10-12 YAŞ GRUBU ERKEK YÜZÜCÜLERDE DİNAMİK GERME EGZERSİZLERİNİN ESNEKLİK GELİŞİMİ VE YÜZME PERFORMANSINA ETKİSİ[3]

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ÖZ

Araştırmanın amacı, 10-12 yaş grubu erkek yüzücülerde 8 haftalık dinamik germe egzersizlerinin esneklik gelişimi ve yüzme performansına etkilerini belirlemektir. Araştırma Konya ilinde çeşitli kulüplerde düzenli olarak yüzme antrenmanları yapan toplam 30 gönüllü erkek sporcunun katılımı ile gerçekleştirildi. Araştırmaya katılan sporcular rastgele deney grubu (DG) (n=15, yaş=10,93±0,80 yıl, boy=150,94±0,06 cm, vücut ağırlığı=43,07±3,13 kg) ve kontrol grubu (KG) (n=15, yaş=11,00±0,85yıl, boy=151,7±0,05 cm, vücut ağırlığı=47,80±3,61 kg) olarak ikiye ayrıldı. DG grubuna, 8 hafta süresince haftada 5 gün yüzme antrenmanlarına ek olarak dinamik germe egzersiz programı, KG'ye ise sadece yüzme antrenmanları uygulandı. Elde edilen bulguların analizinde Paried Samples t-Testi ve Independent Sample t-Testi kullanıldı. Araştırmanın sonunda DG'nin otur-uzan, kol esnekliği, köprü, kalça fleksiyon ve ekstansiyon, diz fleksiyon, omuz fleksiyon, gövde fleksiyon esnekliği ve 25-50-200 m serbest teknik yüzme performanslarında anlamlı düzeyde farkın olduğu belirlenmiştir ($p<0,05$). KG'de ise hiçbir esneklik parametresinde anlamlı değişiklik tespit edilmemiştir ($p>0,05$). Gruplar arası karşılaştırmalarda deney grubunun, kontrol grubuna göre gövde geriye ekstansiyon değerleri anlamlı derecede yüksek, 25 m yüzme ve 50-100-150-200 m geçiş dereceleri ise anlamlı düzeyde düşük bulunmuştur ($p<0,05$).

Sonuç olarak, yüzme antrenmanlarının öncesinde yapılan dinamik germe egzersizlerinin, büyüme ve gelişme çağında olan sporcuların esneklik ve performans gelişimlerine katkı sağladığı söylenebilir.

Anahtar Sözcükler: çocuk, dinamik germe, esneklik, yüzme

THE EFFECT OF DYNAMIC STRETCHING EXERCISES ON FLEXIBILITY DEVELOPMENT AND SWIMMING PERFORMANCE IN 10-12 YEAR-OLD MALE SWIMMERS

ABSTRACT

The purpose of the study is to monitor the effect of 8-week dynamic stretching exercises on flexibility development and swimming performance in male swimmers in 10-12 age group. The study is carried out among 30 boys between ages of 10-12 who regularly do swimming exercises in a variety of sport clubs in Konya. The children taking part in the research is divided in experiment group (EG) (age=10,93±0,80 years, height=150,94±0,06 cm, weight=43,07±3,13 kg) and control group (CG) (age=11,00±0,85years, height=151,7±0,05 cm, weight=47,80±3,61 kg), each of 15. In the course of 8 weeks, experiment group performed dynamic stretching exercises in addition to the swimming exercises while CG only did swimming exercises. In analysing the results Paired Samples T-Test and Independent Sample T-Test has been used. At the end of the study, it was identified that EG made a significant progress in sit-and-stretch, arm flexibility, bridge pose, hip flexion and extension, knee flexion, shoulder flexion, torso flexion and 25-50-200 freestyle and technical swimming tests ($p<0,05$). On the other hand, no substantial change was observed in any of CG's flexibility parameters ($p>0,05$). It was revealed that experiment group's extension values were profoundly higher and its 25 meter swimming and turns in 50-100-150-200 meters were significantly shorter compared to the control group ($p<0,05$).

