ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN - POLONIA
VOL.LX, SUPPL. XVI, 276 SECTIO D 2005

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# *Anaerobic threshold specified as respiratory exchange ratio (RER) in determining aerobic performance of trained and untrained young boys*

## Próg beztlenowy wyznaczany na podstawie współczynnika oddechowego (RQ) w określaniu tlenowych możliwości u młodzieży trenującej i nie trenującej

The anaerobic threshold, a new measure that have been introduced into the diagnostics of effort in sports as an additional indicator of the level of aerobic effort abilities, is undoubtedly a significant source of information about the aerobic performance of an athlete. The anaerobic threshold is defined as the intensity of work load or oxygen consumption in which anaerobic metabolism is accelerated (3, 9, 10). Training loads that approach the anaerobic threshold are considered to be the optimal ones (7).

Satisfactory training effects depend, in the first place, on the load control and careful planning how to develop a given biological property of an individual in the adequate period of his or her biological development. Positive effects produced by intensive physical activity are particularly easily noticed in children and youth. Increased physical activity gives particularly good effects for children and youth.

The first stage in the training process is of vital importance to the child's development as the level of skills and aerobic performance obtained by a child will largely affect his or her sports results in the future.

Therefore when preparing training plans one should take into account both current and anticipated state of morphologic and motor structures as well as physical capacity that is most desirable in athletes in their full maturity.

### MATERIAL AND METHODS

The subjects of this study were untrained young people and people training regularly one of the following discipline judo (subjects' characteristics table 1.).

**Table 1. Characteristics of subjects' (mean ± SEM)**

| Groups | n | Age (years) | Development Age (years) | Weight (kg) | Height (cm) | Training (years) |
|---|---|---|---|---|---|---|
| Untrained | 15 | 14.3 ± 0,5 | 14.0 ± 0.4 | 59.8.1 ± 15.9 | 168.0 ± 12.1 | 0 |
| Judokas | 15 | 14.1 ± 1.2 | 14.06 ± 1.1 | 56.2 ± 11.6 | 165.9 ± 9.08 | 3 |

Measurement anaerobic threshold (AT) end maximal oxygen uptake ( $\dot{V}$ O2max)

The subjects performed the test until exhaustion in the Laboratory of Physical Effort in the Department of Physiology at the Academy of Physical Education and Sports in Gdansk. Gas analyzer EOS Sprint (Jaeger) and the cycloergometer (Jaeger) were used in the study. The continuous protocol started at 1.5 W/kg for 6 min (v = 50 rpm) and increased 25 W every 1 minute until exhaustion. The anaerobic threshold (AT) was established with a noninvasive method on the basis of the load measure

(% $\dot{V}$ O2max) with breath indicator (RER=1) in the test effort as well as maximal oxygen uptake ( $\dot{V}$ O2max).

Values are expressed as means ± SD. The statistical analysis of the date obtained was assessed by ANOVA.

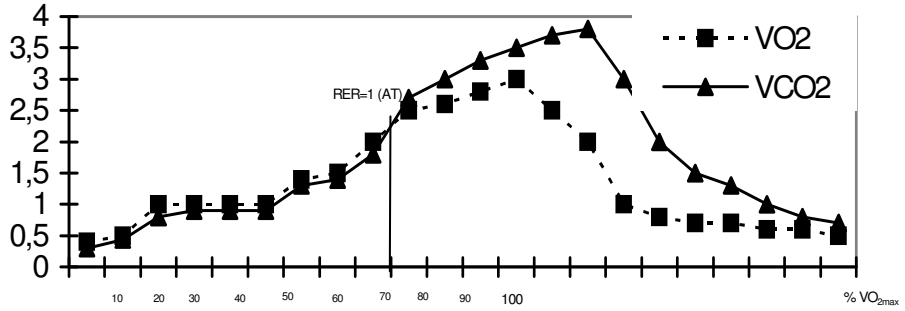


Fig. 1. Measurement anaerobic threshold

**RESULTS**

The highest results of $\dot{V}$ O2max ( 58.7 ml-1 . kg-1 . min) were obtained by the judoists, whereas the lowest ones untrained (45.2 ml-1 . kg-1 . min) (Fig.3.). The differences were statistically significant ($p<0.01$).

