ACTA ICHTHYOLOGICA ET PISCATORIA
Vol. II, Fasc. 2 1972

Remigiusz WĘGRZYNOWICZ, Regina ZBANYSZEK

Physiology

TISSULAR RESPIRATION OF LIVER AND KIDNEY FROM BREAM *ABRAMIS BRAMA* (L.) IN REVERSIBLE ANESTHESIA

INTENSYWNOŚĆ ODDYCHANIA TKANKOWEGO WĄTROBY I NERKI LESZCZA *ABRAMIS BRAMA* (L.) W WYNIKU ELEKTRONARKOZY ODWRACALNEJ

Institute of Ichthyology*)

Investigations were performed on changes of respiration intensity of kidney and liver of bream resulting from reversible anesthesia. Each fish was subjected to test of 1,8 V direct current during 5 minutes remaining in homogenous electric field. Reversible anasthesia increased the intensity of respiration of both organs. The investigations proved also the existing correlation between the weight of body and the extent of metabolic changes of liver and kidney in reversible anesthesia. Sensitivity of fish to current test decreased in relation to increase of its weight.

An application of electric current in sea fishing created more interest in changes which occure in fish organism under stimulation of electricity (Anonymus, 1958; Danjulite, Malukina, 1967; Dethloff, 1963; Lamarque, 1968; Kreutzer, 1950; Privolniev, 1953; Scheminsky, 1936).

Any investigations so far performed aimed mainly to recognition of reactions in favour to concentration of fish. Very little attention had been paid to negative results of electricity activity on ichthyofauna.

The review of existing publications indicates that no investigations had been carried out from metabolic changes of fish subjected to activity of direct current in homogenous electric field. Process of metabolic changes in reversible electro-anesthesia may be considered under two aspects: primarily, in consideration to electric stimulus which may cause the irrevocable changes; secondly, in respect to sensibility of species and of particular specimen (age, weight, etc.).

*) From Department of Fish Physiology

The presented investigations were aimed to study the metabolic changes which express themselves in consumption of oxygen by kidney and liver of bream, in result of reversible electro-anesthesia, with due consideration to variations of body weight.

METHOD

The investigations had been carried out on breams of both sexes, of 5-12 years of age, caught at Zalew Szczeciński during summer and autumn. Prior to tests, the fish were kept in aquarium conditions in supply system water of pH 7.6, additionally aerated. The fish subjected to test of direct current formed the experimental group. Voltage applied to body of each fish was 1.8 V; the fest fish remained in homogeneous electric field. For every fish subjected to test, the applied time of current activity which caused the reversible electro-anesthesia was the same and amounted to 5 minutes. The control group, of similiar individual characteristics, remained within the same environments but was not subjected to activity of current and was examined at the same time as tested group. Directly after decapitation made under the conditions described in work (Węgrzynowicz, Zbanyszek, 1971) the measurements were performed by method of Warburg on sections of liver and kidney. The intensity of respiration processes were defined in $\mu l\ O_2/g$ of wet tissue/hour.

RESULTS AND DISCUSSION

The tests proved that consumption of oxygen by liver and kidney of fish subjected to reversible electro-anaesthesia lasting 5 minutes at applied voltage of 1.8 V, is intensifying. (Tab.1).

Table 1

Consumption of oxygen by liver and kidney of bream Abramis brama (L.) in summer and autumn season, before noon and in evening, expressed in $\mu l\ O_2/g/hour$

Season	Time	n	Liver		Kidney	
			$\bar{x}$	δ	$\bar{x}$	δ
Summer	P	12	298	± 42	327	± 60
	W	11	316	± 65	400	± 85
Autumn	P	34	317	± 67	511	± 55
	W	30	346	± 75	581	± 50

P - Before noon, W - evening, $\bar{x}$ - arithmetic mean,

δ - standard deviation, n - number of specimen examined

For control group, the values of oxygen consumption by liver average between 234 and 372 $\mu l\ O_2/g/hour$ and after electro-anaesthesia - within 276

to 419 μl O_2/g/hour. For both groups, higher intensification of respiration prevail for kidney: from 371 to 587 μl O_2/g/hour for control group and from 400 to 610 μl O_2/g/hour after electro-anaesthesia. In determination of sensitivity to current test (measuring dynamics of organs respiration) the correlation between particular weight groups (from I to V) and degree of sensitivity (Fig.1) must be ascertained.

