

Yener Aksoy*
Seydi Ahmet Ağaoğlu**

THE COMPARISON OF SPRINT REACTION TIME AND ANAEROBIC POWER OF YOUNG FOOTBALL PLAYERS, VOLLEYBALL PLAYERS AND WRESTLERS

PRIMERJAVA ŠPRINTA, REAKCIJSKEGA ČASA IN ANAEROBNE MOČI MED MLADIMI NOGOMETAŠI, ODOBJARJI IN ROKOBORCI

ABSTRACT

This study was surveyed in order to compare and contrast the sprint, reaction time and anaerobic power of football players, volleyball players and wrestlers. The sportsmen were divided into 3 groups according to branches, and the rates of speed, reaction time and anaerobic strength of sportsmen have been measured. Identification of the differences of the groups in terms of statistical evaluation for reaction time and minimum power in sport branches has been indicated by Kruskal Wallis and Dunn's Multiple-Comparison test. On the other side, (one-way anova) and Tukey Multiple-Comparison test were used to indicate the differences among the branches in terms of sprint, peak power, average power and fatigue index.

The measurements according to the branches are like below; reaction time 0.164 sec for footballers, 0.182 sec for volleyball players and 0.185 sec for wrestlers, Sprint time; 3.24 sec for footballers, 3.38 sec for volleyball players and 3.42 sec for wrestler; Peak power; 278.51 watt for football players, 263.23 for volleyball players and 235.51 for wrestlers; Average power; 209.51 watt for footballers, 207.05 watt for volleyball players and 180.97 watt for wrestlers; Minimum power; 166.55 watt for football players, 163.29 watt for volleyball players and 143.22 watt for wrestlers; Fatigue index; 2.48 watt/sec for football players, 2.23 watt/sec for volleyball players and 1.99 watt/sec for wrestlers. It is found out that there are considerable differences ($P > 0.05$) in sprint, reaction time and anaerobic power values between football players and the other branches.

As the trainings and matches of the football players mostly depend on leg-muscle strength and the leg-muscle strength is important for the measurements in the survey, football players' anaerobic power and sprint values are better than the other branches by considering the fact that reaction time is a part of speed.

KeyWords: Peak power; YoungAthletes; Speed;

**Ondokuz Mayıs University, Health Sciences Institute, Department of Physical Education and Sports, SAMSUN*

***Ondokuz Mayıs University, Yaşar Doğu Sport Sciences Faculty, Department of Coaching Training, SAMSUN*

Corresponding author: Yener Aksoy

Esentepe mahallesi, Şehit Necdet Şenses caddesi No:1 Gençlik ve Spor İlçe Müdürlüğü, Vezirköprü, Samsun, Türkiye.

E-mail:yeneraksoygsim@gmail.com

Phone number;+90 530 657 56 51

IZVLEČEK

Namen raziskave je primerjati šprint, reakcijski čas in anaerobno moč med nogometiši, odbojkarji in rokoborci. Športnike smo razdelili v tri skupine glede na vrsto športa ter nato izmerili njihovo hitrost, reakcijski čas in anaerobno moč. S Kruskal-Wallisovim in Dunnovim večkratnim primerjalnim testom smo v skupinah ugotavljali razlike glede statističnih ocen reakcijskega časa in minimalne moči med različnimi športnimi vrstami. Poleg tega pa smo z enosmerno ANOVA in Tukeyevim večkratnim primerjalnim testom ugotavljali razlike med športnimi vrstami pri šprintu, najvišji moči, povprečni moči in indeksu utrujenosti.

Rezultati meritev po športnih vrstah so naslednji: reakcijski čas – 0,164 s pri nogometiših, 0,182 s pri odbojkarjih in 0,185 s pri rokoborcih; čas šprinta – 3,24 s pri nogometiših, 3,38 s pri odbojkarjih in 3,42 s pri rokoborcih; najvišja moč – 278,51 W pri nogometiših, 263,23 W pri odbojkarjih in 235,51 W pri rokoborcih; povprečna moč – 209,51 W pri nogometiših, 207,05 W pri odbojkarjih in 180,97 W pri rokoborcih; minimalna moč – 166,55 W pri nogometiših, 163,29 W pri odbojkarjih in 143,22 W pri rokoborcih; indeks utrujenosti – 2,48 W/s pri nogometiših, 2,23 W/s pri odbojkarjih in 1,99 W/s pri rokoborcih. Ugotovili smo, da so med nogometiši in ostalimi športniki velike razlike ($P > 0,05$) v vrednostih šprinta, reakcijskega časa in anaerobne moči.

