YÜZÜCÜLER VE SEDANTER BİREYLER ARASINDA DİZ EKLEMİ POZİSYON DUYUSUNUN (PROPRIOCEPTION) DEĞERLENDİRİLMESİ[3]

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Received: 16.09.2017

Accepted: 20.11.2017

ÖZ

Bu çalışmanın amacı; yüzücüler ile sedanterler arasındaki diz eklemi pozisyon duyusunun (proprioception) dijital gonyometre (DG) ile belirlenmesidir. Çalışmaya katılan deneklerde vücut ağırlığının taşınmadığı (Non weightbearing ;NWB), vücut ağırlığının kısmi taşındığı (Partial weight beairng ;PWB) ve vücut ağırlığının taşındığı (Weight beraing;WB) pozisyonlarda ölçüm alınmıştır. Araştırmaya 10 kadın (yaş ort: 20.0±3.1 yıl) /10 erkek (21.2±3.9 yıl) yüzücü ve 10 kadın(yaş ort: 21.6±1.3 yıl) / 10 erkek (yaş ort: 23.1±1.1 yıl) 20 sedanter olmak üzere toplam 40 denek katılmıştır. Araştırmada verilerin istatistiksel analizi için Graphpad InStat 16.0 istatistik analiz programı kullanılmıştır. Verilerin normal dağılım gösterip göstermediği Kolmogorov ve Smirnov yöntemi kullanılarak incelenmiştir.Veriler normal dağılım sergilediğinden yüzücü ve sedanter grup arasında 30°, 45° ve 60° 'de NWB, WB ve PWB diz eklemi eklem pozisyon duyusu öllçümleri farklılıklarının analizi çift taraflı student-t testi kullanılarak yapılmıştır. Araştırmada 3 farklı pozisyonda (30°, 45° ve 60°) propriosepsiyon ölçümleri incelendiğinde, yüzücü ve sedanter gruplarda; NWB sırtüstü 45° ve PWB 60°'lerde, yüzücü ve sedanter kadın gruplarda; NWB yüzüstü 30°'de, yüzücü ve sedanter erkek gruplarda; NWB yüzüstü 30°, WB ve PWB 60° değerleri arasında yüzücüler lehine anlamlı farklılık saptanmıştır (p ≤0,05). NWB sırtüstü 30° ve 60°, NWB yüzüstü 45° ve 60°, PWB 30° ve 45° ile WB 30° ve 45° de ise istatistiksel olarak anlamlı bir farklılık görülmemiştir (p>0.05). Erkek yüzücü ve sedanter grup arasında yüzüstü NWB 30º, WB ve PWB 60º 'lerde istatiksel olarak anlamlı farklılık saptanmıştır (p≤ 0,05). Sonuç olarak, yüzücüler hedef açıya daha yakın değerlere sahip olurken, sedanterler daha geniş aralıkta açı değerlerine sahiptirler.

Anahtar Kelimeler: Propriosepsiyon, Vücut Ağırlığının Taşınmadığı, Vücut Ağırlığının Taşındığı, Vücut Ağırlığının Kısmen Taşındığı, Yüzme, Dijital Gonyometre.

THE EVALUATION OF KNEE JOINT POSITION SENSE (PROPRIOCEPTION) BETWEEN SWIMMERS AND SEDENTARY INDIVIDUALS

ABSTRACT

The purpose of this study is to determine of the proprioception composed on knee joint of swimmers and sedantaries applying the method of digitalgonyometer (DG). Totaly 40 men and women 10 women swimmers (Average age: 20.0±3.1 year), 10 men swimmers (Average age: 21.2±3.9 year), and 10 women sedantaries (Average age: 21.6±1.3 year), 10 men sedanteries (Average age: 23.1±1.1year), have participated in this study as volunteers. Graphpad InStat 16.0 statistical analysis program was used for statistical analysis of data in the study. The Kolmogorov and Smirnov methods were used to examine whether the data showed normal distribution. Because the data show normal distribution, analysis of differences in NWB, WB, and PWB knee joint positional position measurements at 30°, 45°, and 60° between the swimmer and the sedanter group was performed using a two-sided student-t test. When the proprioception was examined in 3 different measurement positions weightbearing (WB), partialweight bearing (PWB) and nonweight bearing (NWB) (30º, 45º, 60º). Swimmer and sedentar groups between meaningful differences were identified in favour of back down NWB 45º and PWB 60º (p≤0,01). Women swimmers and sedanteries between meaningful differences were identified in favour of swimmers in the front down NWB 30º. Man swimmer and sedanter groups between differences were identified in favour of swimmers of front down NWB 30º, WB and PWB 60º (p ≤ 0,05). As a result, the swimming target has closer values, while the sedanters have a wider range of angle values.

