It had been widely shown that some anthropometric factors are health risk factors.Body mass index (BMI), waist circumference (WC), hip circumference (HC), waist-to-hip ratio (WHR), are four anthropometric indices commonly used to predict risk of injuries and health problem such as obesity which relatively easy and cheap to obtain [1-3]. The BMI proposed by Keys and colleagues in 1972 is most popular stature-weight index [4]. The World Health Organization (WHO) is an expert committee to provide guidance the use of anthropometry and interpretation of BMI for assessing health, nutrition and social well-being [5]. The WHO categorizedBMI into four classifications: underweight (<18.50 kg/m^2), normal weight (18.50–24.99 kg/m^2), overweight (25.00–29.99 kg/m^2) and obese (>30 kg/m^2) [5-7].

It is proven that as BMI increases the risk of several diseases such as cardiovascular disease, hypertension, type 2 diabetes, and several forms of cancers. Finkelstein et al. (2007) showed a positive relationship between BMI and

muscle injuries (sprains/strains), lower extremity fracture, joint dislocation [8]. Literature review showed that increased BMI and obesity associated with some disease such as acute kidney injury [9], and cardiovascular problem [10],while this result was a conflict with Soto and colleagues (2007) finding. Yard and Comstock (2011) in a study that investigated high school student reported that obese athletes associated with more knee injuries, while underweight athletes sustained a larger proportion of fractures [11]. Vadeboncoeur et al. (2012) showed that a high BMI is not a lower extremity risk factor during training or game participation [12].

A girth measures are simple, portable and inexpensive tests to evaluate body composition [4]. Generally, a measuring tape used for evaluating girth [4]. Waist-to-hip ratio (WHR) is an equally simple anthropometric index used as a marker of central fat distribution or abdominal adiposity [13, 14] and associated with cardiovascular diseases [14]. It simply calculated by dividing the waist girth by the hip girth [4]. The WHR categorized into the excellent category (above 84%), better average (65%- 84%), average (45%- 64%) and below average (25%- 44%) and the poorest category is lower than 25% [4].

Anthropometric factors including taller height [15], heavier weight and a larger WHR [4] have been shown in the literature to be associated with abnormal knee patella tendon. Male volleyball players with a waist girth greater than 83cm have a greater risk of developing patellar tendon pathology. Players with patellar tendon pain may require several months away from the sport or they may never return to their pre-injury level of competition [15]. BMI, WC, and WHR are useful anthropometric indices in predicting cardiovascular risks [14]. The results of the studies showed conflicting results in this area. Hagel (2005) studied hamstrings risk factors among Australian soccer players. They reported that body height were not significantly associated with hamstring injury [16]. Obesity generally contributes as an extra of body mass and body adipose tissue distribution that could enhance the health risk and decline occupational and recreational comfort as a result of injuries such as muscle sprains, ligament strains and dislocations in joints and bones [7].

A survey conducted in 2006 by WHO showed that one billion people are overweight and 300 million are obese and in risk of injury [10]. In the united states Overall, 30% of intensive care unit (ICU) patients are obese and 7% morbidly obese [17]. Several researches investigated the effects of the 11+ and HK on strength ratio [18] balance and proprioception [19] but to date no research investigated the effects of them on anthropometric factors. With attention to the population of obese and also the advantageous of prevention programs the aim of this study is to investigate the effect of two popular warm-up programs on anthropometric factors measures in young male professional soccer players.

MATERIALS AND METHODS

Participants

In the present study 36 male young professional soccer players (age: 18.9 ± 1.4 years; height: 181.3 ± 5.5 cm; body mass: 73.6 ± 6.3 kg) who had been regularly soccer training (5 sessions per week) and also had no history of injury selected for this study. The participants were selected from three professional teams. The subjects were orally informed about the procedures they would undergo, and each read and signed an informed consent form.

Injury prevention programs

The 11+ program and HK injury prevention programs [18-19] were performed three times per week as warm-up before starting technical and tactical drills. This injury prevention programs are free to access in the publications by Daneshjoo and co-workers (2012) [18-19]. For comparison, the control group was asked to continue on with their regular training and warm-up.

Anthropometric tests

All anthropometric tests were measured according to standard procedures of Lohman, Roche, &Martorell (1988)[20]. Body mass (weight) was measured, while the subjects were minimally clothed without shoes and shirts using an electronic scale and recorded to the nearest 100g [21]. Height of the subjects was measured in a standing position, without shoes, using the Seca (Seca, Hamburg, Germany) while the shoulders and head were in a normal position. Waist and hip circumference were measured using a tape meter. Waist circumference was measured after a deep inhale and exhale midway between the inferior margin of the last rib and the crest of the ilium in a horizontal plane. Hip circumference was measured over the greater trochanters at the widest level of hip, recorded to the nearest 0.1cm [20]. WHR simply calculated by dividing the waist by the hip circumstances [4]. BMI calculated by

weight in kilograms divided by height in meters squared (weight (kg) / [height (m)] ^{2}).

