



ISSN:1306-3111
e-Journal of New World Sciences Academy
2009, Volume: 4, Number: 4, Article Number: 2B0032

SPORTS SCIENCES

Received: May 2009
Accepted: September 2009
Series : 2A
ISSN : 1308-7266
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**Önder Dağlıoğlu¹ Levent Cavas² Muhsin Hazar³
Selma Gürler² Bülent Cavas² Kadir Yurdakoç²**
Gaziantep University¹
Dokuz Eylül University² Gazi University³
lcavas@deu.edu.tr
Gaziantep-Turkey

**A COMPARATIVE STUDY: SKIN FOLDS, ESTIMATED PERCENTAGE BODY FAT, TOTAL
BODY FAT WEIGHT AND FAT-FREE BODY MASS IN THE FEMALE AND MALE TURKISH
ATHLETES**

ABSTRACT

The aim of this study was primarily to investigate the anthropometric parameters and body composition in handball, basketball, badminton, volleyball and underwater rugby players who are students in physical education and sports department in Turkey. 49 female and 51 male athletes participated to this study. The skinfolds of rear thigh in female players are significantly ($p<0,05$) higher than those of other female and male skinfold values. Although estimated percentage body fat and body fat weight values in female athletes were significantly ($p<0.05$) higher than those of male athletes, fat free body mass in male athletes was significantly ($p<0.05$) higher than those of female athletes. According to our results, athletes who have taken part in this study are considered that they are appropriate for the sports they are exercising. The results have also shown that ability selection has been applied successfully by Physical Education and Sports Department in Turkey. Similar selections should strongly be recommended for secondary school students, particularly for adolescents, in Turkey.

Keywords: Skin Fold, Estimated Percentage Body Fat, Body Fat Weight, Fat Free Body Mass, Physical Exercise

**KARŞILAŞTIRMALI BİR ÇALIŞMA: BAYAN VE ERKEK TÜRK SPORCULARINDA DERİ
KIVRIM KALINLIKLARI, TAHMİNİ VÜCUT YAĞ YÜZDESİ, TOPLAM VÜCUT YAĞ
AĞIRLIĞI VE YAĞSIZ VÜCUT AĞIRLIĞI**

ÖZET

Bu çalışmanın öncelikli amacı Türkiye'de Beden Eğitimi ve Spor Bölümlerinde kayıtlı öğrenci olan hentbol, basketbol, badminton, voleybol ve sualtı ragbisi oyuncularının antropometrik ve vücut parametrelerinin incelenmesidir. 49 bayan ve 51 erkek sporcu bu çalışmaya katılmıştır. Tahmini vücut yağ yüzdesi ve vücut yağ ağırlık değerleri bayanlarda erkeklere kıyasla daha yüksek saptanmış olsa da ($p<0.05$), erkeklerde yağsız vücut ağırlığı bayanlara kıyasla daha yüksek ($p<0.05$) olarak ölçülmüştür. Sonuçlarımıza göre, çalışmamıza katılan sporcuların yaptıkları spor tipine uygun vücut yapılarında olduğu düşünülmektedir. Sonuçlar ayrıca Beden Eğitimi ve Spor Bölümlerinde yapılan özel yetenek sınavlarının başarılı olduğu sonucunu ortaya koymaktadır. Benzer sporcu seçimlerinin ilköğretim basamağında da, özellikle adolesan çağ çocukları için uygulanması gerekliliği önerilmektedir.

Anahtar Kelimeler: Deri Kıvrım Kalınlığı, Tahmini Vücut Yağ Yüzdesi, Vücut Yağ Ağırlığı, Yağsız Vücut Ağırlığı, Fiziksel Egzersiz



1. INTRODUCTION (GİRİŞ)

The world is being faced cardiovascular diseases related to consumption of high-fat and low-fiber diet [1 and 2]. Physical and regular activities are recommended to all population for health and also preventing cardiovascular diseases [3]. Adolescents represent around 20% of the global world's population and around 84% of them are found in developing countries [4]. Adolescent percentage in Turkish population is 31.2% according to 2001 National Census. The most of this young population has been continuing their life as sedanters. In Turkey, there is not enough ability selection for the appropriate sports for this specific and important part of population. Recently, a study has been carried out by the both Turkish Basketball Federation and Turkish General Directorate of Youth and Sports to select appropriate basketball players called in Turkish: "12 Dev Adam Projesi". Antropometric parameters are of great importance in the selection of appropriate athletes for appropriate sports. The primary reason for determining an athlete's body composition is to obtain information that may be beneficial in improving athletic performance [5]. Body composition and weight are 2 of the many factors that contribute to optimal exercise performance. Taken together, these 2 factors may affect an athlete's potential for success within a given sport. Body weight can influence an athlete's speed, endurance, and power, whereas body composition can affect an athlete's strength, agility, and appearance. Most athletes require a high strength-to-weight ratio to achieve optimal athletic performance, and because body fat adds to weight without adding to strength, low body fat percentages are often emphasised within many sports [6].