Consequently, it is possible to claim that dynamic stretching exercises performed before swimming exercises make substantial contribution to the flexibility and performance development of swimmers who are in the adolescence period.

Key Words: children, dynamic stretching, flexibility, swimming

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INTRODUCTION

Swimming is the unity of the systematic movements performed properly on the surface of the water. Swimming branch which is one of the most active sports today is a type of sports emerged through some human reflexes to protect themselves from the water. Humans in the past discovered the swimming activity both to create various sources of living and to enable transportation via water (1).

Swimming sport is a branch which requires physical aptness. Through regular training and stretching exercises physical aptness is attained. A swimmer's joint strength and thus the ability to move strongly is highly important for the performance. Movement wideness of the swimmer is related to the hand, leg joints; knee, skeletal structure and ankles. Muscle structure is as important as joints while performing the movements. Stretching exercises done before the swimming trainings increase the flexibility of muscles and joints. Thus the body will be physically prepared for the swimming trainings (18, 22).

Flexibility is simply defined as the already available movement wideness of a joint or joint group. It is the ability of enabling the relaxation and stretching of a muscle (2). When antagonist muscles are not warmed enough, their contraction and relaxation do not play along with each other. Depending on this they break the coordination. Flexibility which is promoted by the warm-up in the applied programs makes a positive impact on the mechanical productivity as well. The muscle the flexibility of which has developed reaches more movement span and speed. Decrease in muscle viscosity and increase in flexibility makes a positive impact on the coordinative function of neuromuscular system (15). Muscle capsule, muscle mass, joint structure, and stretching level of tendons, bonds and skin have an important role in the development of the flexibility (9).

Flexibility in the swimming sport is a motor feature which impacts the sportive performance. Researches conducted shows that flexibility in children can be developed by exercises. However, stretching exercises for children should be applied considering their development processes. In this way, the flexibility will develop better. Impact of flexibility on sportive performance varies depending on the sports branch. For example, while flexibility is considerably required to boost the performance in swimming and gymnastics, flexibility in a different level is required depending on the position in basketball and weight lifting because in weight lifting strength is required to lift the weights. However, in the swimming sports, movements are more isotonic and dynamic and less isometric (14).

Dynamic stretching exercises before swimming trainings have an important place in children's developing the flexibility. It is considered that this study which aims to show how flexibility and swimming performance are affected by the dynamic exercises in warm-up session before the training can provide new insights about the impact of dynamic stretching exercises on swimming performance and flexibility development.

METHODS

Participants: This study is realized with the participation of male swimmers who are between 10-12 years old, do regular swimming trainings at least for 2 years in various swimming clubs in the city of Konya. Informed consents about the study participation are received from the custodians of the sportsmen. In the study

conducted with the volunteer participation of 30 sportsmen in total, via random method, it is categorized in 2 groups each for 15 people as control group (CG) and experiment group (EG).

Height and Body Weight: Statures of the sportsmen are measured with height scale having 0,01 cm sensitivity. Body weights of the sportsmen are measured with electronic bascule having 0,1 kg sensitivity and they are asked to get on the bascule in their swimsuits and bare feet (17).

Sit and Reach Test: The sportsman is asked to sit on the floor without bending his knees and placing his soles flat against the flexibility box. He reaches forward along the line on the box with his two hands and the value at the farthest point is recorded in cm (17).

Arm Flexibility Test: The minimum distance the sportsman approaches his arms is measured with a tape measure when he stands on his feet adjoined each other, arms are stretched at arm's length, palms and back are faced against the wall, fingertips touch to the wall (26).

Back-Bend Test: While the sportsman's arms and legs are stretched by doing a backbend, the distance between his fingertips and toe tips is shortened as much as possible. The distance of between his fingertips and heels are measured with a tape measure (26).