RESULTS

The means of pre- and post-tests of the group are presented in Table 1. In the weight results did not show significant differences between pre- and post-tests ($F_{1,33}$=1.641, p=0.209), and group ($F_{2,33}$=2.32, p=0.114). Moreover interaction between time and group was not significant ($F_{2,33}$=0.590, p=0.560).

Table 1. The means of pre- and post-tests of the group (values are mean ± SD) and percentage of change (Δ) [values are mean (95%CI)] of pre-test to post-test.

	Pre-test	Post-test	Δ% (95%CI)	p-value
The 11+				
Weight (kg)	72.9±5.5	71.7±4.6	-1.1(-2.63 to 0.34)	0.119
Waist (cm)	79.1±3.6	78.7±3.5	-0.37(-0.68 to -0.07)	0.021*
Hip (cm)	97.8±3.1	97.4±3.2	-0.46(-0.77 to -1.14)	0.009*
WHR	0.80 ± 0.03	0.80±0.03	0.00(-0.004 to 0.004)	0.992
BMI (kg/m^2)	22.2±1.1	21.8±1.1	-0.33(-0.78 to 0.12)	0.136
HK				
Weight (kg)	71.5±7.0	71.0 ± 7.6	-0.42(-1.47 to 0.61)	0.384
Waist (cm)	78.3±3.4	78.2 ± 3.3	-0.12(-0.4 to 0.15)	0.339
Hip (cm)	96.4±3.2	96.1 ± 3.3	-0.37(-0.76 to 0.01)	0.056
WHR	0.81±0.02	0.81 ± 0.02	0.002(-0.002 to 0.006)	0.359
BMI (kg/m^2)	22.1±1.2	22.0 ± 1.2	-0.15(-0.49 to 0.18)	0.341
Control group				
Weight (kg)	76.4±5.8	76.3±6.3	-0.04(-2.13 to 2.05)	0.966
Waist (cm)	82.9±4.8	82.9±4.6	0.04(-0.86 to 0.94)	0.921
Hip (cm)	98.3±2.7	98.8±2.8	0.50(-0.52 to 1.52)	0.305
WHR	0.84±0.03	0.83±0.03	-0.004(-0.01 to 0.004)	0.330
BMI (kg/m^2)	22.7±1.1	22.7±1.3	-0.01(-0.65 to 0.62)	0.962

*Legend: HK= HarmoKnee group; cm= centimeter; kg= kilogram; BMI= body mass index; WHR= waist to hip ratio; *=p<0.05*

In the waist circumference results did not show significant differences between pre- and post-tests ($F_{1,33}$=1.033, p=0.317). Significant differences was found between group ($F_{2,33}$=5.045, p=0.012). The Bonferroni post-hoc test showed differences in the 11+ (p=0.049) and HK (p=0.019) compared to the control group. The partial eta squared statistic indicated a large effect size (0.23) between groups. Interaction between time and group was not significant ($F_{2,33}$=0.649, p=0.529). The means of pre- and post-tests of the 11+ group are presented in Figure 1.

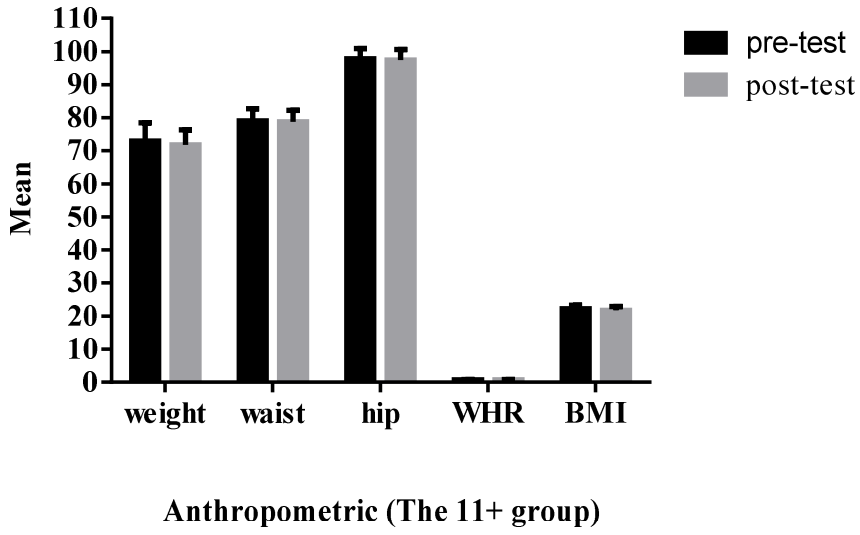

Figure1.Anthropometric factors in the 11+ group

The results did not show significant differences between pre- and post-tests ($F_{1,33}$=0.416, p=0.524), group