Ker nogometni treningi in tekme večinoma temeljijo na moči mišic nog in je ta moč pomembna tudi za meritve v raziskavi, so vrednosti anaerobne moči in šprinta pri nogometiših boljše kot pri ostalih športnikih, če upoštevamo dejstvo, da je reakcijski čas del hitrosti.

Ključne besede: najvišja moč, mladi športniki, hitrost

INTRODUCTION

Today, everyone allows time to do sports which is a dispensable part of human life. Some of those are sportsmen, some are audience and some take part in this circle for a healthy life. It is clear that sports that attracts the human for centuries has reached its top levels in professional dimension. This case has turned into a great competition for both individuals and teams. While the clubs scout on best sportsmen in order to reach more success, the sportsmen force themselves to show higher performances to become a part of great clubs.

Due to the increase of competing conditions and with parallel to other components, specification of the qualities required for sportsmen and the elite sportsmen's profile has changed, significant developments take place in performance and this situation continues day by day. New records are broken and magnificent degrees are reached in both World Championships and Olympic Games in all fields of sports. The limits of performances have extremely gone up. The need for being better than the rivals in competitions forces the coaches to benefit from the scientific data more and more.

Human has been forcing the limits of physical talents and performance, and the scientific knowledge in the current century. The main reason for this is that individuals, groups and countries prefer the sports as a battle field to show their superiority on others. Thus, the sportsmen of today are called 'the gladiators of the age'.

Great masses watch them, imitate them and consider them as a symbol which represent themselves (Bayraktar ve Kurtoğlu, 2004: 269).

Today, reaching the success is only possible with scientific methods. Long-term training programmes are benefitted for supporting sportsmen physically and psychologically in order to reach top levels. (Günaydın ve ark., 2001).

Due to high competitive matches and events in football, volleyball and wrestling, these branches need sportsmen who have significant anaerobic power with good sprint and reaction time. This fact forces coaches to utilize from different programs while training their sportsmen. In many branches, sportsmen do training more than once a day. The content, type and the duration of the trainings affect the performance and recovery of the sportsmen.

The aim of this survey is to compare and contrast the sprint, reaction time and anaerobic power of football players, volleyball players and wrestlers and so find out in which branch the sportsmen are superior in which motoric qualities and the reasons for their superior success.

METHODS

a. Experimental Approach to the Problem

The subjects were informed prior to the tests in order to provide a voluntary participation and raise their motivation and willingness. The temperature (25-27°C) and humidity were taken into consideration to be at the same degree while tests were applied. The subjects took the tests of speed, reaction and anaerobic power in 3 days at the same time zone. The heights and the weights of the subjects were measured and recorded. The heights of the subjects were measured by 0,1cm precision Seca brand height-weight scales while the subjects were standing on bare foot with their bases near the caliper which was sliding on a scale arranged to feel the top of their head. Their weights were also measured by this tool with 0,01kg precision when the subjects had shorts and t-shirts on them and were on bare foot.

b. Subjects

This research involves 28 footballers, 28 volleyball players and 28 wrestlers aged between 15 and 17 who live in Vezirköprü town of Samsun and compete in amateur leagues in their branches for 3 or 4 years. The sportsmen do 90-minute trainings 5 days a week. In order to conduct the study, official consent from the District Governership of Vezirköprü Town, confirmation of the partners of the subjects as the students are under 18 years old, and consent from the Directorate of Vezirköprü Youth and Sport Services are gained.