Hip Flexion and Extension Test: Hip flexion is measured when the sportsman is lying on his back and his knee is in flexion position and hip extension is measured while the sportsmen is lying face down with the goniometer (360°) by taking the trochanter major as the pivot point (21).

Knee Flexion Test: It is measured with the goniometer (360°) while the sportsman is lying his face down and his femur and leg are backed on the mat by taking the lateral condyle of femur as the body pivot point (21).

Shoulder Flexion and Shoulder Extension Test: Shoulder flexion is measured while the sportsman is lying on his back, shoulder extension is measured while he is lying face down and his palm is facing up to the ceiling and measurements are done with the with the goniometer (360°) in the lateral side of the body (21).

Trunk Forward Flexion Measurement: The sportsman sits on a flat floor, his hands are clenched on his nape and legs are apart. The head is moved forward slowly and the trunk is bowed towards to floor as much as possible. The distance between the front head and the floor is measured (12).

Trunk Backward Extension Test: The sportsman lies face down on a flat floor and his hands are clenched on his nape. Sportsman tries to lift his head and chest towards back as high as possible. The distance between his chin and floor is measured with a tape measurement (12).

25 m, 50 m Swimming Performance and 200 m Passing Test: 25 m, 50 m and 200 m swimming performance test is started when the sportsman is in the pool and after the ready instruction and verbal warning he pushed the pool wall with his feet and ended when he touched the wall at the end of the distance. In 200 meters passing test, all 50 meters passing scores are recorded once the feet touch the wall in roll turn (27).

Training Program: Regular swimming training was implement to the control group (CG) and experiment group (EG) for 8 weeks as 5 days in a week. After 10-minute warm-up exercises for CG and EG before the training, 23 different stretching exercises (3) was applied to the EG in each training at the warm-up phase. Main phase lasted 60-75 minutes in trainings of

each two groups. After both trainings, sportsmen were made to do cooling workout with active-passive stretching for 10 minutes.

Table 1: Dynamic Stretching Exercise Program

No	Exercise Type	Set x Repeat
1	Arm Extension	
2	Kneeling	
3	Coachwork Crossed-Bending	
4	Coachwork Rotation	2 X 15
5	Leg Rotation	
6	Back-Trunk Stretch	
7	Glutaeus – Trunk Rotation	
8	Back-Trunk Rotation	
9	Leg Lift Sideways	
10	Knee Bend under and Stretch	
11	Gastro-Soleus	
12	Tibialis Anterıor	2 X 10
13	Hamstrıng Muscle	
14	G. Maksimus and Medius - Leg	
15	Knee Crunch	
16	Guadriceps	
17	Hamstring	2 X 8
18	M. Pectoralis-M. Abdominalis	
19	Leg Hip High and Stretch	
20	G. Maksimus and Medius - Biceps	
21	Leg Lift Backwards-Forwards	2 X 12
22	Lunge and Side Stretch	
23	Glutaeus – Arm Extension	

Statistical Analysis

Statistical analysis of the data acquired from the measurements and tests applied in the study was performed in the statistical package program named SPSS 18. Average and standard deviation of the data was given. In the comparison of average points in paired (dependent) measurements Paired Samples t-Test was applied and in independent measurements Independent Sample t-Test was applied. Significance level was taken as 0,05.

RESULTS

The average age of EG attended to the research is 10,93±0,80 years, and that of CG is calculated as 11,00±0,85 years.

Table 2: Demographic features of the Groups

Variable	Group	N	Test	X±Sd	t	Group	Test	t
Height (cm)	EG	15	pre	150,94±0,06		EG		
			post	151,14±0,06	9,79*	CG	pre	0,66
	CG	15	pre	151,7±0,05		EG		
			post	151,72±0,05	4,03*	CG	post	0,54
Weight (kg)	EG	15	pre	43,07±3,13		EG		
			post	42,25±3,39	5,09*	CG	pre	3,83*
	CG	15	pre	47,80±3,61	1,91	EG		
			post	47,99±3,48		CG	post	4,58*

* p<0,05

The difference between the pre-post test height averages of EG and CG is statistically found as significant (p<0,05). While the difference between the pre-post weight averages of EG is statistically found as significant (p<0,05), the difference between pre-post test averages of CG is defined as insignificant (p>0,05). In comparison between groups, before and after the training, the difference between the weights of EG and CG is found as significant (p<0,05).