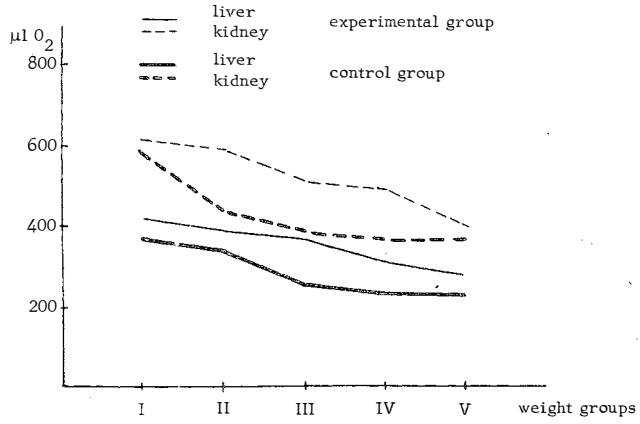

Fig.1. Intensity of oxygen consumption by kidney and liver of bream Abramis brama (L.) (μl O_2/g/hour) in relation to weight of body

More intensive respiration in liver and in kidney noted in both groups (control and experimental) of fish of smallest weight of body. (Tab.1). The quantity of oxygen consumed in both organs was decreasing as the weight of body was increasing. In experimental group, the quantity of oxygen used had always been slightly higher in liver and in kidney when comparing to control group. The degree of sensitivity measured by dynamics of respiration in control group has parallel run for both organs within range of body weight from 330 g to 900 g.

Considering that the investigations were strictly limited to matured specimens of 5-12 years of age with application of electric stimulus during 5 minutes only and at threshold dose which caused the reversible electro-anaesthesis, it may be assumed that under activity of higher current and during longer time, the essential changes in metabolic processes of fish are occuring. Further investigations performed in different environments (temperature, salinity, etc.) on different species and particularly of young specimen, at higher forces and during longer time of electric stimulus (applicable in fishing), may permit for better recognition of metabolic changes.

CONCLUSIONS

1. Reversible electro-anaesthesia of bream during 5 minutes under voltage of 1.8 V, causes more intensive consumption of oxygen by kidney and liver.

2. A correlation is noted between the weight of body and intensity of metabolic changes in liver and kidney result of reversible electro-anaesthesia.

3. Sensitivity of fish to current activity measured by dynamics of respiration of liver and kidney is decreasing as weight of body is increasing.

REFERENCES

A n o n y m u s, 1958: La pêche electrique en Allemagne. - Pêche marit. Paris. 4, 969 : 821-891.

D a n j u l i t e, G.P., M a l u k i n a, G.A., 1967: Issledovanie fizjologičeskogo mechanizma dejstvija pola postojannogo električeskogo toka u ryb. Povedenie i recepcija u ryb. Izd. Nauka. Moskva : 56-62.

D e t h l o f f, J., 1963: Problems of electrofishing and their solutions. FAO II. Fish Gear Congress in London, Roma, ref. No.63, A 4.

L a m a r q u e, P., 1968: Applic.electr.biol. et amenag. Pêches continent : 87-110.

K r e u t z e r, C., 1950: Die physiologischen Grundlagen der Elektrofischerei im Meer. - Arch. f. Fischerei Wiss. 1/2, B-5: 10-14.

P r i v o l n i e v, T.J., 1953: Povedenie ryb w električeskóm pole. Rybn. Choz. 29, 5.

S c h e m i n s k y, F., 1936: Zur Physiologie der Galvanonarkose bei Wassertieren. - Pflüg. Arch. f.d. ges. Physiol. Bd. H.3 237, 3.

INTENSYWNOŚĆ ODDYCHANIA TKANKOWEGO WĄTROBY I NERKI LESZCZA ABRAMIS BRAMA (L.) W WYNIKU ELEKTRONARKOZY ODWRACALNEJ

S t r e s z c z e n i e

Zbadano stopień przemian metabolicznych wyrażonych intensywnością pobierania tlenu przez nerkę i wątrobę leszcza bezpośrednią metodą Warburga w wyniku elektronarkozy odwracalnej w aspekcie różnic wagowych. W wyniku badania stwierdzono współzależność pomiędzy ciężarem, a intensywnością przemian metabolicznych w wątrobie i nerce w wyniku elektronarkozy odwracalnej. Wykazano również, że pobudliwość ryb na działanie prądu mierzona dynamiką oddychania narządów, maleje wraz ze wzrostem ciężaru.

ИНТЕНСИВНОСТЬ ТКАНЕВОГО ДЫХАНИЯ ПЕЧЕНИ И ПОЧКИ ЛЕЩА ABRAMIS BRAMA (L.) В РЕЗУЛЬТАТЕ ОБРАТИМОГО ЭЛЕКТРОНАРКОЗА

Р е з ю м е

Исследовано степень метаболических превращений, выраженных интесивностью поглощения кислорода почкой и печенью леща, при помощи прямого метода Варбурга в результате обратимого электронаркоза в аспекте весовых различий. В результате исследования установлена взаимозависимость между весом и интенсивностью метаболических превращений в печени и почке в результате обратимого электронаркоза. Установлено также, что возбудимость рыб на действие тока, измеряемая динамикой дыхания органов, уменьшается вместе с увеличением веса.

Received 10.VII.1971

Address:

Doc.dr hab.Remigiusz Węgrzynowicz
Mgr Regina Zbanyszek
Instytut Ichtiologii AR

Szczecin, ul.Kazimierza Królewicza 4
Polska-Poland