2. RESEARCH SIGNIFICANCE (ÇALIŞMANIN ÖNEMİ)

The aim of the present study is primarily to investigate the anthropometric parameters such as skinfold and fat values in 49 female and 51 male athletes in Turkey.

3. MATERIAL AND METHODS (MATERYAL VE METOT)

Volunteer and well-trained 49 female and 51 male (10 and 12 Handball, 12 and 11 Basketball, 10 and 10 Badminton, 10 and 10 Volleyball, 7 and 8 Under Water Rugby (UWR) players, respectively) athletes were taken part in this present study. Physical characteristics of athletes have been shown in Table 1.

The skin folds were measured from six sites of body: triceps, abdominal, supscapular, front thigh, suprailiac, rear thigh (for female), chest (for male). The skinfolds were measured by method of Yuhasz, 2003. Estimated percentage body fat, body fat weight and fat-free body mass were also measured using by method described by Mackenzie [7]. In order to measure the estimated percentage of body fat following equations were used:

- For male = Total skin folds (Triceps, Abdominal, Suprailiac, Subscapula, Front thigh, Chest) x 0.097 + 3.64
- For female = Total skin folds (Triceps, Abdominal, Suprailiac, Subscapula, Front thigh, Rear thigh) x 0.1066 + 4.974



Table 1. Physical characteristics of athletes
(Tablo 1. Sporcuların fiziksel özellikleri)

Athletes	Age ¹ (Years)	Height ¹ (m)	Weight ¹ (kg)	BMI ¹
Handball (Female)	21.5 (20.6,22.4)	1.67 (1.63, 1.71)	56.00 (51.83, 60.17)	19.90 (18.84, 20.97)
Handball (Male)	21.8 (20.8,22.8)	1.79 (1.76, 1.82)	71.75 (66.38, 77.12)	22.35 (21.23, 23.48)
Basketball (Female)	20.3 (19.3,21.2)	1.71 (1.68, 1.73)	58.33 (54.63, 62.04)	20.00 (19.13, 20.87)
Basketball (Male)	20.5 (19.5,21.5)	1.81 (1.76, 1.86)	72.00 (67.18, 76.82)	21.94 (20.74, 23.14)
Badminton (Female)	21.7 (20.2,23.2)	1.65 (1.61, 1.69)	53.60 (50.14, 57.06)	19.67 (18.87, 20.47)
Badminton (Male)	21.5 (20.2,22.8)	1.74 (1.72, 1.76)	68.00 (64.10, 71.90)	22.39 (21.14, 23.64)
Volleyball (Female)	20.3 (18.6,22.0)	1.77 (1.73, 1.80)	62.30 (59.14, 65.46)	20.00 (19.21, 20.79)
Volleyball (Male)	21.4 (20.4,22.4)	1.82 (1.80, 1.85)	74.60 (70.06, 79.14)	22.48 (21.27, 23.69)
UWR (Female)	20.6 (18.4,22.8)	1.72 (1.67, 1.77)	59.71 (54.83, 64.60)	20.21 (19.08, 21.34)
UWR (Male)	21.1 (19.9,22.4)	1.77 (1.72, 1.82)	73.71 (71.46, 75.96)	23.54 (21.89, 25.19)

¹Mean (Confidence Interval)

4. STATISTICAL ANALYSIS (İSTATİSTİKSEL ANALİZ)

Statistical analysis of data and results was performed using the SPSS statistical package program, version 11. One-way ANOVA was used to test for possible differences between sports related to their anthropometric parameters. When significant differences ($P<0.05$) were detected, the Tukey's HSD test was used to compare different sport groups. The validity of analysis of variance method was checked with residual analysis. When the constant variance assumption is not hold, Kruskal-Wallis test was performed. In order to show the difference between genders, two-sample t-test was used.

5. RESULTS AND DISCUSSION (SONUÇLAR VE TARTIŞMA)

The results related to skin folds such as triceps, abdominal, supriliac, chest (for only male), rear thigh (for only woman), subscapula and front thigh were measured in female and male athletes who are students in Physical Education and Sports department in Turkey. The skin folds results are presented in Figure 1.