Key Words: Proprioception, Nonweight bearing, Weight bearing, Partial weight bearing, Swimming, Digitalgonyometer.

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2. Anadolu University /Faculty Of Sports Sciences / Coaching Education Department /Eskişehir
3. This study was supported by BAP1103S067 BAP project of Anadolu University as a master thesis.

INTRODUCTION

Swimming is one of the main branches of sport that allows the development of body and spirit features that form the basis of all sports [35]. It is made in water and in an unusual position (horizantal) in an environment unusual to human organism and unusual to other sports disciplines [1].The swimming sport where the gravity feature is almost null makes it possible for all the muscles of individuals doing this sport to work in harmony [10]. Swimming, which provides symmetrical and balanced development of the muscles; includes free, butterfly, supra and breaststroke techniques. In these techniques, success is directly related to the performance to be exhibited [9,34]. There is a need to improve performance determinants such as strength, aerobic capacity, coordination and technique in swimming training. Swimming races are the most special cases where training results are received. According to the results obtained, progress can be made by studying the weakest points which are needed most [33].

The swimmers progress 10-20 km per day. In order to complete this distance, it is necessary to make a foot stroke and an arm pull. In order to achieve the desired performance, it is necessary to bring the knee joint angle at the same level every time in swimming techniques. For example; in free style, an average of 8-10 full arm pulls over 25 meters and an average of 6 foot strokes per arm pull have done. During the foot strokes, especially the knee joint angle should be in a manner that repeats itself and accelerates the athlete to move on the water. For this reason, it is very important that the joint position sense of the athlete is developed [22].

The same use of joints is one of the most basic features of the swimming. Therefore, the risk of overuse injuries of the swimmers is high [22]. In addition, these types of injuries are quite frequent with increasing number of training sessions, periods and intensity in competitor swimmers [36]. Injuries are usually seen in shoulders and knee joints in swimmers. The most common injury in the knee joint is anterior cruciate ligament injury (ACL). To reduce the risk of ACL injury, it is recommended to focus on flexibility, strength, balance and proprioception training in warm-up programs [25].

Being able to overcome these stressed injuries and to achieve performance enhancement requires that the swimmer has improved joint position senses (propositions) in the knee joints. Proprioception is defined as the individual is aware of the extermites position and movement in the space [4]. It is emphasized that the proprioceptive plays a major role in providing joint stabilization and mediating muscle function in researches [15,22,31]. Movements such as excessive flexion and extension during exercise cause the formation of proprioceptive stimulition. With these warnings, some reflexes are actuated to prevent excessive difficulties in the joints. This feedback mechanism plays a protective role in sports injuries [22].

In order to improve the performance of the swimmers, it is necessary to develop performance-determining factors such as flexibility, coordination, technique and strength. Among these factors, strength development and strength exercises, which affect the accuracy of joint position feeling, improve muscle performance[11]. In addition, kinesthetic perception of strength training and sensory integration are also expressed. The development of sensory integration also influences the performance of the swimming [12].

The correctness of joint position sense is an important factor affecting performance

in swimming. Movement of the joints in the upper and lower extremities in the correct position and angles will allow the swimmer to swim using the right technique. A swimmer swimming with the right technique will swim faster by spending less energy. S/he will also improve her/his performance [5].

In the literature, there have been no studies in swimming related to proprpoception whereas there are in folk dancers, handball, ballet, football, basketball and rugby branches [3,2,6,8,7; 29,37].

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In the research done, it is thought that it can be contributed to the swimming sport and to the field of sport sciences with preventing injuries in the knee joint and improving the performance by determining the proprioception values of the knee joint which is one of the most used joints of the swimmers in different measurement environments.

The purpose of this study is; to analyze the knee joint proprioception values of swimmers at different joint positions and different joint angles

MATERIAL AND METHOD

Research Group

10 female/10 male swimmers competing in the national competitions (age range: 17-25) and 10 female/10 male sedentary individuals (age range: 17-25) were volunteer to participate in the study. Participants in the study were asked to complete the participant information form of the American College of Sports Medicine (ACSM) to obtain information about their medical history.

