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# EFFECTS OF PERİODİC TRAİNİNG ON ANTHROPOMETRİC, PHYSİOLOGİCAL AND BİO-MOTORİC DEVELOPMENT CHARACTERİSTİCS OF ELİTE SWİMMERS İN 12-15 AGE GROUPS

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**Abstract:**
The aim of this study was to determine effect of semester trainings applied children on some physical and bio-motoric features. 16 athletes at 14 age group making regularly swimming workouts at Antalya Kulaç Swimming Club were participated in research. In the beginning and end of research, flexibility, vertical jump and 50 m freestyle swimming tests were applied to determine bimotoric developments. As to body weight, anthropometric length, width, circle and underleather fat measurements were taken to determine change in physical features. Wilcoxon test in SPSS 15.0 for Windows package program was used in analyze of data obtained. End of committed training period, it was found that there were statistically significant increase at flexibility, vertical jump and 50 m freestyle swimming performance of participants ($p<0,05$). It has been found that the anthropometric environment, significant reductions in subcutaneous fat and body fat percentage values. It was established that there were decreases at significant level in circle, underleather fat and body fat percentage ($p<0,05$). It was established that significant decreases in values of circle, underleather fat and body fat percentage were occurred. While significant difference was found at shoulder, chest, chest depth, hip, knee and meta-tarsal width from width measurements ($p<0,05$), no significant difference found at elbow, wrist, meta-carpal and ankle width ($p>0,05$). Also, it was established that there was no significant change anyone of length measurements ($p>0,05$).As a result, it was revealed that swimming training programs applied termly to children develop swimming, force and flexibility performance and supply developments at significant level in body composition. Accordingly, i may say that termly swimming trainings develop both physical and biomotoric features of children.

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**Keywords:** child, swimming, flexibility, body composition, vertical jump

## 1. Introduction

There are two major reasons for doing sports. The first is doing sports to live healthily and increasing health quality and the second is doing sports to perform in sports events. No matter what the reason is, there are certain rules for sports. The first rule is to do sports consciously (Saygın et. al, 2005).

An attentive program should be applied after considering several variables, especially in training programs to be applied on children and adolescents. An efficient training cannot be provided to children by applying programs on children before comprehending their development level and development characteristics. An important point to consider through applying training programs on children is to follow their performance development. It is possible to benefit from several performance tests to provide such a performance follow-up. Thanks to these tests, both development characteristics of children on some periods can be followed and children who had a low level of performance development can be determined (Sevinç, 2008).

Swimming is a sport that has participants from several fractions of society, an international popularity and which has become an essential for recreation, performance, rehabilitation and healthy living. No doubt that, participating to this sport on early ages is very important as it helps the future generations to be healthier and to determine young talents who can gain international success in upcoming years (Günay, 2007).

Periodizing training for sport events is an important point to reach success in sports. Additionally, on-ground training should also take place in combination with in-water training. Considering that swimming is only a combination of a couple of motor abilities; some extra training styles for strength, speed, flexibility, technicality, coordination and stability should also be added into swimming training (Soydan, 2006). In this study, it was aimed to determine the effects of periodic swimming training on physical and bio-motoric characteristics of children.

## 2. Instruments and Methods

### 2.1 Study Group

Participants of the study are 8 boys and 8 girls whose average age is 14,0±0,89 years and average training age is 5,44±1,71 years. Participants are sportspeople of Antalya Kulaç Specialized Swimming Club.

### 2.2 Height and Weight Measurement

Heights of participants were measured using a height scale of 0.01 sensitivity.

### 2.3 50 meters Freestyle Swimming Test

Swimming test is held in a 25-meters-long swimming pool. The process started as the swimmers have received "ready, go!" instruction and pushed pool wall by their feet; twirling after completing 25 meters and continued as they swim for another 25 meters. Testing was ended as swimmers complete 50 meters and tap the pool wall by their hands. Distance was completed through freestyle swimming and testing time was measured by a Casio hand chronometer.

### 2.4 Flexibility Measurement

Sit-reach test protocol was applied. Accordingly, the sportspeople first sit on the ground and touched their feet and knees to sit-reach table. Afterwards, sports people touched to flat bar on the table and proceed forward flexibility movement. Sportspeople are given one trial for warm up. The second trial given after the first was recorded test score (Mackenzie, 2005).