Table 3: Groups' results of sit-reach, arm flexion, backbend, trunk forward flexion and trunk backward extension

Variable	Group	Test	X±Sd	t	Group	Test	t
Sit-Reach (cm)	EG	pre	20,07±5,59	6,25*	EG	pre	1,821
		post	21,38±5,20		CG		
	CG	pre	17,3±1,71	0,716	EG	post	2,892
		post	17,3±1,70		CG		
Arm Flexion (cm)	EG	pre	26,04±7,23	5,24*	EG	pre	1,71
		post	24,42±6,41		CG		
	CG	pre	22,77±1,54	2,88	EG	post	1,05
		post	22,63±1,49		CG		
Back-Bend (cm)	EG	pre	62,16±12,48	10,48*	EG	pre	2,38
		post	60,22±12,37		CG		
	CG	pre	70,27±4,31	1,44	EG	post	2,94
		post	70,17±4,30		CG		
Trunk Forward Flexion (cm)	EG	pre	22,56±5,79	11,86*	EG	post	0,13
		post	21,12±5,51		CG		
	CG	pre	22,77±1,90	2,20	EG	post	1,05
		post	22,70±1,92		CG		
Trunk Backward Extension (cm)	EG	pre	24,61±6,57	0,42	EG	pre	5,51*
		post	24,43±5,88		CG		
	CG	pre	15,18±0,85	0,79	EG	post	6,00*
		post	15,21±,089		CG		

* p<0,05

It is found that there is a significant difference among the pre-post test values of sit-reach, arm flexion, backbend, trunk forward flexion of EG attended to the research (p<0,05). The average of trunk backward extension of EG before and after the training program is found significantly higher than the CG (p<0,05).

Table 4: Groups' results of hip flexion and extension, knee flexion, trunk forward flexion and trunk backward extension

Variable	Group	Test	X±Sd	t	Group	Test	t
Hip Flexion (°)	EG	pre post	116,67±6,27 118,30±5,78	5,4*	EG CG	pre	0,16
	CG	pre post	116,40±1,21 116,47±1,19	1,46	EG CG	son	1,24
Hip Extension (°)	EG	pre post	27,17±2,65 28,13±2,64	9,37*	EG CG	pre	1,32
	CG	pre Post	25,77±3,13 25,73±3,17	1,00	EG CG	post	2,25
Knee Flexion (°)	EG	pre post	123,63±9,87 125,10±9,54	10,33*	EG CG	pre	0,98
	CG	pre post	126,17±1,87 126,27±1,96	1,87	EG CG	post	0,46
Shoulder Flexion (°)	EG	pre post	174,90±4,65 176,67±4,01	8,37*	EG CG	pre	0,49
	CG	pre post	175,53±1,65 175,67±1,61	1,74	EG CG	post	0,89
Shoulder Extension (°)	EG	pre post	35,13±8,15 35,93±8,43	1,19	EG CG	pre	1,18
	CG	pre post	32,20±5,02 32,27±5,02	1,46	EG CG	post	1,44

* p<0,05

While statistically significant difference is found among the pre-post test averages of hip flexion and extension, knee flexion and shoulder flexion of EG (p<0,05), significant difference is not found among the averages of CG (p>0,05). Statistically significant difference is not found between the pre-post test averages of shoulder extension of EG and CG and in comparison made between the group (p>0,05).

