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ÇOCUKLARDA DEĞİŞİK ŞİDDETLERDE YAPILAN DEVAMLI KOŞULARIN, ANAEROBİK EŞİK SEVİYİSİNE ETKİLERİ

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Özet: Amaç; Bugün anaerobik eşik(AE) kavramı artık dayanıklılığın en önemli göstergelerinden biri olarak kabul edilmektedir. Pek çok araştırmacı çalışmalarında yapılan dayanıklılık antrenmanların VO2maks'ın gelişiminde bir tavan oluşturduğunu ve bir noktadan sonra gelişimin meydana gelmediğini buna karşın AE noktasında antrenmanlar süresinde gelişimin meydana geldiğini gözlemişlerdir. Bu çalışmada çocuklarda anaerobik eşik (AE), %5AE altı, %5AE üstü şiddet değerlerinde yapılan antrenmanın eşik noktasındaki kalp atım, koşu hızı, koşulan mesafe, süre üzerindeki etkilerine bakılmıştır. Haftada 4 gün 6 haftalık farklı şiddetlerdeki devamlı koşular belirgin bir şekilde (AE (%0,4), %5 eşik üstü (%11), %5 eşik altı (%0,3)) AE noktasındaki koşu hızlarını geliştirmesine rağmen ($p<0,05$). Gruplar arası farka bakıldığında sadece anaerobik eşik düzey %5 üst grup ve anaerobik eşik düzey %5 altı grupları arasında istatiksel olarak anlamlı bir fark bulunmuştur ($p>0,05$). Anaerobik eşik noktasının %5 üst grubu ile anaerobik eşik noktasının %5 altı grubunun 6 haftalık antrenman sonrası Conconi testinde koşabildikleri toplam koşu mesafeleri artmıştır($p<0,05$). Eşik grubu %-1 lik bir azalma göstermiş, eşik üstü grubu %7,6 eşik altı grubu %3 daha fazla koşmuştur. Buna karşın gruplar arası fark istatistiksel olarak anlamlı bulunmamıştır ($p>0,05$). Altı haftalık antrenman programı sonucunda, her üç gruptaki deneklerin A.E noktasındaki koşu hızlarında bir artış görülmektedir. Bu artış AE noktasının %5 üstü şiddetindeki grupta istatistiksel olarak anlamlıdır ($p<0,05$). Sırasıyla A.E noktasında antrenman yapan gruptaki artış %0,4 , A.E noktasının %5 üstündeki şiddete antrenman yapan gruptaki artış %11 .A.E noktasının %5 altındaki şiddette antrenman yapan gruptaki artış ise %0,3 olarak gerçekleşmiştir.

Anahtar kelimeler: Anaerobik eşik, Çocuk, Laktat, Conconi, MaxsVO2

EFFECTS OF CONTINUOUS RUNNİNG ON AEROBIC THRESHOLD LEVEL, IN DIFFERENT MAGNITUDES IN CHILDREN

Abstract: Objective; Today, concept of anaerobic threshold (AT) is now accepted as one of the most important indicators of endurance. In their researches, numerous researchers observed that endurance trainings create a ceiling for VO2maxs. development and no development occurs after a point but during trainings a development occurs in AT point. In this research, effects of training performed in children at (AT) anaerobic threshold under 5 % AT, above 5 % AT; on heart rate, running speed, running distance and time at threshold point were observed. Although continuous conditions for 6 weeks and 4 days in a week in different magnitudes (AT (0,4 %), 5 % over threshold (%11), 5 % under threshold (0,3 %)) significantly improved running speeds at AT point ($p<0,05$); when considering differences between groups, a significant difference was found

between only group with 5 % over threshold level and group with 5 % under threshold level (p>0,05). Total running distances of 5 % over group and 5 % under group of anaerobic threshold point in Conconi test after 6 weeks training increased (p<0,05). Threshold groups indicated a decrease of 1 % and over threshold indicated an increase of 7,6 % and under threshold group indicated an increase of 3 %. On the other hand difference between groups were not found significantly (p>0,05). As a result of six weeks training program, an increase was observed in running speeds of each three groups at AT point. This increase is statistically significant in AT 5 % over group (p<0,05). Respectively, increase of group trained at AT point was 0,4 %, increase of group trained at 5 % over AT was 11 % and increase of group trained 5 % under AT was 0,3 %.

Key worlds: Anaerobic threshold, Child, Lactate, Conconi, MaxsVO2.