### 2.5 Vertical Jump Test

Jump meter was used in vertical jump test. Before the test, slow-run for five times and stretching was applied to children. Firstly, the children were showed how the test will be done. Afterwards, children were given two trials with two-minutes brakes and best degrees were recorded as test score.

### 2.6 Anthropometric Measurements

Area, length and diameter measurements: A compass was used to take width measurements; area and length measurements were taken from specific measurement points. Subcutaneous Fat Measurements: Subcutaneous fat measurements are done with a Holtain Skinfold calliper.

### 2.7 Body Fat Index

Lange formula (Body fat index= (biceps + triceps + subscapula + pectoral + suprailiac + quadriceps) x 0,097 + 3,64] was used to determine participants (Açıkada et. al., 1999)

### 2.8 Grabbing Strength

Grabbing strength was measured with a hand grip. After a five minutes-warm-up, the measurements were taken while the participants stand, without bending their arms and not in contact with the body and the arm is at 45º against the body. This was repeated for left and right arm for three times and the highest value was recorded as the test score.

### 2.9 Leg Strength

Leg strength measurements were taken by using a Takkei leg dynamometer. After a five -minutes- warm up, participants laced themselves on the dynamometer table with their knees bended, their arms strait, their backs strait, the bodies were slightly bended forward, and they pulled the dynamometer bar with their hands upwards through maximum support from their legs. This pull was repeated for each participant and the best value was recorded as the test score.

### 2.10 Back Strength

Sportspeople's back strength was measured by using a Takkei back dynamometer. After a five -minutes- warm up, participants laced themselves on the dynamometer table with their knees bended, their arms strait, their backs strait and the bodies were slightly bended forward and they pulled the dynamometer bar with their hands upwards through maximum support from their legs. Scoring: this pull was repeated for 3 times after 3 to 5 minutes-warm-ups and the best value was recorded as the test score.

### 2.11 Pulse Measurements

Pulses were taken by using a polar watch. Stable pulses were taken after participants lay down on a stretcher for five minutes, without any moves. Pulses before training were taken before the sportspeople start warming up. Warm-up pulses were taken as sportspeople swim in water for 200 meters freestyle. Maximal pulses were taken after participants swim 200 meters freestyle sprint. After-training pulses were taken 1 minute after the warm up- ends.

### 2.12 Applied Warm-up Model

Basic swimming training was applied to participants 6 days a week for 8 weeks. Swimming activity took place in the training as all swimmers could swim. Each training period has started with swimming exercises specific to swimming sport and basic cooling exercises were completed at the end.

### 2.13 Statistical Analysis

Wilcoxon Test could be benefited too compare pre-test and post-test values of a group where there are less than 30 participants (Alpar, 2006). Wilcoxon Test was used to compare pre-test and post-test values of children participants as they were 18 people at total. Additionally, descriptive analysis was used to determine the average of all variables from participants.

## 3. Results

**Table 1:** Participants according to their age and habit of doing sports

| Variables | N | X | Ss |
|---|---|---|---|
| **Age** | 16 | 14,00 | 0,894 |
| **Sports age** | 16 | 5,44 | 1,711 |

*P<0.05

**Table 2:** Comparison of participants' height and weight pre-test and post averages

| Variables | Tests | N | X | Ss | t | p |
|---|---|---|---|---|---|---|
| **Size** | Pre-test | 16 | 163,06 | 9,044 | -1,633 | 0,102 |
| | Post-test | | 163,19 | 9,190 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Body weight** | Pre-test | 16 | 54,09 | 11,668 | -2,744 | 0,006* |
| | Post-test | | 52,88 | 10,984 | | |