Table 1. Descriptive Statistics of Swimmer and Sedanter Group

Subjects (n)	Gender	Age Mean±SD	Branch				BMI Mean±SD	Dominant leg	
			Free	Back	Break	Butter		Sağ	Sol
Swimmer (n=20)	Male	21.2±3.9	2	2	4	2	21.4±2.4	6	4
	Female	20.0±3.1	3	2	3	2	20.5±2.4	8	2
Sedentary (n=20)	Erkek	23.1±1.1					22.9±1.8	8	2
	Kadın	21.6±1.3					20.7±2.8	8	2

Free=Freestyle, Back=Backstroke, Break=Breakstroke, Butter=Butterfly, BMI= Body Mass Index, Mean = Mean, SD = Standard Deviation

Research Design

Volunteer subjects consisting of swimmer and control group were subjected to proprioceptive measurements of knee joint with Non-Weight Bearing (NWB), Weight Bearing (WB) and Partial Weight Bearing (PWB) positions with Digital Goniometer (Table 2). Measurements in the NWB position were taken; in the freestyle and backstroke lying position; measurements in WB position; were taken on the dominant foot in the standing position and the PWB measurements were taken in the backstroke position on the proprioception stand inclined by 20°. Measurements were made at 30°, 45° and 60° angles when the

knee is bent. The initial position was set to 0° in NWB, WB and PWB positions, and measurements were taken from the dominant leg. In this study, at the beginning of the proprioceptive perception test, the specialist put the knee joint to the target angle in the closed position and kept it at this position for 3 seconds and the knee joint was brought back to the starting position. At the next stage, when the eyes are closed, the subject is asked to wait for 5 seconds in the test position by bringing the knee joint to the target and the oral instructions given by the expert at the beginning of the test. Three averages were taken for each angle and the absolute angular error averages (target angle proximity and distance value differences) were recorded. In the conclusion, the errors of the test angles and the measurements in WB, NWB and PWB positions were compared. The images related to measurement applications are given in Table 2.

Table 2: Measurement Positions

a **b** **c**

a: Partial Weightbearing (PWB), **b:** Non- Weightbearing (NWB), **c:** Weightbearing (WB).

Location and Environmental Conditions of the Study

During the study, the measurements of the subjects were carried out at Anadolu University Faculty of Sports Sciences, Movement and Motor Control Laboratory (HAMOK). The ambient temperature at which tests are conducted is kept unaffected by the outside environment. The working times were planned considering the appropriate times of the HAMOK and the subjects, and measurements were usually taken in the morning hours. At the beginning of the study, attention was paid to the study by giving sufficient information about the tests to be done to the athletes who participated in the study by the researcher.

Data Collection Tools

Body Mass Index Measurement

The heights of the subjects in the test were measured on a Holtain, UK stadiometer with a precision of 0.1 mm, and body weights in an electronic laboratory scale of Seca, Vogel & Halka, with a precisin of 0.1 kg.

Knee Joint Position Sensing Measurement

In the study, subjects' knee joint proprioception measurements were taken with a digital goniometer (Baseline 10044E Digital Absolute + Axis Goniometer 10044E SKU: CM10044E) with a precision of 1 degree. The goniometer is fixed with bandages on the knee joint of the dominant leg of the subject.

Analysis of Data

Statistical analysis of the three experiments taken for each knee angle was performed in the Graphpad InStat 16.0 statistical analysis program. Using Kolmogorov and Smirnov method, it was examined whether the data showed normal distribution and it was observed that it showed normal

distribution. Firstly, the mean and standard deviations of the values obtained (mean±SS) were calculated and there was no difference between the SS values of the groups. Therefore parametric test statistics were applied. Analysis of differences in joint position sense values of NWB, WB and PWB knee joints at 30°, 45° and 60° between swimmer and sedanter groups were performed using the double-sided student-t test. The level of statistical significance was taken as 0.05.

FINDINGS

Findings of whether there is a difference between NWB freestyle and backstroke values of swimmer and sedanter female subjects are shown in Table 3. When the table was examined, there was no statistically significant difference (p> 0.05) between the proprioceptive values of NWB backstroke 30 ° and 60 ° knee joints of swimmers and sedentary women groups; whereas in NWB freestyle values there is a statistically significant difference between the groups (P≤0.01). In addition, a statistically significant difference was found between the groups in proprioceptive values of the NWB backstroke 45° knee joint (P≤0.05); there was no significant difference between the groups in propriety values of NWB freestyle 45° and 60° knee joints (P ≤ 0.05) (Table 3).