c. Procedures

20 Meter Speed Run measurement was done through putting a photocell with 0,01 sec precision on the starting and finish points of the test. 3 repetitions after 3-minute resting breaks, the best measurements were recorded 'in seconds'. **The Reaction Time Measurement** was done by LAFAYETTE MOART brand device and the importance of the test was told to the subjects. Prior to the test, a 5 repetition warm-up was applied. The eyes of the subjects focused on the screen and their heads were kept 40 cm away from it. The subjects were asked to put their pointing finger on the button. They were asked to push on the button as soon as they see the light after receiving the order of ready within 1-3 seconds. The average value was measured through the best and the worst values after 10 repetitions. For the **anaerobic power**; the starting and finish points are set by using NEWTEST POWERTIMER 300. The measurement was done through putting a photocell with 0,01 sec precision on the starting and finish points of the test. After the heights and weights of the sportsmen are recorded on the tool, they were made to run 35 m. sprints of 6 times successively with having breaks of 10sec between sprints. Following 6 sprints, the test finished. The times of the tests were recorded by the tool automatically. This tool measured anaerobic power by using Watt (AG: $\text{weight} \times \text{running distance}^2 / \text{running time}^3$, The Index of Fatigue = $\text{Maximum} - \text{Minimum Power} / \text{Total Running Time}^3$).

d. Statistical Analyses

The data obtained from the survey are evaluated by using STATISTICAL PACKAGE FOR SOCIAL SCIENCE (SPSS) 15.0V PROGRAM. The presumption normality of the parameters measured in the research and homogeneity of the variants are checked. The presumption of normality is tested by Shapiro-Wilk Test while the Levene test is used for the control of the variants' homogeneity. The One-way Variant Analysis (onewayanova) and Tukey multiple comparison test are applied to the sprint, peak power, average power and the fatigue index parameters that provided required variants. And the parameters of reaction time and minimum power that does not provide required variants are determined by Kruskal Wallis-H and Dunn multiple comparison test. Kruskal Wallis-H Test and Dunn multiple comparison test is used for determining the differences between the measurements of the reaction time and minimum power that are focused on the thesis. On the other hand, the other parameters (sprint time, peak power, average power and fatigue index) are evaluated by one way variant analysis (one way anova) and Tukey multiple comparison test. The relations between the variants are evaluated through Pearson correlation analysis. $P < 0,05$ value is accepted as level of importance in statistical evaluation.

RESULTS

As the trainings and matches of the football players mostly depend on leg-muscle strength and the leg-muscle strength is important for the measurements in the survey, football players' anaerobic

power and sprint values are better than the other branches by considering the fact that reaction time is a part of speed.

The measurements according to the branches are like below; reaction time 0.164 sec for footballers, 0.182 sec for volleyball players and 0.185 sec for wrestlers, Sprint time; 3.24 sec for footballers, 3.38 sec for volleyball players and 3.42 sec for wrestler; Peak power; 278.51 watt for football players, 263.23 for volleyball players and 235.51 for wrestlers; Average power; 209.51 watt for footballers, 207.05 watt for volleyball players and 180.97 watt for wrestlers; Minimum power; 166.55 watt for football players, 163.29 watt for volleyball players and 143.22 watt for wrestlers; Fatigue index; 2.48 watt/sec for football players, 2.23 watt/sec for volleyball players and 1.99 watt/sec for wrestlers. It is found out that there are considerable differences ($P > 0.05$) in sprint, reaction time and anaerobic power values between football players' and the other branches.

Table 1. Descriptive statistics and the results of the analysis

		Number of Sportsmen	Average	Standart Deviation	Median	P-Value
Sprint (sec)	Football	28	3,24 ^b	0,12		0,001
	Wrestling	28	3,42 ^a	0,15		
	Volleyball	28	3,38 ^a	0,18		
	General	84	3,35	0,17		
ReactionTime (sec)	Football	28	0,16	0,02	0,164 ^b	0,002
	Wrestling	28	0,18	0,01	0,185 ^a	
	Volleyball	28	0,17	0,02	0,182 ^a	
	General	84	0,17	0,02		
PeakPower (watt)	Football	28	278,51 ^a	60,46		0,006
	Wrestling	28	235,51 ^b	40,92		
	Volleyball	28	263,23 ^{ab}	44,17		
	General	84	259,08	51,85		
Minimum Power (watt)	Football	28	166,55	40,14	167,7 ^a	0,003
	Wrestling	28	143,22	33,23	132,4 ^b	
	Volleyball	28	163,29	40,32	162,8 ^a	
	General	84	157,68	38,99		
AveragePower (watt)	Football	28	209,51 ^a	47,06		0,016
	Wrestling	28	180,97 ^b	32,40		
	Volleyball	28	207,05 ^a	39,04		
	General	84	199,18	41,55		
Fatigue Index (watt/sec)	Football	28	2,48 ^a	0,77		0,050
	Wrestling	28	1,99 ^b	0,55		
	Volleyball	28	2,23 ^{ab}	0,83		
	General	84	2,23	0,74		

The symbols ^{a,b} and ^{ab} in the 'average column' indicates if there is significant differences among the branches.