($F_{2,33}$=1.756, p=0.188) in the hip circumference. Interaction between time and group was not significant ($F_{2,33}$=3.162, p=0.055). The means of pre- and post-tests of the HK group are presented in Figure 2.

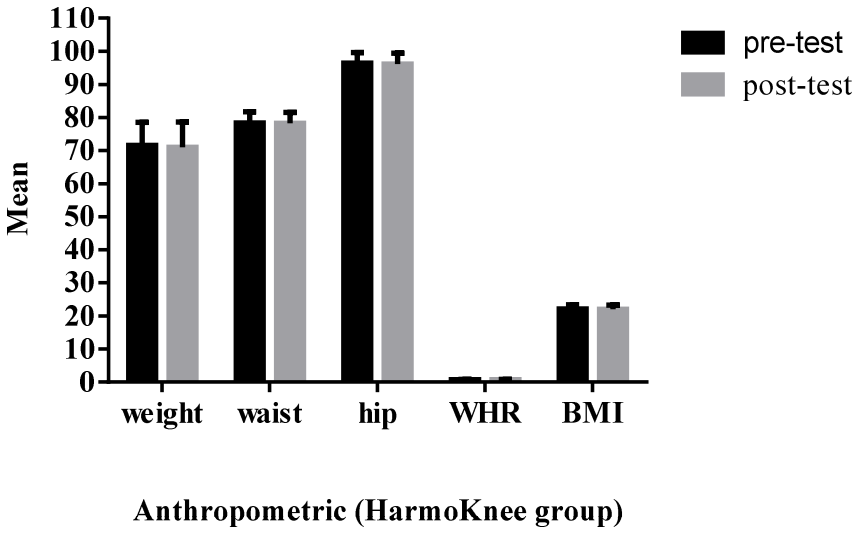

Figure 2. Anthropometric factors in the HK group

In the BMI, results did not show significant main effect in time ($F_{1,33}$=1.656, p=0.207), group ($F_{2,33}$=1.505, p=0.237) and interaction between time and group ($F_{2,33}$=0.507, p=0.607). No significant differences were found in time ($F_{1,33}$=0.155, p=0.697) and interaction between time and group ($F_{2,33}$=1.133, p=0.334) for WHR. Results showed significant main effect between group ($F_{2,33}$=4.345, p=0.021). The Bonferroni post-hoc test showed differences in the 11+ group (p= 0.030) compared to the control group. The partial eta squared indicated a large effect size (0.21) between groups.

DISCUSSION

The aim of this study was to investigate the effect of the 11+ and HK warm-up programs on the anthropometric factors measures of young professional male soccer players.This study increase available database on anthropometric factors such as weight, waist and hip circumferences, BMI, WHR of young male professional soccer players. Results indicated significant differences in the 11+ and HK compared to the control group in waist circumference with large effect size (Table 1). The present results confirm that both experimental programs have potential to positively effect on waist circumference of soccer players. The literature reviewed showed that a waist circumference greater than 83cm have a greater risk of injury [15]. Then we can conclude that young male professional soccer players in present study are normal in waist circumference (<83cm). This may be because of positively effects of playing soccer at professional level.

The comparison in the WHR between groups showed a significant difference in the 11+ compared to the control group with large effect size, but no difference was observed in the HK group (Table 1). These results suggest that the 11+ possibly be more beneficial to improve WHR in young male soccer players than HK. In other words, certain components of the 11+ injury prevention programs have higher impact on the WHR than on that of the HK elements.The above findings are in agreement with those that reported the 8-week intervention exercises improved WHR in 20 middle-age females (age 40.4±6.7 years) [22]. A research showed significant reduction of WHR (2.7%) after 8-month in-session soccer activities in 33 young handball players [21].

CONCLUSION

The results of this study enhance available database on weight, waist circumference, hip circumferences, BMI and WHR of young male professional soccer players. Both injury prevention programs improved waist circumference of soccer players. The results showed that the 11+ have more potential to improve WHR than HK program. Further

modification of both programs may be required to fully improve weight and hip circumference.

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