*P<0.05

**Table 3:** Comparison of participants' basic motor characteristics' pre-test and post-test averages

| Variables | Tests | N | X | Ss | t | p |
|---|---|---|---|---|---|---|
| **Flexibility** | Pre-test | 16 | 12,72 | 5,663 | -3,402 | 0,001* |
| | Post-test | | 15,44 | 7,004 | | |
| **50 meters free style swimming (Speed)** | Pre-test | 16 | 32,60 | 2,707 | -3,129 | 0,002* |
| | Post-test | | 30,74 | 3,054 | | |
| **Vertical jump** | Pre-test | 16 | 46,06 | 12,530 | -2,536 | 0,011* |
| | Post-test | | 47,63 | 12,355 | | |
| **Leg strength** | Pre-test | 16 | 55,00 | 19,946 | -2,695 | 0,007* |
| | Post-test | | 57,59 | 20,846 | | |
| **Back strength** | Pre-test | 16 | 56,91 | 22,896 | -3,422 | 0,001* |
| | Post-test | | 60,31 | 23,859 | | |
| **Right hand grip force** | Pre-test | 16 | 28,01 | 9,871 | -1,604 | 0,109 |
| | Post-test | | 28,93 | 9,731 | | |
| **Left hand grip force** | Pre-test | 16 | 25,95 | 7,418 | -1,940 | 0,052 |
| | Post-test | | 26,86 | 8,103 | | |

*P<0.05

**Table 4:** Comparison of participants' area measurements' pre-test and post-test averages

| Variables | Tests | N | X | Ss | t | p |
|---|---|---|---|---|---|---|
| **Shoulder** | Pre-test | 16 | 94,69 | 11,412 | -3,579 | 0,000 |
| | Post-test | | 92,69 | 10,904 | | |
| **Chest** | Pre-test | 16 | 82,78 | 6,332 | -3,455 | 0,001* |
| | Post-test | | 80,94 | 6,060 | | |
| **Chest inspiration** | Pre-test | 16 | 85,69 | 5,949 | -3,424 | 0,001* |
| | Post-test | | 82,81 | 5,712 | | |
| **Chest expiration** | Pre-test | 16 | 80,03 | 6,744 | -3,654 | 0,000 |
| | Post-test | | 77,06 | 6,496 | | |
| **Arm** | Pre-test | 16 | 24,78 | 3,286 | -3,698 | 0,000 |
| | Post-test | | 22,81 | 3,415 | | |
| **Arm contraction** | Pre-test | 16 | 26,88 | 3,442 | -3,699 | 0,000 |
| | Post-test | | 24,94 | 3,449 | | |
| **Fore-arm** | Pre-test | 16 | 23,00 | 2,510 | -3,575 | 0,000 |
| | Post-test | | 21,28 | 2,380 | | |
| **Fore-arm contraction** | Pre-test | 16 | 24,63 | 3,063 | -3,656 | 0,000 |
| | Post-test | | 23,38 | 2,930 | | |
| **Abdomen** | Pre-test | 16 | 70,41 | 6,800 | -3,656 | 0,000 |
| | Post-test | | 67,69 | 6,640 | | |
| **Hip** | Pre-test | 16 | 85,63 | 9,444 | -3,624 | 0,000 |
| | Post-test | | 81,75 | 9,227 | | |
| **Femur** | Pre-test | 16 | 47,41 | 6,883 | -3,656 | 0,000 |
| | Post-test | | 44,56 | 6,964 | | |
| **Leg** | Pre-test | 16 | 32,91 | 3,620 | -3,654 | 0,000 |
| | Post-test | | 30,31 | 3,454 | | |