While there is no statistically significant difference between the wrestlers and volleyball players when their 20m sprint values are compared, a remarkable difference between the footballers and other branches is determined. It is found that footballers' 20m sprint values are better than the other branches' ($P < 0,05$). In other words, footballers are the fastest at 20m while the wrestlers are the slowest.

There is no significant difference statistically in the reaction time values between the volleyball players and wrestlers but there is significant difference between the footballers and the other 2 branches. It is determined that footballers' reaction time is shorter than the other branches ($P < 0,05$).

There is a statistically significant difference among the branches when the peak power of the footballers, wrestlers and volleyball players are compared ($P < 0,05$). It is determined that footballers have the highest peak power while the wrestlers have the lowest.

While there is no significant difference between the average power of footballers, wrestlers and volleyball players, it is found that there is statistically significant difference between the wrestlers and the other branches ($P < 0,05$). And the average power of wrestlers are measured as the lowest and the footballers' are the highest.

There is no significant difference between the minimum power of footballers and volleyball players, but there is significant difference between the wrestlers and the other two branches when all three branches are compared ($P < 0,05$). It is found that the minimum power of wrestlers are the lowest and the footballers' are the highest.

When the fatigue index of three branches, footballers, wrestlers and volleyball players, are compared, a significant difference stands out ($p < 0,05$). The value of fatigue index of the wrestlers are recorded as the lowest and the footballers' the highest.

DISCUSSION

Actions that require high intensity and are related to anaerobic power such as short-distant sprints, changing directions, sudden stops, headers, jumps and kicking ball occur so often in soccer. Considering that an average of 40 time sprints of 15-20 meters and sudden jumps take place in a football match, footballers are supposed to have to high anaerobic power. (Ferhan, 2000).

Volleyball, as a result of game's characteristics, involves complicated forms that particularly depend on aerobic and anaerobic transitions related to energy system used in this branch. (Şahin Kafkas ve Çoksevim, 2014). Thus, working principals of volleyball can be aligned as general strength, speed, endurance, coordination and flexibility.

Wrestling is a sport branch in which anaerobic power is used dominantly and that speed, strength, promptness, flexibility, balance, muscular and cardiovascular factors have great impact on the performance. (Gökdemir, 2000).

The identifier of high level performance in a football match is the ability to perform the high intensity actions like sprint. Although the maximum speed distance in a football match is 40 m, the average is 15-17 (AŞÇI, 2006). According to some other data of the literature, it is claimed that a footballer runs 35-52 times of 22,4 meter sprints during a match (Gool and Boutmans,

1988; Tumilty, 1993). Thus, a footballer should develop his speed as well. Since the speed is one of the basic motor skills, the reason for the higher sprint value of footballers compared to other branches may be considered normal.

In the tests, values for 20m speed run of 16-17 years old wrestlers before the trainings were found 2,85seconds for experimental group and 2,87 seconds for control group while the values were 2,78 for experimental group and 2,91 for the control group after the training period. (Gökdemir et al.,1999).

Kılıç (1994) applied speed and strenght trainings to 14-16 aged group and according to the 20m running test results, the values obtained are: before the training; the research group performed 3,48 sec and 3,39 sec after the training; before the training the control group performed 3,61 sec and 3,49 sec after the training.

Arslan (2010) identified the max. value: 3,27 sec, min. value: 2,65sec, and average value; 3,03 sec in 20m speed run test for amateur football players. The values for 20m sprint run in the thesis work seems parallel with the values of amateur footballers.

The 20m sprint test that was applied to handball, volleyball and football university teams by Duyul Albay et al,(2008) gave the values below; 3,06 sec for footballers, 3,09sec for handball players and 3,23sec for volleyball players.

The measurements of the test of Albay's and et al. show great parallelism with our study measurements; the best values belong to footballers in Albays's study which supports the measurements of ours.

Speed is the promptness of the action. It is important for a midfielder in football who plays in distance like 50-80 meters. In order to enhance the speed, it is important to develop the lenght of steps, frequency of steps and the promptness of the movements of hand and arms (Baechle, 1994). It is natural that their sprint values are better than the others since they do more trainnigs on the length and frequency of steps.