Table 5: Results of groups' 25 m, 50 m freestyle technical swimming and 50-100-150-200 m passing results

Variable	Group	Test	X±Sd	t	Group	Test	t
25 m Freestyle Technical Swimming (sec)	EG	pre post	17,55±1,02 16,99±0,98	5,63*	EG CG	pre	2,54
	CG	pre post	18,65±1,32 18,44±1,30	2,38	EG CG	post	3,42*
50 m Freestyle Technical Swimming (sec)	EG	pre post	34,91±2,42 34,33±2,23	4,71*	EG CG	pre	4,18*
	CG	pre post	38,56±2,36 38,21±2,35	3,46*	EG CG	post	4,64*
50 m Passing (sec)	EG	pre post	36,33±2,43 35,27±2,46	18,61*	EG CG	pre	8,71*
	CG	pre post	39,36±2,28 39,04±2,25	4,65*	EG CG	post	7,13*
100 m Passing (sec)	EG	pre post	70,62±5,41 69,52±5,52	5,43*	EG CG	pre	6,92*
	CG	pre post	81,67±3,01 81,37±2,99	3,17	EG CG	post	7,31*
150 m Passing (sec)	EG	pre post	108,17±7,76 106,37±7,91	2,69*	EG CG	pre	6,21*
	CG	pre post	123,09±5,14 122,98±5,26	1,67	EG CG	post	6,77*
200 m Passing (sec)	EG	pre post	156,75±4,02 155,11±4,27	6,91*	EG CG	pre	3,99*
	CG	pre post	164,95±6,86 164,61±6,77	2,94	EG CG	post	4,60*

* p<0,05

In EG, a significant decrease is found in pre-post test averages of freestyle technical swimming (p<0,05). After the training program, it is found that 25 m freestyle technical swimming average of EG is significantly lower than CG (p<0,05). The difference between EG and CG pre-post test averages of 50 meters freestyle technical swimming is statistically significant (p<0,05). It is observed that 50 m freestyle swimming averages of experiment group both before and after the training is significantly lower than the control group (p<0,05). It is observed that the difference between the pre-post test averages of passing the first 50 meters by EG and CG in 200 meters freestyle swimming is significant (p<0,05). While it is found that there is a significant decrease among the pre-post test averages in 100, 150 and 200 meters passing by EG (p<0,05), a statistically significant difference is not found in control group (p>0,05). In comparison between the groups it is found that 50 m, 100 m, 150 m and 200 m passing test averages of experiment group is significantly lower than the control group (p<0,05).

DISCUSSION

In this study it is targeted to identify the flexibility parameters and developmental differences between the swimmers at growth and developmental age who performed the dynamic stretching exercises and the ones who did not perform in the warm-up phase of 8-week training program.

In the study we conducted it is identified that there is a significant increase in flexibility level of sit-stretch in EG, there is a statistically significant decrease in the averages of arm flexibility and bridge position test. In a study conducted, 54 children who newly started to gymnastics were made to perform flexibility workouts for 8 weeks and at the end of the program it is observed that there are significant changes in sit-stretch, splits and bridge position values of the children (16).

In our study it is found that there is a significant increase in hip flexion, hip extension and knee flexion of experimental group at the end of 8-week training and there is not a significant difference in control group. In a study conducted 4 different warm-up protocols is applied to 41 women who are the students of school of physical education and sports. Significant results are found in knee flexion value of the group who performed dynamic exercise group together with the jumping exercises, in knee, hip flexion and extension values of the group who performed stretching exercise, in flexibility value of the massage group (5). In a study where dynamic stretching protocol is applied in different days to 12 distinguished sportswomen, it is recorded that dynamic stretching exercises developed the strength rates of functional hamstring/quadriceps at end-face angle of range of joint motion (23).

As it is observed in many studies conducted, dynamic stretching exercises generally impacts the development of flexibility in a positive way and also support the findings of our study. Muscles and tendons forming the motion system have a flexible structure. Stretching exercises applied to muscles and tendons creates increases in muscle length and range of joint motion (9).