Table 3. Swimmer and Sedanter Women's Groups NWB Backstroke and Facedown 30 °, 45 ° and 60 ° Proprioceptive Values Comparison

	30°		45°		60°	
NWB Backstroke	**Mean±SD**	**p**	**Mean±SD**	**p**	**Mean±SD**	**p**
Female Swimmer	29.7±0.5	0,83	44.3±2.1	0.04*	59.9±1.1	0,75
Female Sedentary	30.1±6.2		50.8±9.4		59.2±7.6	
NWB Facedown						
Female Swimmer	29.9±0.7	0,01**	44.8±0.5	0.08	60.4±1.4	0.93
Female Sedentary	23.5±6.9		41.4±5.9		60.2±7.1	

*p≤0,05, **P≤0.01

Findings in Table 4 show that there is no difference between NWB freestyle and backstroke values of swimmer and sedanter male subjects.

Table 4 shows that there was no significant difference (P> 0.05) between the proprioceptive values of the knee joints at 30°, 45° and 60° on the NWB backstroke position of the swimmer and sedanter male groups, whereas there was a significant difference in favor of the swimmer group between the proprioceptive values of the knee joints at 30° NWB freestyle (P≤0.01). There was no significant difference between the swimmer and sedanter groups at the 45° and 60° angles of the NWB freestyle (Table 4).

Table 4. Swimmer and Sedanter Men's Groups NWB Backstroke and Facedown 30 °, 45 ° and 60 ° Proprioceptive Value Comparison

	30°		45°		60°	
NWB Backstroke	**Mean±SD**	**p**	**Mean±SD**	**p**	**Mean±SD**	**p**
Male Swimmer	29.9±1.3	0.58	44.9±1.7	0.06	58.8±3.0	0,11
Male Sedentary	31.7±9.5		50.8±9.3		63.3±8.1	
NWB Facedown						
Male Swimmer	29.8±1.0	0,01**	44.8±0.5	0.08	60.4±1.4	0.93
Male Sedentary	39.0±11.3		41.4±5.9		60.2±7.1	

*p≤0,05, **P≤0.01

The values that emerged when examined without gender differences are given in Table 5. When the data were analyzed, there was no significant difference between swimmer and sedanter groups (regardless of gender) between 30° and 60° angle, proprioception, and there was a significant difference between swimmer and sedanter group in favor of swimmer group in NWB backstroke 45° knee joint (P≤0.01) . There was no significant difference (p> 0.05) between proprioceptive values of NWB freestyle 30°, 4° and 60° angles (Table 5).

Table 5. Swimmer and Sedanter Groups NWB Backstroke and Facedown 30 °, 45 ° and 60 ° Proprioceptive Values Comparison

	30°		45°		60°	
NWB Backstroke	**Mean±SD**	**p**	**Mean±SD**	**p**	**Mean±SD**	**p**
Swimmer	29.8±1.0	0.55	44.6±1.9	0.00**	59.3±2.3	0,32
Sedentary	31.9±7.8		50.8±9.1		61.25±7.9	
NWB Facedown						
Swimmer	29.8±0.8	0,60	44.9±1.4	0.91	59.6±2.7	0.24
Sedentary	31.3±12.1		45.2±10.2		61.8±7.9	

*p≤0,05, **P≤0.01

Findings regarding whether there is a difference between the values of WB and PWB positions for swimmer and sedanter women groups are shown in Table 6. No significant difference was found between the propriety values in the WB and PWB 30°, 45° and 60° swimmer and sedanter women groups.

Table 6. Swimmer and Sedanter Woman Groups WB, PWB 30 °, 45 ° and 60 ° Proprioceptive Values Comparison

	30°		45°		60°	
WB	**Mean±SD**	**p**	**Mean±SD**	**p**	**Mean±SD**	**p**
Female Swimmer	28.5±4.2	0.44	46.4±7.9	0.26	58.4±9.6	0,87
Female Sedentary	29.6±1.1		46.4±7.9		57.9±4.2	
PWB						
Female Swimmer	29.6±1.1	0.96	44.5±0.9	0.91	59.6±0.8	0.14
Female Sedentary	29.6±9.0		45.6±7.9		63.1±7.3	

*p≤0,05, **P≤0.01

Findings of whether there is a difference between the values of the WB and PWB positions for the swimmer and sedanter male groups are shown in Table 7. When the table was examined, there was no significant difference between the proprioceptive values at WB and PWB 30° and 45° swimmer and sedanter male groups, while the proprioception values of WB and PWB 60° knee joints showed a significant difference in favor of sedanter group between swimmer and sedanter group (* P≤0.05 , ** P≤0.01).