Footballers with better sprint times have an advantage of 0,03 sec and it can be asserted that it is important to reach the ball regarding the distance and time (Eniseler, et al.)

The reason for superior speed values of footballers compared to wrestlers and volleyball players in our study can be explained with the fact that footballers have to do many short sprints during the competetions. Thus, they focus on speed workouts in the trainings. In addition, considering the characteristics of football game, speed is more significant for football when it is compared to wrestling and volleyball. Speed is an motoric skill that is advantage in football for tackling the rival, passing the ball into active field, making counter attacks, feinting the rival and completing the goal position. Thus, it is acceptable that fotballers have better speed values.

According to the test results of 30m speed run in different bracnhes among Physical Education and Sports College students, the following data were obtained; footballers; 4,2738 seconds, wrestlers; 4,2841, volleyball players; 4,2660 (İmamoğlu et al., 2004).The reason for the difference between our study and İmamoğlu et al. (their study shows the best values for volleyball players while ours shows footballers') can be explained by genetics and the fact that speed is a developable skill.

Speed and reaction are the qualities that enhance the success of the footballers. A footballer should be fast while running, attacking and defending during the match. Due to the speed,

the whole team play better. Being one of the basic skills, speed includes complicated qualities including movement and reaction. Moving the body with high speed depends on the strength while taking the distance in shortest time depends on speed. The speed of footballers individually affects the success of the team (Günay and Yüce, 2008). Considering the general data, the importance of speed for footballers is unquestionable and it is so natural that the values related to speed of footballers are better when compared to wrestlers and volleyball players.

Regarding the significant correlation between the speed and reaction time, it is an expected result that footballers who have better reaction times also have better speed values. Footballers have the best values in tests related to reaction time, and due to requirements of the football game characteristics, they are supposed to have better speed values as well.

It is clear that reaction time is a significant factor for sports branches that require good sprint values. Besides being an important motoric skill for all sports fields, speed is particularly significant in football as it is related with sudden stops, re-acceleration and changing directions except promptly. Furthermore, regarding the size of football field, the need for short-distant sprints, effort for getting the ball before the rival and making fast counter attacks reaction time is highly important factor in football.

We correlate the better values of footballers compared to wrestlers and volleyball players with footballers' short and frequent sprint during the matches and their focus on sprints in the trainings. In addition, considering the features of football game, it is obvious that speed is used more efficiently in football than wrestling and volleyball. Speed is an important motor skill in stopping the opponent, getting the ball into action, making counter and fast attacks, feinting and taking advantage in goal positions in football. Thus, footballers are supposed to have better values of speed.

The measurement of the reaction time is so important especially in short distance runs or start of a swimmer. The reaction time should be considered as a part of the other actions and activities. The success of many fast movements depends on the reaction speed of the player adjusted to the opponent's movements. These actions happen in accordance with what the player decides to do and when to take into action. These various activities can be observed in sports like boxing, football or motor-racing because reaction time is regarded as one of the components of various basic skills (Rudisill, 1992).

Since the footballers must give sudden decisions and pass the ball by seeing their teammates in a wide pitch, they are supposed to have better reaction time than wrestlers and volleyball players.

They found out the auditory hand reaction time as in below in their research: for professional footballers; 0.160 ± 0.19 sec, for amateur footballers; 0.163 ± 0.20 sec, and for visual hand reaction time for professional footballers 0.175 ± 0.14 sec, for amateur footballers 0.177 ± 0.18 sec. (İmamoglu et al).

In another study, right hand reaction for footballers time was recorded as 369,14 mls, 386.33 mls for wrestlers and 405,96 mls for volleyball players, and it was concluded that footballers have better reaction time than wrestlers and volleyball players. These findings support our measurements (Akarsu, 2008).

When we take the average 40 time sprints of 15-20m and 60-90sec, and jumps in a match into consideration, footballers are supposed to have high anaerobic power (Ferah, 2000). It is normal

that footballers have better anaerobic power than volleyball players and wrestlers since they make constant short runs during the matches and trainings. In order to reach these conclusions, we used RAST to measure the anaerobic power through 6x35 m sprints.