INTRODUCTION

As it is known, children are in a growth and development period. In this period, physiologic systems of young children are not in appropriate level to bear loads of heavy trainings. This strength only can be obtained after childhood. Especially, children who are under 12 years old have a high level of sympathetic system activity. Therefore high heart rate and long endurance activities cause easily depletion of their capacities. Aerobic power of children in this period is low. They do not have enough oxygen use capacity. (http://www.sporbilim.com)

Well – trained athletes, because they supply energy completely from anaerobic processes at low speeds, show low lactate values. When speed increases gradually, muscles generate lactic acid, but amount of this acid reaches a level that can not be neutralized. There is level that can be neutralized depending on increase of lactic acid. This is the lactate concentration between 2 – 4 mmol/l lactate, this level is also called as aerobic – anaerobic transition zone (Farrel,1979:338)

Anaerobic threshold point is at 85 % of maximal heart rate, (Bağırgan,1990), and generally between 150 – 170 throb / min (Davis, 1985:6, Gür, 1990: 14). This value is 130 throb / min for non – trained people and can increase up to 180 throb / min (Gür, 1992: 30-46; Gür, 1990:14; Maglischo, 1993).

Although value of VO2 max. that is an important criteria on the basis of endurance depends on genetic factors (80 – 90 %), value of AT completely depends on trainings (Fox, 1984). While AT is 50 – 60 % of VO2max. for non – trained people, this value can reach 80 – 90 % for trained people. (Bunch, 1993:233; Davis, 1985:10; Ergen, 1993; Gür, 1992:30-46; Gür, 1990:14).

In terms of reliability and validity of Conconi test that is an indirect method and easy to apply, although some researcher found differences between AT point values obtained by lactate and ventilation method and values obtained by Conconi test, many researchers emphasizes high reliability of this test. (Conconi et al.,1996:509).

Anaerobic Threshold

Aim of the cardiovascular system is to transport O2 from lungs to cells and remove CO2 from cells. Amount of O2 must be 20 times when walking, 40 times when jogging and 60 times or more when training hard. As training intensity increases, O2 amount transmitted to

muscles increases and required energy is supplied from anaerobic system. When training intensity reaches a certain point, aerobic system becomes insufficient and anaerobic metabolisms join energy generation. This training intensity where anaerobic metabolisms are included in ATP renewal is called as anaerobic thresholds (Fox,1984).

Anaerobic Threshold in Children

Because lactate level in same relative exercise in children in comparison to adults is lower, 4mmol/1 value can be high for children. Thus, Williams studied on 4 mmol/I lactate level of blood in 50 females and 53 males who are between 11 – 13 years old. 34 % of males and 12 % of females can not reach 4 mmol lactate level at VO2max. level. As a result, lactate threshold shows high values as VO2max %, so 4 mmol criteria is not an appropriate method for this age group children. In another study, it is stated that MlSS occurs at 2,1 mmol/l in male children and 2,3 mmol/l in female children for non – trained 13 years old children. It was observed that level of 2,5 mmol/l coincides 84 % VO2max in males and 82 % VO2max in females; level of 4 mmol/1 coincides 93 % and 90 % VO2max respectively. Besides, HR and VO2 coinciding 2,5 mmol/lactate level are not different than those are observed in MlSS. As a result, it is recommended that 2,5 mmol/I level is more appropriate for determination of anaerobic threshold in children. (Çolak 2000).

Determination of Anaerobic Threshold

By Ventilation Way: Work load in sudden increase point of average O2 fraction expired and / or nonlinear increase point in CO2 generation, beginning point of nonlinear increase in ventilation is accepted as AT point. (Çolak, 2000)

Lactate Method: Determination of anaerobic threshold according to blood lactate is a direct method. In this method, rate of training (running, swimming, oaring, bicycling, heart rate…) is be graphed with lactic acid values. Lactic acid measuring is an expensive method. (Bueno,1989:28).

Conconi Method:

Conconi, et al., developed a field test to determine AT in racers by an indirect method. In this test, with gradually increasing running speed, on the basis of linear relationship between HRs and running speed, running speed coinciding the point where linear relationship between HRs and running speed does not continue any more is accepted as AT. They proved validity of this method by comparing lactate threshold value obtained from venous blood measurements with AT speed coinciding HR breaking point (Conconi et al.,1982:870).