Table 7. Swimmer and Sedanter Male Groups WB, PWB 30 °, 45 ° and 60 ° Proprioceptive Values Comparison

	30°		45°		60°	
WB	**Mean±SD**	**p**	**Mean±SD**	**p**	**Mean±SD**	**p**
Male Swimmer	29.4±4.9	0.12	44.02±5.0	0.36	43.2±3.9	0.00**
Male Sedentary	32.5±3.5		46.2±4.6		62.8±4.9	
PWB						
Male Swimmer	29.3±2.3	0.48	42.8±2.5	0.07	57.6±4.4	0.02**
Male Sedentary	30.9±6.8		47.9±8.3		66.8±11.2	

*p≤0,05, **P≤0.01

The values appearing in WB and PWB measurement positions of swimmer and sedanter groups (regardless of gender) are shown in Table 8. There was no significant difference between WB 30°, 45° and 60° knee joint proprioception values. A significant difference was found between PWB 60° knee joint proprioception values in favor of the swimmer group (** P≤0.01), while there was no difference between the PWB 30° and 45° knee joint proprioception values.

Table 8. Swimmer and Sedanter Groups WB, PWB 30 °, 45 ° and 60 ° Proprioceptive Value Comparison

	30°		45°		60°	
WB	**Mean±SD**	**p**	**Mean±SD**	**p**	**Mean±SD**	**p**
Swimmer	29.0±4.5	0.09	45.3±6.5	0.73	58.5±7.2	0.35
Sedentary	31.1±2.9		44.7±4.4		60.3±5.1	
PWB						
Swimmer	29.4±1.7	0.62	43.6±2.0	0.10	58.6±3.2	0.00**
Sedentary	30.3±7.8		46.7±8.0		65.0±9.4	

*p≤0,05, **P≤0.01

There was a significant difference between the swimmer and sedanter male groups in the measured values, while the proprioceptive values in the NWB freestyle 30°, WB and PWB 60° knee joints were significantly different between the swimmer and sedanter male groups. Significant differences were found between the swimmer and sedanter groups between NWB backstroke 45° and PWB 60° values.

DISCUSSION AND CONCLUSION

In this study, it was shown that the swimmer's NWB backstroke 45 ° and PWB 60° proprioceptive perception scores were better than sedanters, in other words, the error rates were lower, so that the position senses were better for these aisles. They are trained with bringing the arm and leg angles to the same degree by repeating. Therefore, it can be considered that the result can be related to the development of the ability to bring the arm and leg angles to the same degree constantly (propriosepstif perceptions) during the technical training performed by the swimmers. Repeated movements to achieve the same technique consistently in the workout provide proprioceptive feedback [19]. This suggests that training may have an effect on the proprioceotion [7]. The swimmers generally perform their workouts in the absence of gravity (in water). In this context, it can be said that the results obtained may be related to the training that the swimmers carry out without carrying the weight of the body.

In the research that Berkes et al. (2008) investigated the effects of proprioceptive exercise in the knee joint position sense of female handball teams, proprioceptive training was performed on the subjects and the values of three different knee angles were measured by goniometer 5 times before and after the season and the absolute error data were obtained. It was found that the group having the exercise had an improvement in the joint position sense before and after the season, no improvement was observed in the control group.

Riberio et al. (2010) investigated the development of knee joint position sensation before sportive activity and WB and NWB measurements were performed

immediately before and after the warming of the knee position senses of 10 karateists. There was no statistically significant difference between the NWB and WB and a decrease in WB angular error rate after warming.

In our current study, it is concluded that the swimmer group only had a lower error rate than sedanters as a result of NWB freestyle stroke 30° and NWB backstroke 45° proprioceptive perception tests, and that swimmers had better joint position sensation in the absence of body weight. It may be due to swimmers training in the non gravity media. Differences in the standard deviations between repetitions in terms of sedanteries support this finding. It can be said that the position sense of the knee joints of the swimmers is better than the sedentaries.

Blanck et al. (2000) examined the proprioception sensation in the WB position between ballerinas (n = 10) and control group (n = 10). The knee flexion measurements were measured at the WB standing position at two angles of joint angle (shallow <45 °, deep> 55 °). No statistically significant difference was found between ballerinas and control group.

Stillman et al. (2001) investigated the role of body weight in the sense of knee joint position in the study. The tests were conducted with 20 people in NWB and WB environments. NWB backstroke position positioning, NWB backstroke ankle positioning, knee and hip positioning, and WB minimal hand support and unilateral leg position measurements were taken. No statistically significant relationship was found between WB and NWB position results.