*P<0.05

**Table 5:** Comparison of participants' width measurements' pre-test and post-test averages

| Variables | Tests | N | X | Ss | t | p |
|---|---|---|---|---|---|---|
| Shoulder | Pre-test | 16 | 36,56 | 3,245 | -2,112 | 0,035* |
| | Post-test | | 36,19 | 3,526 | | |
| Elbow | Pre-test | 16 | 6,44 | ,629 | -1,342 | 0,180 |
| | Post-test | | 6,41 | ,581 | | |
| Wrist | Pre-test | 16 | 5,13 | ,500 | -1,604 | 0,109 |
| | Post-test | | 5,10 | ,468 | | |
| Meta-carpal | Pre-test | 16 | 6,77 | 1,096 | -1,633 | 0,102 |
| | Post-test | | 6,76 | 1,076 | | |
| Chest | Pre-test | 16 | 24,44 | 2,097 | -3,590 | 0,000 |
| | Post-test | | 23,49 | 2,054 | | |
| Chest depth | Pre-test | 16 | 18,31 | 1,887 | -2,023 | 0,043* |
| | Post-test | | 18,25 | 1,797 | | |
| Hip | Pre-test | 16 | 27,44 | 3,614 | -2,214 | 0,027* |
| | Post-test | | 27,37 | 3,514 | | |
| Knee | Pre-test | 16 | 9,13 | ,885 | -2,041 | 0,041* |
| | Post-test | | 9,12 | ,881 | | |
| Ankle | Pre-test | 16 | 6,81 | ,981 | -1,841 | 0,066 |
| | Post-test | | 6,81 | ,976 | | |
| Meta-tarsal | Pre-test | 16 | 9,00 | 1,155 | -2,032 | 0,042* |
| | Post-test | | 8,95 | 1,115 | | |

*P<0.05

**Table 6:** Comparison of participants' height measurements' pre-test and post-test averages

| Variables | Tests | N | X | Ss | t | p |
|---|---|---|---|---|---|---|
| Bust | Pre-test | 16 | 81,09 | 6,578 | -1,604 | 0,109 |
| | Post-test | | 81,14 | 6,634 | | |
| Arm | Pre-test | 16 | 29,63 | 1,962 | -1,414 | 0,157 |
| | Post-test | | 29,64 | 1,948 | | |
| Fore-arm | Pre-test | 16 | 25,22 | 1,816 | -1,732 | 0,083 |
| | Post-test | | 25,24 | 1,827 | | |
| Hand | Pre-test | 16 | 17,59 | 1,357 | -1,414 | 0,157 |
| | Post-test | | 17,61 | 1,359 | | |
| Femur | Pre-test | 16 | 42,66 | 3,780 | -1,633 | 0,102 |
| | Post-test | | 42,68 | 3,813 | | |
| Leg | Pre-test | 16 | 39,59 | 2,471 | -1,633 | 0,102 |
| | Post-test | | 39,62 | 2,467 | | |
| Foot | Pre-test | 16 | 24,38 | 1,565 | -1,604 | 0,109 |
| | Post-test | | 24,41 | 1,596 | | |
| Overarm | Pre-test | 16 | 164,28 | 10,063 | -1,633 | 0,102 |
| | Post-test | | 164,32 | 10,109 | | |

*P<0.05

**Table 7:** Comparison of participants' subcutaneous fat measurements' pre-test and post-test averages

| Variables | Tests | N | X | Ss | t | p |
|---|---|---|---|---|---|---|
| **Biceps** | Pre-test | 16 | 5,48 | 2,346 | -3,521 | 0,000 |
| | Post-test | | 4,63 | 1,997 | | |
| **Triceps** | Pre-test | 16 | 8,84 | 4,130 | -3,567 | 0,000 |
| | Post-test | | 7,67 | 3,695 | | |
| **Pectoral** | Pre-test | 16 | 3,13 | 1,031 | -3,528 | 0,000 |
| | Post-test | | 2,73 | ,950 | | |
| **Subscapula** | Pre-test | 16 | 7,68 | 2,291 | -3,590 | 0,000 |
| | Post-test | | 6,54 | 2,341 | | |
| **Abdomen** | Pre-test | 16 | 10,16 | 6,103 | -3,617 | 0,000 |
| | Post-test | | 9,18 | 5,341 | | |
| **İliac** | Pre-test | 16 | 6,08 | 3,559 | -3,552 | 0,000 |
| | Post-test | | 5,44 | 3,240 | | |
| **Subrailiac** | Pre-test | 16 | 3,94 | 2,396 | -2,023 | 0,043* |
| | Post-test | | 3,50 | 1,539 | | |
| **Quadiriceps** | Pre-test | 16 | 12,93 | 8,685 | -3,589 | 0,000 |
| | Post-test | | 11,81 | 7,974 | | |
| **Calf** | Pre-test | 16 | 13,74 | 5,741 | -3,589 | 0,000 |
| | Post-test | | 11,60 | 5,412 | | |
| **Body Fat Percent** | Pre-test | 16 | 7,71 | 1,645 | -3,519 | 0,000 |
| | Post-test | | 7,21 | 1,441 | | |