Since the vertical jumps, headers, shoots, sudden direction changes, sudden accelerations, tackling, sudden actions requiring explosive power, extraordinary sudden actions and quick muscular movements requiring technical skills take place in the basis of football, it can be concluded that footballers have better anaerobic power than wrestlers and volleyball players.

In a study surveyed in order to search the physical and physiological parameters of Turkish National Youth Team of free style and greco-roman, the anaerobic power of free-style wrestlers were found $122,6 \pm 25,1$ kg-m/sec and of the greco-roman wrestlers were $123,6 \pm 35,2$ kg-m/sec (Baykuş, 1989). The results of Margaria-Kalamen anaerobic power test that were measured on the Physical Education and Sports School students were for footballers; 157,09 kg-m/sec, for wrestlers; 162,92 kg-m/sec, for volleyball footballers; 152,27 kg-m/sn. The best results belong to the wrestlers (İmamoğlu ve ark., 2004). In another anaerobic power test used vertical jump and applied on the students of university team, the following results showing that volleyball players had the best values were found; 119,23 kg-m/sec for wrestlers, 129,90 kg-m/sec for volleyball players, and 116,07 kg-m/sn for footballers (Tutkun, 1996). In Wingate anaerobic power applied on different the sportsmen of different branches, the results of measurement were 781,9 watt for volleyball player, 729,2 watt for wrestlers, 793,3 watt for basketball players. The results showed that volleyball players had the highest anaerobic power (Saç ve Taşmektepligil, 2010).

As it is seen above, the different tests resulted in the favor of different branches. In our study, as we measured the anaerobic power through sprint runs, the results were in favor of football players.

Anaerobic powers of handball players, volleyball players and footballers of university teams were measured through vertical jumps and the results obtained are as; for volleyball players; 146.05 kg-m/sec, for footballers 119.06 kg-m/sec and for handball players; 133.39 kg-m/sec (Duyul et al, 2008). The reason for better values of anaerobic for volleyball player than other branches is correlated with measuring method 'vertical jumping' which provided advantages them as they are familiar with similar activities during the matches and their trainings. When we take the average 40 time sprints of 15-20m and 60-90sec, and jumps in a match into consideration, footballers are supposed to have high anaerobic power (Ferah, 2000). Footballers seemed more advantaged through 6x35 sprint measurements in our study that we used RAST and it is most probably the reason that footballers are better in anaerobic power than volleyball players and wrestlers.

In the light of this data, provided by our study, high level anaerobic power of footballers can be explained by short distance sprints, sudden stops, intensive and frequent anaerobic movements like changing directions which also contribute to enhance anaerobic power. In contrast, there are some studies in which the anaerobic power of wrestlers and volleyball players are higher than footballers. These mentioned findings contrast to general studies probably source from the differences in the measuring methods and different age groups of the athletes. However, it is clearly seen that jumping ability in volleyball and power in wrestling are in the foreground. Thus, it can be considered as normal that the volleyball players have the highest anaerobic peak power in measuring through vertical jump while wrestlers have the highest in measuring that is made by Wingate method. And it is acceptable that footballers have the highest anaerobic power tested by RAST method which depends on the speed in our study.

PRACTICAL APPLICATIONS

- More subjects and larger groups can be studied in further studies related to this issue.
- Similar studies can be disseminated and worked on different branches of sport.
- Fatigue index can be measured by different methods and compared with the current measurements.
- The study can be compared with the sportsmen in different branches regarding gender and age group.
- Regarding the fact that short reaction time is an advantage in sports, trainers are recommended to give space to workouts on shortening the reaction time.
- In similar studies, different measuring methods for anaerobic power can be used to compare the other motor skills.
- Trainings focusing on increasing the anaerobic power and the speed should be placed in wrestling training programs.

ACKNOWLEDGEMENTS

Special thanks to Prof. Dr. Seydi Ahmet Ağaoglu who has not withhold his continuous support, time and tolerance during my study, to subjects who participated in experiments voluntarily and my wife, my daughters and family who patiently showed their support and help sincerely.

