

The effect of inhalation with Oxywatt on swimmers' exercise capacity during intense physical effort repeated multiple times

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The purpose of the study was to determine the effect of inhalation of higher oxygen content (Oxywatt) on swimmers' exercise capacity during intense physical effort repeated multiple times.

The research involved 9 swimmers having at least 2nd sports class. The primary selection criterion of the research was the period of at least 6 years of systematic swimming workout. All the participants of the experiment had valid health examination results. The subjects were informed about the purpose and procedure of the research. The subjects were also informed about the possibility of withdrawal from the research without giving reasons. All the participants expressed a written consent to participate in the research. A research project was accepted by the Bioethical Commission for Research at the Jerzy Kukuczka Academy of Physical Education in Katowice.

Three series of research were carried out in the project in the Function Tests Department at the Jerzy Kukuczka Academy of Physical Education in Katowice. One week before commencement of the research, all the subjects undergone a trial series of laboratory tests to become familiar with the research procedure. Measurements of body height and weight, as well as its composition, were taken at all subjects before entering the research series. The measurement of body composition analysis was carried out with an electrical impedance method using the InBody 220 (Biospace) device.

The course of research series

The research included three random research series:

RS1 – output testing, without additional inhalation,

RS2 - combined with inhalation with OXYwatt,

RS3 - inhalation of placebo, sterile air instead of oxygen in OXYwatt containers.

Each research series was characterised by the same methodology and the same time of research, what is more, the order of subjects was maintained.

During RS1, two hours upon eating light mixed meal composed of: 50% carbohydrates, 30% fat, 20% protein, a modified triple 30-second Wingate test for upper limbs was carried out. The modified Wingate test was performed with Brachumera Sport (Lode) ergometer. Before commencement of the test, the participants performed a 6-minute warm up with 50W resistance and cadence of 70-80 rpm. Then, upon a 2-minute passive break, they entered to performing three 30-second Wingate tests, separated by a 5-minute passive break. All the tests were based on obtaining the highest number of revolutions in the shortest time and maintaining them over a period of 30 seconds. During each Wingate test the following measurements were performed: maximum power (PP), mean power (MP), minimum power (MinP) and total work (TW). In order to determine the efficiency of glycolytic processes, a measurement of lactate concentration (LA) in blood and indicators of acid-based balance of blood, including a degree of oxygen saturation, were carried out. These measurements were performed before the first Wingate test as well as in 3, 6, 9 and 12 minute after the third Wingate test.

After 72 hours of rest, all the subjects entered to performing RS2. During RS2 the same methodology of research, as it was in case of RS1, was maintained. The only factor differentiating it from RS1 was the introduction of inhalation with Oxywatt containing 95% O₂ concentration during 5-minute breaks between the tests. Inhalations started 30 seconds after the end of the first and the second Wingate tests and continued for another 3: 30 minutes.

After 4 minutes of passive break (30 seconds of normoxia and 3:30 minutes of hyperoxia), the subjects ended inhalation and prepared for the following test.

After 72 hours of rest since RS2, all the subjects set about performing RS3. During RS 3 the same methodology of research, as it was in case of RS2, was maintained. However, inhalation was carried out with "placebo" gas, which was packed in the same way as in case of RS2, the concentration of which amounted to 20,9% of O₂.

The order of research series was random and the subjects did not know what gas they breathe in.

The results of the test

The table presents mean values, median, standard deviation and statistically significant differences in the variables tested in subsequent research series.

Table 1. Tested variable during subsequent research series (RS1, RS2, RS3) in a group of swimmers (n=8);