*P<0.05

**Table 8:** Comparison of participants' pulse measurements' pre-test and post-test averages

| Variables | Tests | N | X | Ss | t | p |
|---|---|---|---|---|---|---|
| **Relaxation pulse** | Pre-test | 16 | 77,31 | 4,012 | 3,592 | 0,000 |
| | Post-test | | 74,00 | 3,812 | | |
| **Starting pulse for training** | Pre-test | 16 | 89,00 | 3,967 | -1,225 | 0,220 |
| | Post-test | | 88,63 | 4,380 | | |
| **Heart rate during warm-up** | Pre-test | 16 | 165,00 | 19,016 | -3,818 | 0,000 |
| | Post-test | | 160,81 | 18,609 | | |
| **Maximal pulse** | Pre-test | 16 | 194,20 | 3,783 | 21,377 | 0,000 |
| | Post-test | | 188,73 | 3,555 | | |
| **Pulse after training** | Pre-test | 16 | 163,63 | 10,398 | -3,754 | 0,000 |
| | Post-test | | 161,25 | 10,182 | | |

*P<0.05

## 4. Dıscussıon

In our study, participants' age average was 14.0±0.89 years and average sports-age was 5.44±1.71 years. Additionally, participants' average for height was 163.06±9.04 cm for pre-test and 163.19±9.19 cm, for post-test. Their averages of body weight were 54.09±11.66 kg for pre-test and 52.88±10.98 for post-test. According to these findings, any changes on average heights have not been determined, yet, a significant decrease on average body weight was found.

Generally, remarkable impact of periodic physical activity is on body weight. However, this change on weight depends on maintainability of the activity. For adults, weight decreases simultaneously with training and fat cells shrinks. Periodic physical activity in early childhood and adolescence decreases the possible obesity risk on adults (Baltacı and Düzgün, 2008). As an addition, body weight is one of essential criteria to determine body composition (Muratlı, 2007).

Flexibility is an important movement characteristic for all sports. In our study, participants' flexibility averages were 12.72±5.66 cm for pre-test and 15.44±7.04 cm for post-test. Accordingly, it was found that periodic swimming training significantly increases flexibility.

Muratlı (2007) has reported that flexibility characteristic should be improvised by early childhood. The reason for the matter, as he stated, it gets harder to improve this characteristic, depending on the age.

Considering the studies in the literature, we see some contradictions in between participating into swimming sport and flexibility development. Several studies have reported that there is no significant correlation between participating into swimming sport and flexibility (Dawson et al., 2002; Jagomagi and Jürimae 2005; Zülkadiroğlu 1995; Berg et al., 1995). There is a controversy in between the results of these studies and our study. The reason for the matter might be different age and physical characteristics of participants or differences among applied training programs for children.

There are also several studies reporting a significant correlation in between applied physical activity programs and flexibility of children. Saygın et al., (2005) have reported that children who participate in sportive activities have a higher level of flexibility than those who do not. Similarly, another study conducted over children 10-11 age groups reported that there is a significant relation in between participation in sports and flexibility (Yenal et. al., 1999).

Vertical jump test, used in performance tests in sports, is benefited to determine one's anaerobic strength characteristics. In our study, participants' averages of vertical jump were 46.06±12.53 cm for pre-test and 47.63±12.35 for post-test. Accordingly, a significant statistical difference between vertical jump pre-test and post-test result was determined. Eventually, we can state that periodic swimming training has a contribution into children's anaerobic strength development.

In a similar study, the relation between children's participation into sports and their vertical jump performance and it is reported that children who participate in sportive activities have a higher level of vertical jump strength than those who do not (Saygın et. al., 2005). Results of this study also support the idea that there is a relation between children's participation into sports and their vertical jump performance.

In other studies aiming to determine children's vertical jump performance, vertical jump averages were determined as 30.52±6.12 cm (Tutkun et al., 2006) for 12 years age children and 27.54±0.47cm for 10 years age male students (Ziyagil et. al., 1999).