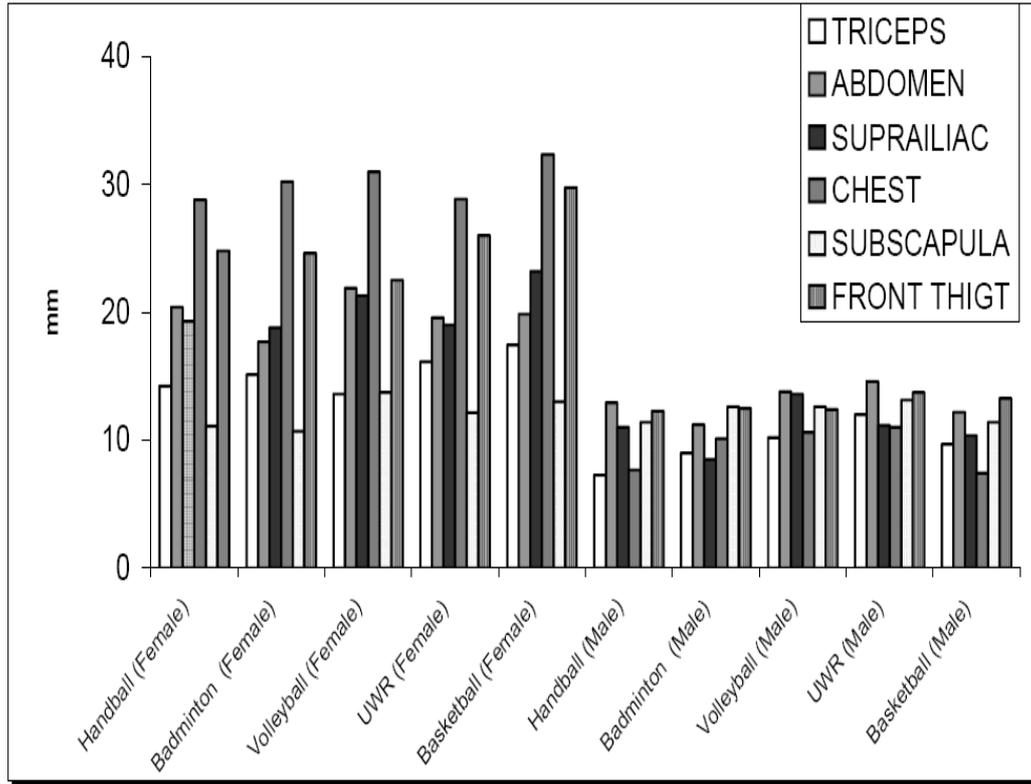


Figure 1. Skin folds values in the female and male Turkish athletes (Şekil 1. Bayan ve erkek Türk sporcularında deri kıvrım kalınlık değerleri)

According to our results, maximum and minimum triceps skin folds in female and male athletes were found basketball-volleyball and UWR-handball, respectively. The mean of triceps of female and male athletes was 15.30 ± 3.83 mm and 9.60 ± 2.46 mm, respectively. The results obtained in our study supported the thesis written by Hızal (1989) where triceps values were found 7.70 ± 3.50 mm and 13.70 ± 3.30 mm in Turkish male and female athletes, respectively [8]. The triceps values were found as 9.60 ± 2.46 mm in male and 15.30 ± 3.83 mm female athletes. While no significant ($p < 0.05$) difference existed between female's triceps values, there were significant differences between handball players' triceps values and basketball-volleyball-UWR players' triceps values. As can be seen from Figure 1, means of skin folds of abdominal in female and male athletes were 19.9 ± 4.72 mm and 12.9 ± 3.11 mm respectively. There was significant ($p < 0.05$) difference between two values. The difference can be caused by higher muscle mass content in male athletes than those of female. Since there are limited papers on the abdominal skin folds values in Turkish athletes, it was difficult to compare our results with other papers. On the other hand, in the paper on Turkish greased wrestlers [9], abdominal skin folds were found 12.25 ± 1.25 mm in the first class, 17.17 ± 2.16 mm in the second class, 25.05 ± 3.51 mm in the third class and 16.00 ± 2.72 mm in the fourth class wrestlers. Moreover, Ibnziaten et al (2002) found a progressively decline from the age of 10 to the age of 14 [10]. They found 14-12 mm abdominal skin fold values. In the Figure 1, the mean of suprailiac skin folds were found as 20.51 ± 5.68 mm in female athletes and 10.882 ± 3.958 mm in male athletes. We also found significant ($p < 0.001$) difference between suprailiac skin fold values