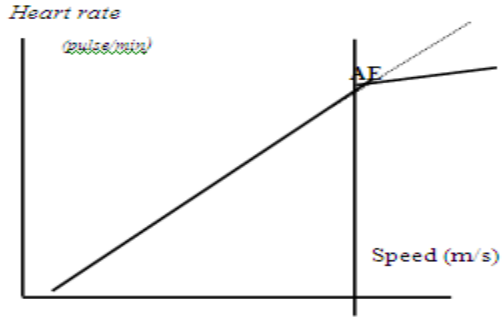

Figure 1. Determination of aerobic threshold according to heart rate and running speed (Conconi method).

AIM

Aim of this research is to determine how a change is caused on anaerobic threshold point by continuous conditions in anaerobic threshold, 5 % over anaerobic threshold and 5 % under anaerobic threshold.

SCOPE

18 sportsmen whose average age is 13,77±78, average height is 157,05±5 cm and body weight is 46,40±5,6 kg; students of Sakarya City, Hendek Borough, Central Elementary School, joined this study. An evaluation form was applied to the subjects of the test for their willingness.

METHOD

Data Collection Tools

For Anaerobic threshold measurements, True 750 S.O.F.T SYSTEM brand, with speed capacity of 12 mile/h and 0,1 speed intervals, treadmill was used.

For heart rate measurements of subjects, Polar Sport Tester Heart Rate Monitor mounted on the treadmill and that is able to measure heart rates with 5, 10, 15 seconds time intervals. In this research, program that can record heart rates in every 5 seconds was chosen.

Data Collection

Measurements were performed in February – March, Sakarya / Hendek Municipality Trade Center Cemal Kamacı Sports Hall, in a room having a normal air current. For anaerobic threshold measurement according to Conconi method, subjects were warmed up for 6 minutes on True 750 S.O.F.T SYSTEM treadmill with at gradually increasing speeds (4,2 mile/h for first 2 minutes, 4,5 mile/h for following 2 minutes and 4,8 mile/h for final 2 minutes), then they started for test and study was continued by increasing running speed for 0,3 mile/h (roughly 0,5 km/h) in each 200 meters. HR (Heart Rate) of the subject was read from telemeter after each 200 meters and recorded by the researcher. Test was finished by the researcher when the subject can not run anymore. Obtained data was converted into km/h from mile/h. After all measurements and calculations, it was found that correlation between running speed and heart rate is r=0,98.

At the end of the study, HR was determined as values between the point where HR deviates from linearity and running speed AT point from HR – running speed graph, on a graph paper.

After AT level determination, subjects were divided into three groups at random.

1. Group was trained for 20 minutes of training (running) time (volume) at AT point.
2. Group was trained for 20 minutes at 5 % over AT point.
3. Group was trained for 20 minutes at 5 % under AT point.

All groups were trained for four days in each week, totally six weeks, on Monday, Wednesday, Thursday and Saturday. At the end of six weeks training, recovery of subjects were ensured with 4/5 days of recovery period.

Analysis of Data

Differences of first and end tests of this research were compared via Wilcoxon test. Mann Witney U was applied for intra and

inter – group differences and Kruskall-Wallis-H test was applied in order to determine between which groups this difference existed. Data was collected by using 0,05 level of significance was used in this research. Final percentage differences were calculated via the formula of (first test – final test / first test) x 100. Statistical processes were realized via SPSS packaged software.

FINDINGS

Pre – training program (first test) anaerobic threshold (AT) points and measurement values (anaerobic threshold, 5 % over anaerobic threshold and 5 % under anaerobic threshold) in this point of subject groups included in this study can be seen in Table 1.

Table 1. Pre – test measurement values of the groups

	A. Threshold group (N=6) X SD	Over threshold (N=6) X SD	Under threshold (N=6) X SD
A.EKHİ (km/h)	11,75 ± 1,21	12,33 ± 1,72	12,11 ± 0,61
A.EKAHİ (pulse/min)	175,83 ± 12,60	169,00 ± 10,86	175,83 ± 12,60
A.EKK (kg)	46,46 ± 6,5	47,81 ± 5,65	44,93 ± 7,60
CONKMİ (meter)	3433,33±1364,79	3233,33 ± 907,00	3200,0 ± 357,77

Physical measurement vales of subject groups included in this research (anaerobic threshold, 5 % over anaerobic threshold and 5 % under anaerobic threshold) at the end of training (final test) and anaerobic threshold point can be seen in Table 2.