I wish the sports community, academicians and sports lovers can benefit from this study which has no financial interest with any private company or manufacturers

REFERENCES

- Akarsu, S. (2008). The Relationship Among Reaction Time, Strength and Flexibility in Sedentary, and Adolescent and Adults In different Sport Branches (Master's Thesis). Atatürk University, Health Sciences Institute, Erzurum, Turkey. Retrieved from <https://atauni.edu.tr/saglik-bilimleri-enstitusu>
- Arslan, O. (2010). Evaluation of Anaerobic Power Values and Sprint Performances of Amateur Footballers in Different Positions (Master's Thesis). Ondokuz Mayıs University, Health Sciences Institute, Samsun, Turkey. Retrieved from <http://sosbilens.omu.edu.tr/>
- Aşçı, A. (2006). Performance Analysis in Football (Doctoral Thesis). Hacettepe University, School of Sports Sciences and Technology, Beytepe-Ankara, Turkey. Retrieved from <http://www.sporbilimleri.hacettepe.edu.tr/>
- Baechle, T.R.(1994). Essentials Of Strength Training And Conditioning. Champaign, IL. Human Kinetics, (1); 13–17.
- Bayraktar, B. & Kurtoğlu, M.(2004). “Sporda Performans ve Performans Artırma Yöntemleri”, Ed.: [Performance in Sports and Methods Enhancing Performance in Sports] Atası, T. (2004) Doping ve Futbolda Performans Artırma Yöntemleri [Doping and Methods for Enhancing Performance in Football]. İstanbul, Form Reklam Hizmetleri, 269-270.
- Baykuş, S. (1989). The Analysis Of Physiological Characteristics Of 17–20 Years Old The Turkish National Free Style And Greco-Roman Espoir Teams Wrestlers (Unpublished Master's Thesis). Middle East Technical University, Ankara, Turkey.

- Duyul Albay, M., Tutkun, E., Ađaođlu, Y.S., Canikli, A., & Albay, F.(2008). Examination of Some Motoric and Antropometric Skills of Volleyball and Football University Teams. *Spormeter Physical Education and Sports Sciences Journal*;(6).
- Eniseler, N. amlıyer, H. & Gde, O.(1996). The Comparison of 30m Sprints of Footballer Playing in Different Divisions Acoording to the Their Position. *Football Science and Technology Journal*, (2); 3–8.
- Ferah, A. (2000). *Football Training and Teaching*, Ed:1. Ankara, Nehir Publishing (7).
- Gool, D.V. & Boutmans, J.(1988). *The Physiological Load Imposed On Soccer Players During Real Match-Play*. London, 51–59.
- Günay, M. & Yce, A. İ.(2008). *Fundamentals of Football Trainings*. Ankara, Bađırgan Publishing, 16.
- Günaydın, G., Ko, H. & Ciciođlu, G.(2001). Trk Bayan Milli Takım Greřlerinin Fiziksel ve Fizyolojik Profillerinin Belirlenmesi [Specification of Physical and Physiological profiles of Turkish Women’s wrestling Team]. *Hacettepe niversitesi Spor Bilimleri Dergisi*, (1) 25–32.
- Gkdemir, K.(2000). *Greř Antrenmanının Bilimsel Temelleri Ed;1[Scientific Fundamentals of Wrestling Training]*. Ankara, Poyraz Ofset, 15.
- Gkdemir, K., eker, B., & Ciciođlu, İ. (1999). abuk Kuvvet Antrenmanlarının 16-17 Yař Grubu Greřlerin Bazı Fiziksel ve Fizyolojik Parametreleri zerine Etkisi[The Effects of Strength Trainings on Particular Physical and Physiological Parameters of 16-17 Years Old Wrestlers]. *Seluk niversitesi Beden Eđitimi ve Spor Bilimleri Dergisi*, 1(1).
- İmamođlu, O., Ađaođlu, S.A., & Ađaođlu, Y. S. (2000). Comparison of Sprint and reaction Times of Amateur and Professional Footballers. *I.Gazi Physical Education and Sports Sciences Congress Declaration Book*. Ankara: Sim Publishing, 56–59.
- Kılı, R. (1994). *The Effects of Round Speed and Strenght Training Method on Various Physical Features 14-16 Aged Wrestlers (Masters’s thesis)*. Gazi University Health Sciences Institute, Ankara , Turkey, 31–33. Retrieved from <http://saglikb.gazi.edu.tr/>
- Rudisill, M. (1992). *The Effect Of Physical Activity Programme On Reaction Time On Time For Older Adult*. *Jour. Hum. Mow. Stu.*, 205.
- Tumilty, D. (1993). *Physiological Characteristics Of Elite Soccer Players*. *Sports Med.*;80–96.