

## Experimental Study of Ionized Tap Water on the Status of Female Rats

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**Introduction.** There are plenty of articles and advertising projects about industrial water ionizers to produce acidic (or dead) and alkaline (or living) water in households' conditions. According to the proponents of ionizers, the acidic water produced by mentioned device is a natural bactericide, pest destroyer, whereas alkaline water penetrates deeper and better neutralizes acids, better leaches toxic substances out of body, contains more oxygen, and acts as a natural antioxidant and body alkalization substance [1]. However, the limiting numbers of scientific publications dealing with effects of ionized water on biological objects are available in literature. For example, using reduced water produced in the cathode side by electrolysis as a solvent instead of 2 mM NaCl solution of the same pH level as the reduced water increased the superoxide dismutation activity of some antioxidants. Moreover, neither the reduced water nor its electrolyte solution showed any superoxide dismutation activity by itself. On the other hand, the reduced water was able to decrease hydrogen peroxide levels. It has been found that the behaviour of H<sub>2</sub> in reduced water, which was activated by a platinum electrode, differed from that of H<sub>2</sub> introduced by bubbling of hydrogen gas [2]. Also, experiments with rats had been carried out and results show both positive [3] and negative [4, 5] impact of electrolysed water. Alkaline (living) water have been claimed frequently to boost antioxidant mechanisms. However, results described in [6] no significant differences in serum levels of a group of trace elements including arsenic were observed between the groups of rats given the two types of water (ordinary bottled and alkaline). Serum antioxidant enzymes (catalase and dismutase) were similar between the different groups of rats both in normal or those stressed by gentamicin injection. In the two groups injected with gentamicin, total antioxidant capacity was significantly higher in the group given alkaline water. In conclusion, giving alkaline water to normal rats for three weeks does not show any sign of toxicity and seems to be associated with increased total antioxidant in rats stressed with gentamicin overdose.

So, taking into account a lot of declarations and lack of scientific research linked with ionized and / or alkaline water, and having in mind that it is critical and most important liquid for humans and animals, each study enhancing our knowledge about water has great importance. The aim of the study was to

investigate physical characteristics and the effects of ionized (electrolyzed) tap water on rat's maternal body weight, blood and urine pH, open circuit potential values and external signs.

**Experimental.** 30 Wistar rats were divided into 3 groups: the first experimental group (I EG) was given to drink alkaline water, the second – acidic water (II EG), while the third (control) was given tap water (III EG); all rats used various types of water for 2 months. The number of rats was chosen in accordance with FELASA recommendation assuming 30 - 50% prevalence rate [7]. Rats were weighted, pH of the urine, blood and the open circuit potential were measured, and external signs were evaluated.

**Results.** Tap drinking water conforming sanitary regulations may contain some dashes of chlorides, bromides, organic compounds and other. However, during electrochemical reactions occurring during water electrolysis, pH changes, and forming of free radicals both in cathodic and anodic compartments forming and some increase in chlor- and bromine- containing organic compounds was detected, and their concentrations exceeds permitted levels (see Table 1)

**Table 1.** Content ( $\mu\text{g/l}$ ) of some halohydrocarbons determined in cathodic and anodic compartments of electrolyser after 20 min. of electrolysis.

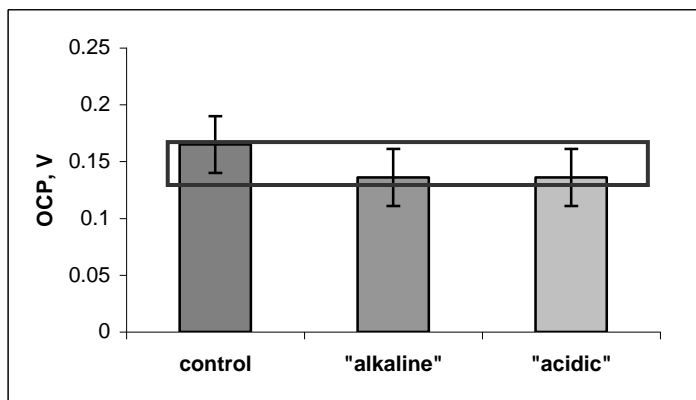
	Chloro- form	Bromdi- chlor- methane	Chlor- dibrom- methane	Bromo- form	1,2-Dichlor- ethane	Trichlor- ethane
Initial level	<0,10	<0,10	<0,10	<0,10	<2,0	<0,10
Cathodic compartment	0,52	0,14	<0,10	<0,10	<2,0	<0,10
Anodic compartment	27,4	19,6	11,4	1,48	<2,0	<0,10

Urine pH in rats that drank alkaline water was more acidic ( $p > 0.05$ ). pH of blood among groups also did not differ.

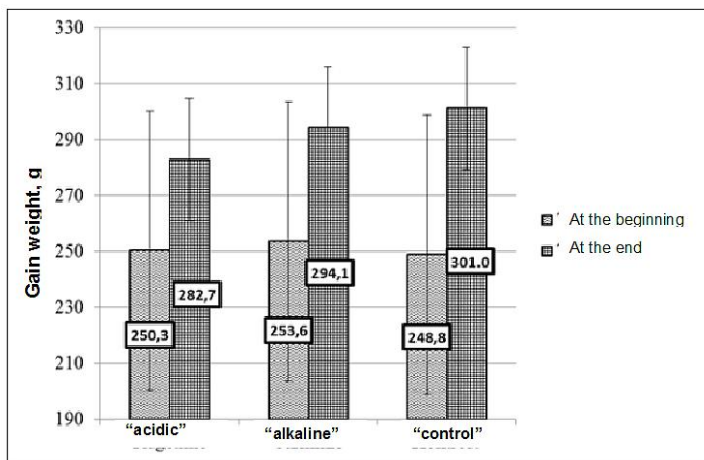
In the medical, biological, and ecological literature, an open circuit potential (OCP) of platinum electrode placed into a test medium against a certain reference electrode is considered as the redox potential of the medium. A redox potential of blood and blood plasma or serum can serve as an integral reflection of the redox processes proceeding in the organism. As it is shown in Fig. 1, the values of OCP determined in rats' blood vary within the range of 55 mV that is normal distribution for bodies without pathology [8].

As it is shown in Fig. 2, rats drank ionized (electrolysed) water for 2 months gained less average weight irrespectively of water "acidic" or "alkaline" in comparison with rats drunken untreated tap water.

In addition, after two weeks from the beginning of experiment the external signs of change were observed for rats. The rats who had received both types of ionized water, suffered stress: the stress of their condition showed a "bloody" tearing, sluggishness; for rats drunken acidic water the skin became rough. Meanwhile, no similar evidences had been observed for the rats of control group.



**Fig. 1.** OCP of Pt electrode in the blood media determined in the following groups of rats: "control" (rats drank untreated tap water), "alkaline" (rats drank alkaline electrolysed water), and "acidic" (rats drank acidic electrolysed water). Rectangular marks the range of settled values of OCP.



**Fig. 2.** Gain weight determined in the following groups of rats: "control" (rats drank untreated tap water), "alkaline" (rats drank alkaline electrolysed water), and "acidic" (rats drank acidic electrolysed water).

**Conclusions.** Ionized (electrolyzed) water negatively affected rats' physical status: they gained less weight; some characteristic external signs appeared, whereas small differences in chemical properties of blood and urine were detected. Also, values of open circuit potential determined in rats' blood vary within the range of 55 mV that is normal distribution for bodies without pathology.

## References

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