* p<0.05 - statistically significant differences with respect to output testing

** p<0.01 - statistically significant differences with respect to output testing

Variable	RS1 - output			RS2 - Oxywatt			RS3 - placebo		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
PP ₁ (W)	956.00	994.00	147.7	987	987	107.7	1002.25	1002.2	126.9
PP ₂ (W)	948.1	928.0	88.1	1016.38	987.0	139.1	957.8	957.8	124.3
PP ₃ (W)	917.1	876.0	110.8	939.3	939.3	110.9	940.0	940.0	144.3
MP ₁ (W)	456.7	455.0	56.9	476.0	468.0	44.0	468.7	456.0	39.55
MP ₂ (W)	434.1	422.0	34.7	471.1*	458.0*	58.4	447.7	447.0	49.6
MP ₃ (W)	403.5	379.0	65.8	451.7*	444.0*	65.1	410.8	410.8	73.3
TW ₁ (J)	13612.6	13570.0	1695.5	14193.6	13944.0	1314.1	13971.6	13585.0	1167.9
TW ₂ (J)	12947.9	12587.0	1400.5	14049.1*	13656.0*	1562.2	13349.3	13317.0	1477.8
TW ₃ (J)	11963.7	11305.0	2195.9	13423.8*	13241.0*	1976.3	12606.2	12463.0	1891.6
Δ LA (mmol/l)	10.42	10.86	1.69	11.75**	12.0**	2.11	10.56	11.03	1.45

PP₁ – maximum anaerobic power in the first Wingate test, PP₂ - maximum anaerobic power in the second Wingate test, PP₃ – maximum anaerobic power in the third Wingate test, MP₁ - mean power in the first Wingate test, MP₂ - mean power in the second Wingate test, MP₃ – mean power in the third Wingate test, TW₁ - total work in the first Wingate test, TW₂ – total work in the second Wingate test, TW₃ – total work in the third Wingate test, Δ LA – increase of lactate concentration in blood after three Wingate tests

A single factor analysis of variance with repeated measurements showed statistically significant differences in absolute values of mean power during the second (MP₂; F=12.4; p<0.01) and the third Wingate tests (MP₃; F=13.88; p<0.01). What is more, a similar direction of changes was observed in case of total work performed in the second (TW₂; F=12.4; p<0.01) as well as the third Wingate tests (TW₃; F=9.3; p<0.01.). The analysis also showed statistically significant differences in case of post-workout increase of lactate concentration in blood (Δ LA; F=13.8; p<0.001).

The analyses of post-hoc ANOVA Friedman test indicated significant (p<0.05) increase in the mean power generated in the second (MP₂) and the third (MP₃) Wingate tests after inhalation with Oxywatt (RS2). The growth amounts to 8.5 % for MP₂ and 3.1 % for MP₃, respectively. No similar changes were observed in RS3 after placebo application (Fig. 1 a, b). Upon Oxywatt application in RS2, there was a significant (p<0.05) increase in the values of TW₂ and TW₃, which amounted to 8.5 % and 3.1 %, respectively (Fig. 2a, b). These changes were accompanied by a statistically significant (p<0.01) increase (12.7 %) of Δ LA after performing three Wingate tests in RS2 (Fig. 3).

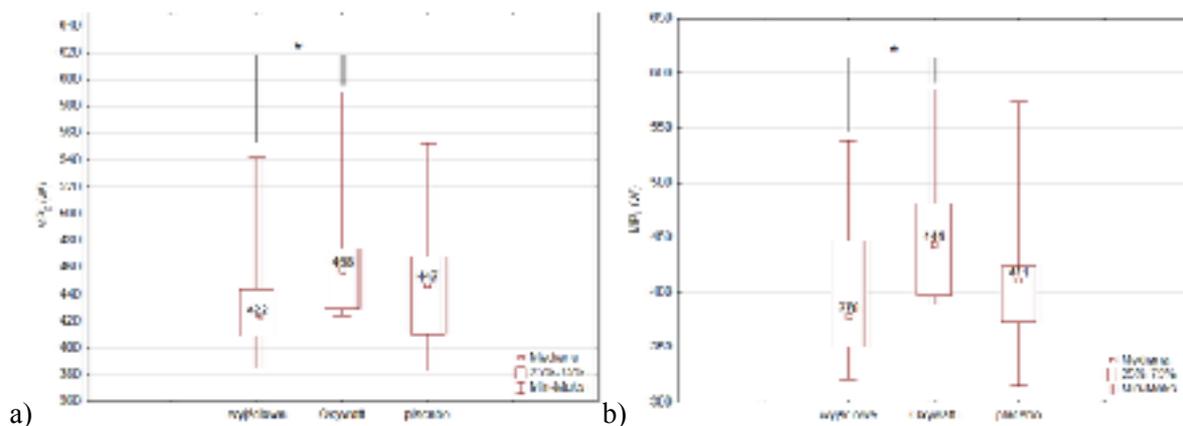


Fig. 1 a,b. The changes of mean power generated during the second (MP₂) and the third (MP₃) Wingate tests in subsequent research series; * p<0.05