Considering vertical jump as an indicator of anaerobic strength, we can result that participating into swimming trainings may improve anaerobic strength characteristics. However, we cannot simply state that any exercises may improve anaerobic strength. Improvisation of the characteristics of related strength will remain inefficient, if exercises to improve anaerobic characteristics are eliminated from the training program.

Ağar (2006) have reported that, skip rope and interval running exercises for 9-11 year-old boys in three times a week and for 30 seconds periods for 6 weeks have increased anaerobic strength capacity at a significant statistical level. Similarly, Dupont et al., have reported that severe interval training increases anaerobic performance.

Erol et al., (1999) have analyzed significant differences on anaerobic strength parameter, through their study conducted on 13-14 year-old for 10 weeks. İbiş (2002) have reported in his study conducted in summer sports schools that, there is a significant difference in anaerobic strength characteristics of participants' pre-training and post-training measurements.

Increase in the strength of children through participating into sports is a result of the increase in the muscle index through trainings. Additionally, improved muscle coordination is also a fact that increases strength (Muratlı, 2007). Thus, additional coordinative trainings as an extra for strength trainings also support increase of strength.

In our study, alternations take place on children's grabbing strength, back and leg strength were analysed. Results of the study showed that there was no significant change in grabbing strength of the right hand; however, there was a significant increment in back, leg strength and strength of left hand. Thus, we can state that:

According to several studies, a widening in muscle fibrils also makes a contribution into strength development (Ağaoğlu, 1994). Saygın (2003) have reported in their study aiming to analyze the effect of physical training on physical fitness that, there is no significant statistical difference in between experiment groups' and control groups' pre-training values and leg strength parameters, however, there was a significant statistical difference between groups' post-training test values.

It is suggested in the literature that muscle strength may develop in childhood. On the view, it is suggested that strength continuity training might be applied on children (Benck et. al., 2002). It is reported that, strength trainings, applied one or twice a week leads an increase in strength on 7-12 aged children. The result of the study sports the idea that muscle strength can be developed in early ages (Faigenbaum et al., 2002).

In our study, participants' 50 meters freestyle swimming pre-test value was 32.60±2.70 seconds and post-test average was 30.74±3.05. Accordingly, it is determined that periodic swimming trainings applied on children increases 50 meters freestyle swimming performance. Major reasons for the increased swimming performances of participants are that, they attended the trainings regularly and the training model has appropriately served the main aim.

Some studies of the literature, which shares common results with our study also report that there is a significant improvisation between trainings and swimming performance. In the study, conducted over 120 elite swimmers, it is reported that there is a significant improvisation on sportspeople's 50 meters swimming performance (Toubekis et. al., 2006). In another study conducted on girls and boys in 9-12 years age, it is determined that there is a significant improvisation on participants 25 meters freestyle degrees (Günay, 2007). In a similar study conducted over 9-13 years aged primary school students, it is determined that there was a significant development in their 25 meters swimming performance at the end of the training (Çelebi, 2008).

It is very natural to expect significant alterations in sportspeople's body compositions as aerobic energy system is used in swimming, in general. On the purpose, children's body area measurements were tested before and after the test. According to the results, there was a significant decrease in children's measurements of shoulders, chest, chest inspiration, leg, arm, fore arm, fore arm contraction, abdomens, hips, thigh and arm contraction. The main reason for the matter could be the decrease of subcutaneous fat values, depending on aerobic energy use.

Body composition plays an important role on sportspeople's performance (Muratlı, 2007). Are measurements are benefited to prediction of body composition (Şanal, 2008). However, area measurements are affected by muscle, subcutaneous fat tissue and connective tissue (Munn et. al., 2005) In a similar study based on aerobic energy system, it is determined that there is a significant decrease in participants' chest, hips, upper leg, calf, belly, and thigh area measurements (Baylan, 2008).