of sexes. This difference might be explained by higher adaptation of muscle mass in male athletes than those of female. Minimum and maximum skin folds values in female and male were found basketball-badminton and UWR-badminton, respectively. There was no statistical difference ($p>0.05$) between suprailiac levels of sport in both sexes. The mean suprailiac skin folds in Norwegian children (age 16-19) studied by Waaler (1983) were $9.10\pm$ and $6.60\pm$, respectively [11]. We found about two times lower suprailiac skin fold values when we compared our results with above study. However, age might be an explanation for these drastic differences. In other study written by Durin (1974 [12], suprailiac skin folds 14.00 ± 12.00 mm in male and 16.00 ± 9.30 mm in female were found in above study. According to Figure 2, it is interesting to note that while there were statistical differences between other female and male skin folds values, we could not observe any significant ($p>0.05$) difference between subscapular skin folds of male and female athletes. Among the Norwegian children in the age of 16, subscapular values were 11.40 ± 4.40 mm in female and 7.40 ± 3.40 mm in male athletes. Our results particularly support the finding of Waaler [11]. Our results also confirmed the results written by Durin (1974) [12], Hızal (1989) [8], Rissanen (1988) [13] and Çankaya (1999) [14]. When the front thigh skin folds values are concerned, statistical difference was found between skin folds of front thigh of basketball and volleyball players ($p<0.05$). On the other there was no significant difference between male's front thigh values ($p>0.05$). However, when the front thigh skin folds were compared between female and male athletes, statistical difference was found ($p<0.05$). Front thigh skin folds were found in male badminton and first class greased wrestlers as 7.10 ± 1.24 mm and 12.75 ± 1.10 mm, respectively. Although our results support greased wrestler's skin folds values, they did not confirm the badminton's front thigh values. In addition, the mean of front thigh of female athletes did not support the Turkish badminton players. Specifically, our badminton player's front thigh skin fold values were about two times lower than those of national team's players. In our study, we measured rear thigh skin fold in only female athletes and chest in only male athletes. No statistical ($p>0.05$) difference was found between rear thigh skin folds values among female athletes. On the other hand, we found statistical ($p<0.05$) difference between; Handball-Volleyball ($p=0.040$), Handball-UWR ($p=0.034$), Basketball-Volleyball ($p=0.021$), Basketball-UWR ($p=0.019$). In the present study, estimated percentage of body fat, body fat weight and fat free body mass were also measured in both female and male Turkish athletes. As can be seen from Table 3, although no statistical differences ($p>0.05$) were found between parameters of intra-sex (among sports), significant differences ($p<0.05$) were found between inter-sexes.

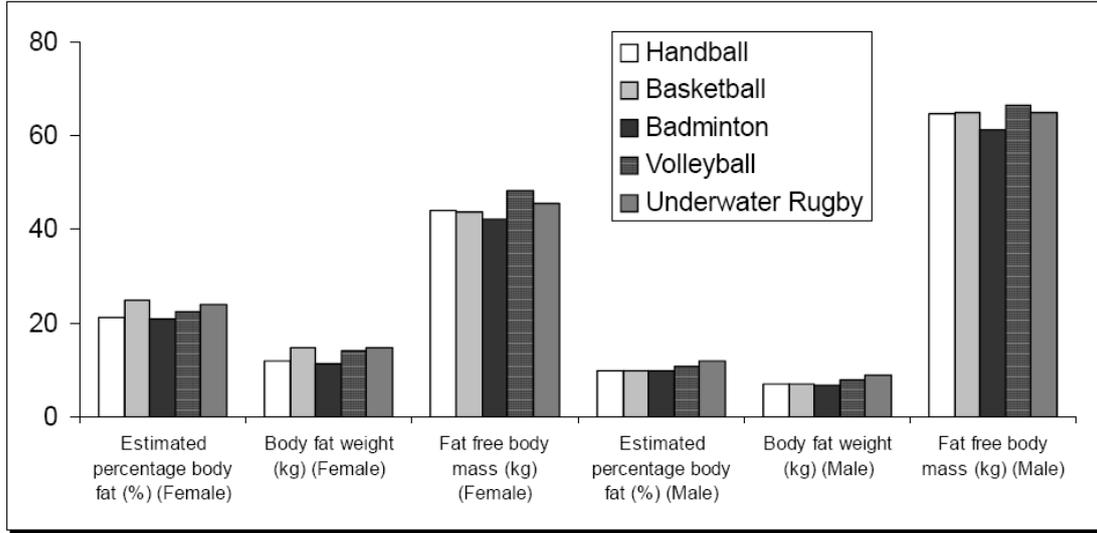


Figure 2. Estimated percentage of body fat, body fat weight, fat free body mass values in female and male Turkish athletes (Şekil 2. Bayan ve erkek Türk sporcularında tahmini vücut yağ yüzdesi, vücut yağ ağırlığı, yağsız vücut ağırlığı değerleri)

According to our results, athletes who have taken part in this study are appropriate for the sports they are exercising. The results have also shown that ability selection has been applied successfully by Physical Education and Sports Department in Turkey. Similar selections should strongly be recommended for secondary school students, particularly for adolescents, in Turkey.

NOTICE (NOT)

Abstract of this paper was presented in 13th Balkan Sports Medicine Congress, April 29-May 2, 2004, Drama, Greece.

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