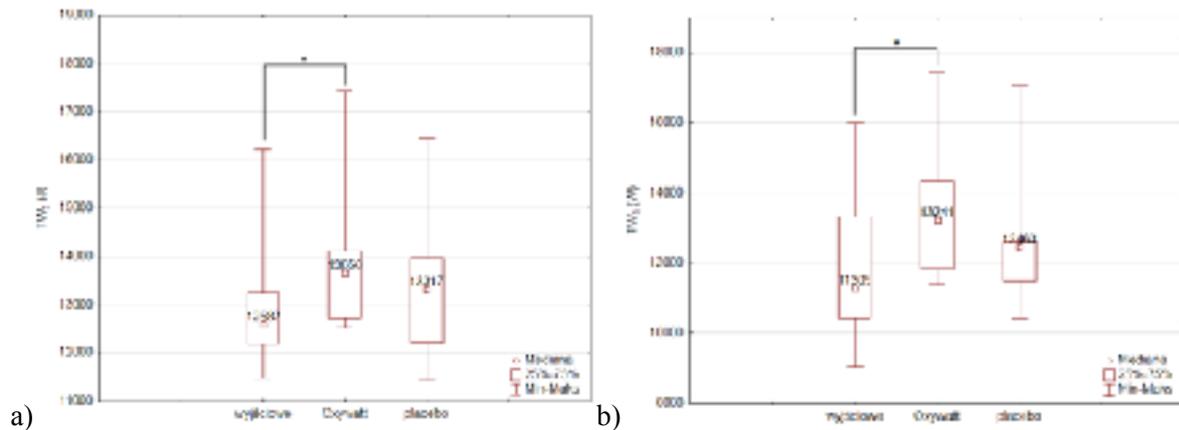


Fig. 2 a,b The changes of total work performed during the second (MP₂) and the third (MP₃) Wingate tests in subsequent research series; * p<0.05

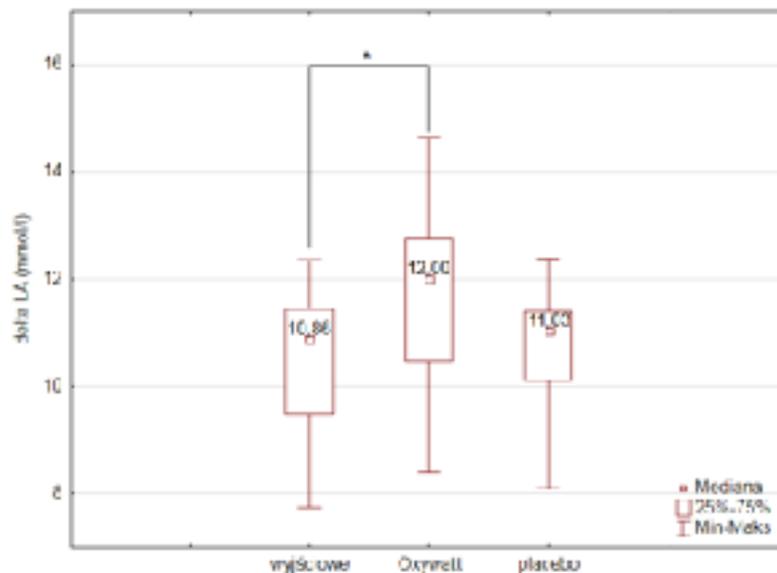


Fig. 3 The changes of increase of lactate concentration in blood (delta LA) after ending the exercise protocol in subsequent research series; * p<0.01

Conclusions

The results obtained indicate that inhalation with Oxywatt during breaks in the course of physical effort repeated multiple times accelerates returning to working capacity in a significant manner ($p < 0.05$). It was showed significantly ($p < 0.05$) through higher mean power as well as total amount of work performed during the second (MP₂, TW₂) and the third (MP₃, TW₃) repetition after inhalation with Oxywatt product. On the other hand, after placebo

administering an upward trend was observed, however, these changes were not statistically significant.

Literature