Table 2. Final test measurement values of the groups

	Threshold group (N=7) X SD	Over Threshold (N=6) X SD	Under Threshold (N=5) X SD
A.EKHS (km/h)	12,11 ± 0,63	13,83 ± 1,40	12,53 ± 0,76
A.EKAH (pulse/min)	178,50 ± 7,58	173,83 ± 6,14	177,50 ± 8,26
CONKMS (meter)	3400,00 ± 1232,88	3500 ± 1009,95	3300 ± 303,31
A.EKK (kg)	44,50 ± 5,38	45,85 ± 5,607	43,41 ± 6,93

At the end of six week training program, an increase was observed in running speeds at AT points of each three groups. This increase is statistically significant for 5 % over AT point group ($p<0,05$). Increases in groups training at AT point and 5 % over AT point were 0,4 5 and 11 % respectively.

In each two groups, total running distances that they can run in Conconi test increased and a decrease was determined in threshold group. These increases and decreases are not significant statistically ($p<0,05$). Increases in threshold group, over threshold group and under threshold group were 1 %, 7,6 % and 3 % respectively.

Differences Between First and Final Tests of Groups and Differences Between Groups

Differences between first and final tests of groups and differences between groups were shown in this part of findings.

Anaerobic threshold level group

Differences between first and final test measurements of AT level group were compared via Wilcoxon test.

Subjects at anaerobic threshold point did not show a statistically significant difference according to first and final tests on the basis of running speed and heart rate (p>0.05). However, subjects showed a statistically significant difference on the basis of weight according to first and final test results (p< 0.05).

Differences between first and final test measurements of 5 % over anaerobic threshold group were compared via Wilcoxon test and given in Table 3.

Table 3. Comparison of first – final test results of running speed at 5 % over of anaerobic point group

	AT speed rate (km/speed)	AE level heart rate (min.)	Running distance	Weight differ.
Value	-2,207	-1,577	-2,070	-2,201
P	*,027	,115	,038	*,028

*p<0,05

As it can be seen in the Table, they did not show significant differences in first and final tests on the basis of total running distances (p>0.05). However, subjects showed significant differences in first and final tests on the basis of threshold speed and weight (p<0.05).

5 % under Anaerobic threshold level group

Differences between first and final test measurements of 5 % under AT level group were compared via Wilcoxon test.

Subjects at anaerobic threshold point did not show statistically significant differences in first and final test on the basis of running speed and heart rate (p>0.05). However, they showed a statistically significant difference according to first and final test results on the basis of weight (p< 0.05).

Comparison of Differences Between Groups

Result was obtained with Kruskal-Wallis variance analysis used to compare first and final test values of groups.

It was seen that there is no statistically significant difference between first and final test values of experimental groups (p>0.05).

DISCUSSION

Aim of this research is to effects of studies at anaerobic threshold, over AT and under AT on AT points.

Continues running on 4 days in each week and in 6 weeks, in different magnitudes increased running speed at AT point (AT (0,4 %), 5 % over threshold (11%), 5 % under threshold (0,3 %)) (p<0,05). However, when comparing differences between groups, a statistically significant difference was found only between 5 % over anaerobic threshold level group and 5 % under anaerobic threshold level group (p>0,05).

At the end six weeks training program, running speeds of subjects in each three groups at AT point increased. This increase was statistically significant in 5 % over AT point group ($p<0,05$). Increases of group were 0,4 %, 11 % and 0,3 % for groups of AT point, 5 % over AT and 5 % under AT groups respectively.

Belman and Gaesser, in order to research effects of trainings under and above lactate threshold on old people (between 65 – 75 years old), 8 subjects were trained above lactate threshold (% 121 of lactate threshold = 82 % VO2max) and 9 subjects were trained under lactate threshold (72 % of lactate threshold = 53 % of VO2max) for 8 weeks, 4 days in each week and 30 minutes in each days under. As a result, significant increases in VO2max were found in both groups ($p<0,05$). However, this increase was not significant between groups ($p>0,05$). A development of 10 – 12 % in lactate threshold was observed and this increase was equal in both groups (Belman,1991).

Results obtained by us and results previously obtained by many researchers (Baum, 1999; Belman, 1991; Denis; Keith et al., 1992; Sjodin et al., 1982) support each other. Different results observed when comparing results of the study may be arisen from application time, frequency and physical development of subject groups.

At the end of the research, observed results those are different from some researches in the literature may be caused by training intensity and program.

As a result of the trainings, although HR value at AT point was decreased by 3,5 %, increased by 4,8 % and decreased by 3 % in AT group, 5 % over AT group and 5 % under AT group respectively, these differences are not statistically significant ($p>0,05$). Also there was no statistically significant difference between HR values at AT point of groups ($p>0,05$).