While the judoists obtained RER=1 AT 65% of $\dot{V}$ O2max, the did the untrained AT 58 % of $\dot{V}$ O2max. (Fig.2.) The differences were statistically significant ($p<0,05$).


Fig. 2. Anaerobic threshold (AT) in the young judo athletes and untrained ($p<0.05$ *).

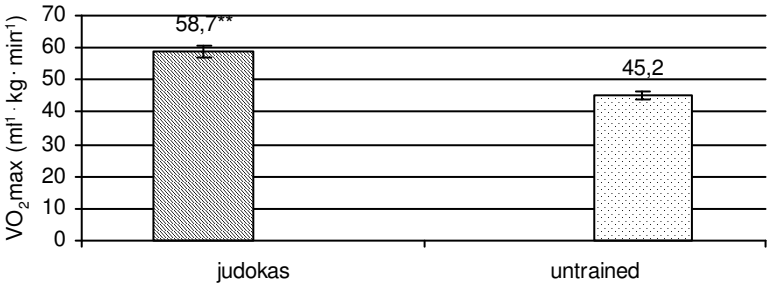


Fig. 3. Maximal oxygen uptake ($VO_2max$) in young judo athletes and untrained
( $p<0.01$ **).

## DISCUSSION

Effective adaptation to specific physical efforts of a definite discipline of sports is largely predetermined by properties of ontogenesis.

In ontogenesis significant changes in an individual's effort energy processes take place. Sports training may have both positive and negative influence on the biological development of a young athlete.

Some authors seek methods to define effort potential on the basis of anaerobic threshold (AT) of young people training regularly and of those untrained (2, 5, 6). Opinions concerning methods of measuring AT are in disagreement (1, 4). According to our investigation the AT measure based on effort load with RER =1 (noninvasive method) works well with children. Our previous results confirm this as well (4, 8).

According to Han (6), at the stage of pubertal growth spurt in boys a slowdown in the development of their aerobic performance may happen. The young judokas obtained surprisingly good results, which might result from the fact that they were not reguired to make excessive special efforts. Special efforts in this sports discipline require high anaerobic energy potential in releasing energy for muscles' work. Taking into account maximal oxygen uptake and AT it might be said that young judokas show good base for the increased special training loads in their full maturity.

## CONCLUSIONS

Respiratory exchange ratio enables to differentiate athletes with respect to aerobic performance.

It is advisable to control the development of aerobic capacity in young athletes, as this biological property is one of the indieces of general health.

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**SUMMARY**

The aim of this study was to determine the aerobic performance of trained young judokas (n=15, age 14.1), and untrained (n=15, age 14.3), on the basis of anaerobic threshold (AT) specified as RER=1 and of $\dot{V}$O2max. The subjects performed the test until exhaustion on a cycloergometer. Gas analyser EOS Sprint (Jaeger) was used in the study. The highest results of $\dot{V}$O2max ( 58.7 ml-1 . kg-1 . min) were obtained by the judokas. While the trained obtained RER=1 AT 65% of $\dot{V}$O2max. The differences were statistically significant ($p<0,01$). The significant differences probably result from the character of conducted training in the considered disciplines.

**STRESZCZENIE**

Celem badań jest określenie możliwości tlenowych u młodzieży trenującej judo (n=15, age 14.1) oraz nie trenującej (n=15, age 14.3), na podstawie pomiaru progu beztlenowego (AT) przy obciążeniu RQ=1 w pracy oraz $\dot{V}$O2max. Badani wykonali test do odmowy wykonywania pracy na ergometrze rowerowym. Pomiarów dokonano przy użyciu analizatora gazów oddechowych EOS Sprint (Jaeger). Najwyższe wartości VO2max ( 58.7 ml-1 . kg-1 . min) uzyskali trenujący judo oraz AT 65% of $\dot{V}$O2max. Były to różnice statystycznie istotne ($p<0.01$). Różnica ta wynika prawdopodobnie ze stosowanych obciążeń treningowych w tej dyscyplinie sportowej.