In the current study, it was concluded that the error rates of male swimmers were lower than female swimmers as a result of NWB freestyle 30 °, WB and PWB 60 ° proprioceptive perception tests. The number of men using the breaststroke technique in the study is higher than the other branches. Wider leg angles are used in the breaststroke technique compared to freestyle, backstroke and butterfly techniques [23]. The angle between the leg and trunk during the foot kick is between 110° and 140° [14]. It can be stated that the end result is supported by the excessive number of men involved in the research and these subjects are using the breaststroke technique, and these people apply wide leg angle application with repetitive movements due to the breaststroke technique.

In the study performed by Akdoğan (2011), the joint position sensation in the knee joint between folk dancers and sedanters who were regularly trained was examined by goniometer method. A total of 30 men, 15 folk dancers and 15 sedanters, participated in the research. In the study, when the measurements of dominant leg joint position sensations at 15, 30, 45, and 60 ° in 4 different measurement positions were examined, it was seen that NWB showed statistically significant difference in favor of folk dancers at 45º and 60º in the backstroke position ($p \leq 0,05$). There was no statistically significant difference in NWB backstroke 15º and 30º and NWB freestyle, PWB and WB single foot and double feet positions of 15º, 30º 45º and 60º.

Akman's (2007) study examined the proprioception and joint position sensation (EPH) developed in the knee joints of blacksea folk dancers. When the values obtained by electrogoniometer were examined, there was a statistically significant difference between dancers in right angle 20° angle measurements whereas no significant difference was found in 40° and 60° angle measurements of the same knee. There were no statistically significant differences in 20°, 40° and 60° EPH measurements of the right knee and left knee. There was no statistically significant difference between dominant and non-dominant measures in dancer and sedanter groups.

In a study conducted by Bartlett et al. (2002), they examined the knee proprioception in rugby players. Pre-exercise warm-up exercises have shown significant results in knee proprioception measurements.

Higgins et al. (1997), examined the sensation of position of knee joint in WB and NWB in athletes and compared them with anterior tibial translation. According to this study, the proprioception has been expressed to increase with WB exercises, because the number of mechanoreceptors is thought to increase the proprioceptive input.

In this study, the average age of the sedanter group is higher than the average age of the swimmer group. As a result of some measurements, the proprioception value error rate of the sedanter group was found to be higher than the proprioception value error rate of the swimmer group ($p < 0.05$) in the result of some measurements (NWB 30°, PWB 60°, WB 60° and PWB 60°). The fact that the swimmer group has a lower error rate than the sedanter group can be considered to be related to the fact that the average age of the sedanter group is higher than the average age of the swimmer group. In individuals, regression is seen in both motoric and sensory information with age [32, 24,16, 20, 13]. Bullock-Saxton et al. (2001) investigated the effect of age at knee joint at body weight bearing position. The study was conducted with a group of 60 people consisting of young, middle aged and elderly people in the study where NWB, WB and PWB (20° inclined proprioception stand) positions were measured. It was found that the proprioception did not show an increase in age in the WB position but it was statistically increased in the PWB position. In all age groups, WB position values PWB position measurement averages were statistically significant.

In the study performed by Günaydın et al. (2016), the pre-season and post-season proprioception, endurance and coordination evaluations of the football players and the effectiveness of the training programs applied during the season on these parameters and the change of the players in the season are examined. There was no difference in the results of the proprioceptions made by the athletes at the beginning of the season and at the end of the season and in the comparison with the sedanter individual.

Yonker (2005) conducted a comparison between static and dynamic proprioceptive skills of football, basketball and gymnastics. In the dynamic proprioception tests, subjects were asked to reach the maximum distance in eight directions (anterior, anterior lateral, anterior medial, lateral, medial, posterior, posterior lateral, posterior medial) of the subjects on the dominant and non-dominant leg without receiving support. There was a significant difference between the groups in the static and dynamic equilibrium tests. However, no statistically significant difference was found between dominant and non-dominant legs.

In conclusion, in this study, it is thought that the lower error rate of swimmers in NWB 45° and PWB 60° joint position sense values may be related to sporting activities of swimming without using body weight. There was no difference between the swimmer and sedanter groups NWB backstroke 30°, 60° and NWB freestyle values, while there was a difference between the two groups in the standard deviation values. Thus, while the swimming target has closer values, the sedanters have a wider range of angle values. In this case, it is possible to achieve the result that the feelings of the joint position of the swimmers may be more improved than the sedanters.

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