In the study we conducted it is found that there is a significant development in shoulder flexion rates of experiment group and there is not a significant difference in shoulder extension rates. It is found that there is not significant difference in shoulder flexion and extension rates of control group. In a similar research, the impacts of 8-week dynamic stretching exercises on the development of flexibility in 20 swimmer girls who are at the age group of 10-12. As a result of the dynamic stretching

exercises, it is found that there is a significant increase in the rates of shoulder flexion and extension, foot plantar flexion and foot dorsiflexion. It is pointed that this increase in flexibility parameters as a result of the applied training are dependent on the increase in the range of joint motion and strength of muscle group which helps performing the position (8).

It is stated that dynamic stretching exercises make positive contribution in technical development of swimming by increasing the range of shoulder motion and are important in terms of swimmer's ability to move faster, stronger and for a longer time. Furthermore, it is considered that dynamic stretching exercises have protective impact against the disabilities such as muscle contraction and pains in shoulder joint which are commonly experienced by the swimmers due to poor flexibility (8, 25).

In another study conducted on 68 students at the age group of 11-12 years, it is identified that there is a significant development in pre-post test results of hip flexion and extension, shoulder flexion and extension in exercise group and there is not any significant difference in control group. In comparison between the groups, there is a significant difference in post test results of hip extension and shoulder flexion and in pre-test results of hip flexion in exercise group while there is not any significant difference in shoulder extension results (19).

At the end of our study, it is defined that there is a significant decrease in the rates of torso forward flexion in experiment group and is not any significant difference in the rates of torso backward extension. As for the rates of torso flexion and extension in control group, there is not any significant difference. In comparison between groups, it is identified that there is not any significant difference between the rates of torso forward flexion and the rate of torso backward extension in experiment group is significantly higher than that of the control group.

Flexibility impacts the coordinative skills and technics of the sportsmen/women in each case. According to Çoknaz (2004) flexibility workouts performed with stretching exercises enable the best mobility in the joint and contribute the range of motion. Flexibility in the joint not only depends on the joint itself but also ability of high contraction of muscles, stripes protecting the joints, nerves and muscle flexibility. For this reason, such muscle and connective tissues should be strengthened and stretched in a prudent way.

In a study which researches the impacts of dynamic stretching exercises on flexibility, it is observed that 10-week dynamic stretching exercises develop the rates of sit-stretch flexion, splits, arm flexion, knee flexion, shoulder flexion and extension, hip extension, torso flexion and extension, bridge flexion while there is not any significant change in hip flexion rates. As a result, it is stated that dynamic stretching exercises impact the development of flexibility in a positive way and such workouts can be performed at the warm-up stage of the training (7).

In a study conducted by Jagomagi and Jurimae (2005) they find that flexibility averages of distinguished swimmers who swim in breast stroke are significantly higher than the control group. As a result of a study where distinguished girl and boy swimmers at the age of 8-12 are received 4-week swimming training, any significant difference at the average flexibility of both groups (6). In another study, 30 girl swimmers are made to perform stretching and swimming training for 6 months and at the end of the study a significant increase is found in the flexion rate of the training group (20). When the studies above are examined, it is observed that swimming trainings alone do not contribute to flexibility development but swimming trainings

performed with stretching workouts develop the flexibility.

In our study, testing the 25 m and 50 m freestyle swimming results and 50 m, 100 m, 150 m, 200 m passing levels of control and experiment group after and before the training program, the development in swimming performance is analyzed. In comparison between the groups it is found that 25 m freestyle swimming by EG is significantly lower than the control group. When 50 m freestyle swimming performance is reviewed, it is found that there is a significant difference in pre-post test results of the groups, 50 m freestyle swimming performance results are significantly lower than the control group. It is defined that there is a significant difference between the pre-post test results of first 50 m passing by EG and CG during 200 m freestyle swimming.

It is observed that there is a significant decrease in pre-post test results of experiment group in 100 m, 150 m and 200 m passing tests while there is not any significant difference in control group. In comparison between groups, experiment group showed better performance than control group in 50 m, 100 m, 150 m and 200 m passing tests than the control group. According to these findings, it can be said that EG which did training by performing swimming and dynamic stretching exercises showed better performance than CG which did only swimming training.