In our study, a statistically significant difference in participants shoulder, chest depth, hips, knees metatarsal width measurements' pre-test and post-test averages was analyzed, however, no statistically significant difference was determined in elbow, wrist, meta-carpal and ankle pre-test and post-test averages. Considering that participants are in a fast-development phase according to their age group, we can state that these significant increments may be resulted from children's development characteristics. It is known that the relation between development and motor performance is related to anthropometric factors and is an important factor for performance (Özer, 1993). In our study, the reason for the lack of significant alterations in some diameter measurements was introduced as children's development phases. Indeed, in a similar study, it is reported that there is a direct relation between children's age and anthropometric diameter values development both for boys and girls (Pekel et al., 2006).

Importance of anthropometric diameter measurements in sport events is excessive and this measurement provides significant information in sports events where physical characteristics remain in the forefront. Anthropometric width characteristics play a very important role for sportspeople's proper performance of their movements in trainings or sports events. Characteristics of important articulars such as shoulder and hip articulation, for example, affects an important characteristic; flexibility (Muratlı, 2007).

In our study, there is also no significant alteration in participants bust, arm, fore arm, hand, thigh, leg, feet and over arm length measurements. Although there are studies reporting that there is a significant relation between doing sports and bone development, our study results that there are no significant alterations in children's anthropometric length measurements and this may be a result of children's development phases.

Considering similar result in the literature, significant decreases in sportspeople's subcutaneous fats in biceps, triceps, pectoral, sub-scapula, calf, iliac, sub-railiac, quadriceps, and abdomens areas were determined, comparing the values before the training. It also determined that total body index fell back to %7.21±1.44 mm from %7.71±1.64 mm and this decrease also stands on a significance level. Thus, through applied swimming trainings, both regional subcutaneous fat values and total fat values decreased in a significant level. The reason why is intensive aerobic energy system use throughout the applied training program.

Gökdemir and Koç (2000), in their stability training, which took eight weeks and applied as three days a week, have reported that participant's body fat percentage values fell to 7.90±0.59% from 8.33±0.60%. Sevinç (2008) have reported that, through the football skills training for 10-14 years aged children, body fat ratio test averages fell to 14.91±6.37% in post-test measurements from 17.81 ± 5.15% in pre-test measurements.

In another study, effect of recreation activities on boys' and girls' body fat ratio was analysed and eventually it was resulted that recreation activities, which were held on children who accommodates in a reformatory, lead a decrease in body fat ratio (Kurşunel et. al., 2010).

Watts et al., (2003) have reported that 11-12 mountaineers who take place in several sports have a lower fat percentage compared to those who are not active. Açıkada et al., in their study where they analyse effects of before-season practice trainings on some strength and stability characteristics, have determined sportspeople's body fat percentages as 6,77 % before training and 6,22 & after training.

Our study resulted that there is a significant decrease in sportspeople's values of stable pulse, pulse before and after training, and pulses during war-up. The reason why there is a significant decrease in sportspeople's pulses after training is hypertrophy of heart volume as a result of aerobic capacity and the thrifty work of the heart.

One of the most significant physiological changes through regular dynamic training programs is the increase of max $VO_2$. Increase in the $VO_2$ is a result of firstly the heart's performance as a pump and secondly the effectiveness of blood infusion and $O_2$ using activity of the muscle. Additionally, the hearts maximal minute volume increases. In sub-maximal effort, minute volume does not change and number of the pulses is lower for those who are training, compared to those who are not. This lowness is reimbursed by an increase in the pulse volume (http://www.erdalzorba.com, Access Date 10 April 2013). Thus, a significant decrease in sportspeople's pulse volume as a result of heat's pulse values is an expected result.

In several studies of the literature, it is also reported that there are significant improvements max $VO_2$ pulse volume and arterial pressure through stability trainings and this leads to an improvement in heart efficiency.

## 5. Results and Dıscussıon

As a result, it is found that there are significant decreases in participants' body weights through periodic swimming trainings applied, significant improvements in flexibility and vertical jump values and a significant improvement in 50 meters freestyle swimming performance. As an addition, significant decreases in participants body area measurements, subcutaneous fat and total body fat ratio. Also, significant alternations in participants' shoulder, chest, chest depth, hips, knees, metatarsal width values were analysed, yet, no alternations on participants' elbows, wrists, metacarpal and ankles were resulted. According to these results, we can state that, some improvements on children's body compositions and some conditional characteristics will take place through swimming trainings.

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