Yoshikate Y, trained 7 middle aged women (33-57 ages) for 6 weeks, 3 days in each week and 60 minutes in each day with 50 % of VO2max on bicycle ergonometer. As a result, 32 % development in lactate threshold and 16 % development in OBLA were observed and no change was observed on RH values in lactate threshold and OBLA (Yoshitake,1990).

Results found by us in this research are similar to results of Yoshikate Y. This shows that physiologic stress at AT point does not change even if a development is achieved at AT point.

Total running distances in Conconi test of 5 % over and 5 % under anaerobic threshold groups after 6 weeks trainings ($p<0,05$). Threshold groups showed a 1 % decrease; over threshold group increased by 7,6 % and under threshold group increased by 3 % of running distance. On the other hand, differences between the groups are not statistically significant ($p>0,05$).

Howard P et al., trained 18 male college student on bicycle ergonometer (50 – 60 pedal/rev.) for 8 weeks, 3 times in a week and 30 minutes in each time in two groups; AT group and over AT group. Finally, 14,3 % development was observed in group trained more intensively in PWC test, in other words it was increased from 1400 kpm to 1600 kpm. A development of 7,7 % was observed in the group training at AT point, in other words it was increased from 1300 kpm to 1400 kpm. However, although development in over threshold

group is more than 6,6 %, this difference between two groups did not found as statistically significant (Howard et al., 1984).

Results found by us in this research in Conconi test are similar to results of Howard P et al. in PWC. These results may caused by development of AT point in all groups.

Maximum RH value attained in AT group during trainings was 4,7 pulse/min and 1 pulse/min more than over threshold group and under threshold group respectively, but this difference was not statistically significant (p>0,05).

Although maximum HR value of over threshold group was 4,7 pulse/min less than threshold group, this difference was not statistically significant (p>0,05). Even so, this value was 3,7 pulse/min more than under threshold group, but this difference also was not significant (p<0,05). Maximum HR value attained by under threshold group at AT point was 1 pulse/min less and 3,7 pulse/min more than threshold group and over threshold group respectively, but this difference was not found as statistically significant (p<0,05). This shows that under threshold group can train with less hardness in same intensity in comparison to over threshold and threshold groups.

In conclusion, while trainings in different intensities applied for endurance development have similar effects, group trained in less intensity has less physiologic stress in same training intensity. This shows that low intense trainings may be more helpful for endurance.

RESULTS AND RECOMMENDATIONS

Results

1. Six weeks continues training performed at AT point had no effect on running speed at AT point (p<0,05).
   1.1. Six weeks continues training performed at AT point had no effect on decrease of heart rate at AT point (p>0,05).
   1.2. Six weeks continues training performed at AT point had no effect on total running time at anaerobic threshold point (p>0,05).
   1.3. Six weeks continues training performed at AT point was not able to increase total running distance achieved in Conconi test (p<0,05).
   1.4. Six weeks continues training performed at AT point had no effect on weight loss (p>0,05).
2. Six weeks continues training performed 5 % over AT point had no effect on development of running speed at AT point (p<0,05).
   2.1. Six weeks continues training performed 5 % over AT point had no effect on decrease of heart rate at AT point (p>0,05).
   2.2. Six weeks continues training performed 5 % over AT point was not able to increase total running distance achieved in Conconi test (p<0,05).
   2.3. Six weeks continues training performed 5 % under AT point had no effect on decrease of heart rate attained when running at anaerobic threshold (p>0,05).
   2.4. Six weeks continues training performed 5 % under AT point had no effect on weight loss (p>0,05).
3. Six weeks continues training performed 5 % over AT point affected development of running speed at AT point (p<0,05).

3.1. Six weeks continues training performed 5 % over AT point had no effect on decrease of heart rate at AT point (p>0,05).
3.2. Six weeks continues training performed 5 % over AT point affected total running distance achieved in Conconi test (p<0,05). Total running distance increased.
3.4. Six weeks continues training performed 5 % over AT point had no effect on decrease of maximum heart rate when running at anaerobic threshold (p>0,05). As a result, maximum heart rate achieved when running increased.

Recommendations

In this research, effects of trainings performed at anaerobic threshold (AT), 5 % over anaerobic threshold and 5 % under anaerobic threshold; on heart rate, running speed, running distance and time at anaerobic threshold point. As it can be seen, there are many other factors effecting endurance. Each of these factors can be investigated separately. Direct method of this research according to lactic acid measurements shows developments in difference lactate values while these values supply more expressive information about endurance development. Similar researches may be studied by increasing/decreasing training time and frequency.

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