In the study conducted on 120 swimmers, Toubekis et al (2006) defined that there are significant developments in 50 m freestyle swimming performance of the swimmers as a result of three-month interval swimming trainings. As a result of the 6-month training applied on 24 girl and 24 boy swimmers who are between the ages of 9-12, it is identified that there is a significant decrease in 25 m freestyle swimming of the swimmers and a significant development in flexibility levels (10).

The most important reason of turbulence (friction) occurring during the swimming is related to the fact that movements during the body is going forward in the water are not properly performed. Stretching exercises make the whole body move smoothly and easily by increasing the range of joint motion and reduce the friction to the minimum levels (11). Adequate level of flexibility boots the swimming performance by enabling the performance of technical movements easily and properly. For this reason, swimmers are required to do stretching exercises regularly. It can be said that such exercises gain importance especially during the ages of 11 and 13 when the flexibility loses are experienced at the highest levels (8).

CONCLUSION

In conclusion, it is identified that there are positive impacts in flexibility and swimming performance of the group which is made to do dynamic stretching exercises. It can be said that such findings acquired and dynamic stretching exercises performed before the swimming trainings contribute on the flexibility and performance developments of the swimmers who are at the growth and developmental age.

REFERENCES

1. Alpar.R., Yüzme ve Sutopu Antrenmanlarının Temelleri, GSGM Yüzme Atlama Sutopu Federasyonu Yayınları, s.123- 244, Ankara, 1994. [In Turkish]

2. Bieze A., Gnacinski M., Rouse A., Sunderberg S.,˝ Effects of a Chronic PNF Stretching Program on Speedand Explosiveness in Division 3 Collegiate Athlete ˝ J Undergraduate Kinesiology Res.2.pp.1-9, 2006.

3. Bilge.M., Stretching İlkeleri, Nobel Yayıncılık, s.5-21,144-305, Ankara, 2013. [In Turkish]

4. Çoknaz.H., Sporda Temel Alıştırma Uygulamaları, Bağırgan Yayınevi, s.7, Ankara, 2004. [In Turkish]

5. Çolak M., Çetin E.,˝ Bayanlara Uygulanan Farklı Isınma Protokollerinin Eklem Hareket Genişliği ve Esneklik Üzerine Etkileri ˝ FÜ Sağ Tıp Derg.24.pp.1-8, 2010. [In Turkish]

6. Dawson B., Vladich T., Blanksby B.A.,˝8–12 Years Old Junior Swimmers on Flexibility and Swim Performance˝J Strength Cond Res.3.pp.13-18, 2002.

7. Döver E., Kürkçü R., Yeniçeri M., Can S.,˝18-25 Yaş Grubu Bayanlarda Dinamik Gerdirme Egzersizlerinin Esnekliklerine Etkisi ˝ Atatürk Üniversitesi BESBD.7.s.1, 2005. [In Turkish]

8. Göksu Ö., Yüksek S.,˝10-12 Yaş Bayan Yüzücülere Uygulanan Sekiz Haftalık Dinamik Germe Egzersizlerinin Esneklik Gelişimi Üzerine Etkisi˝İÜ Spor Bilimleri Dergisi.11.s.62-67, 2003. [In Turkish]

9. Guyton.A.C., Hall.J.E., Tıbbi Fizyoloji, 12. Baskı, Nobel Tıp Kitabevleri, s.172-256, İstanbul, 2013.

10. Günay E., Düzenli Yapılan Yüzme Antrenmanlarının Çocukların Bazı Fiziksel ve Fizyolojik Parametreleri Üzerine Etkisi. Yüksek Lisans Tezi, Gazi Üniversitesi Sağlık Bilimleri Enstitüsü, Ankara. 2007. [In Turkish]

11. Hagerman P.S., Flexibility for Swimming. NSCA Performance Training.1.pp.12-16, 2002.

12. Hubley.C.L, Testing Flexibility, Human Kinestics, p.309-359, 1991.

13. Jagomagi G, Jurimae T., ˝The Influence of Anthropometrical and Flexibility Parameters on The Results of Breaststroke Swimming˝ PubMed – indexed for medline, 63.pp.213-219, 2005.

14. Kaya F., Yüktaşır B., Biçer B., Yalçın H.B.,˝ Esneklik, Sürat ve Çabukluk İlişkisi˝ Spor ve Tıp Derg.12. s.1, 2004. [In Turkish]

15. Karabina.F.,Pirselimoğlu.E.T., Antrenman Bilgisi, 3. Baskı, MEB Yayınları, s.41-165, Ankara, 2012. [In Turkish]

16. Koyuncuoğlu K., Şentürk U., Abanoz H., Taşkiran K.,˝ Okul Öncesi (5-6 Yaş) Cimnastik Çalışmasının Esneklik, Denge ve Koordinasyon Üzerine Etkisi˝ 13. Uluslararası Spor Bilimleri Kongresi, s.340-341, Konya, 7-9 Kasım 2014. [In Turkish]

17. Mackenzie.B., 101 Performance Evaluation Test, Electric Word Plc. p.96-117, London, 2005.

18. MEGEP (Milli Eğitim ve Öğretim Sisteminin Güçlendirilmesi Projesi)., Denizcilik, Su Üzerinde Yüzmek, MEB Yayınları, s.18-34, Ankara, 2008. [In Turkish]

19. Müftüoğlu N.E., Serbest Cimnastik ve Pilates Mat Egzersizlerinin 11-12 Yaş Çocuklarında Omuz ve Kalça Esnekliğine Etkileri. Yüksek Lisans Tezi, Gazi Üniversitesi Sağlık Bilimleri Enstitüsü, Ankara, 2015. [In Turkish]

20. Robinson L., McKillop-Smith S., Ross N.L., Pertwee R.G., Hampson R.E., Platt B., Riedel G.,˝Effects of 6 Months of Swimming Training and Flexibility˝ Psychopharmacology.12.pp.245-251, 2007.

21. Otman.S., Demirel.H., Sade.A., Tedavi Hareketlerinde Temel Değerlendirme Prensipleri, 3. Baskı, Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Yayınları, s.9-44, Ankara, 2003. [In Turkish]

22. Saygın Ö., Polat Y., Karacabey K.,˝ Çocuklarda Hareket Eğitiminin Fiziksel Uygunluk Özelliklerine Etkisi˝ Fırat Üniversitesi Sağlık Bilimleri Dergisi, 19.s.205-212, 2005. [In Turkish]

23. Şekir U., Arabacı R., Akova B.,˝ Acute Effects of Dynamic Stretching on Peak and End-Range Functional Hamstring/Quadriceps Strength Ratios˝ Türkiye Klinikleri J Med Sci.30.p.164-73, 2010.

24. Toubekis A.G., Smilios I., Bogdanis G.C., Mavridis G., Tokmakidis S.P..,˝ Effect of 3 Months Interval Swimming Training Program on Sprint Swimming Performance˝ Appl Physiol Nutr Metab.31.pp.709-716, 2006.

25. Unick J., Kieffer H.S., Cheesman W., Freeney A.,˝The Acute Effects of Staticand Ballistic Stretching on Vertical Jump Performance in Trained Women ˝ J Strength Cond Res, 19.pp.206-212, 2005.

26. Watson.A.W.S., Physical Fitness and Athletic Performance, 2. edition, Routledge, p.9-18, Newyork, 1995.

27. Yapıcı A., Cengiz C.,˝50 m Yüzme Performansının Alt Ekstremite Wingate Anaerobik Güç ve Kapasite Testi İle İlişkisi˝ IntJSCS.3.s.44-54, 2015. [In Turkish]