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Reproduction and Viability of Female Rat Offspring When Exposed To Ethanol

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Annotation. The work was carried out on female mongrel white rats (n=40) who were exposed to 10% ethanol solution during pregnancy, from one to five months before its onset, and on their viable offspring (n=220). Two periods of increase in the mortality rate of female rats were revealed: the first occurred in the 1st month of the experiment (mortality reached 25 %) and the second-in the 4th and 5th months of the experiment, when this indicator increased to 10 %. In rats, an increase in the duration of pregnancy was observed: the most significant prolongation of pregnancy (by 5 days) was revealed in females who were under the influence of ethanol for five months before its onset. The structure of total intrauterine mortality was dominated by preimplantation mortality, the highest rates of which were observed in rats treated with ethanol only during pregnancy, as well as for two and five months before its onset. The maximum post-implantation mortality was recorded in females exposed to alcohol for five months prior to pregnancy.

Keywords: ethanol, pregnancy, embryo, fetus, newborns, mortality.

Introduction

Numerous studies have proven the negative effect of ethanol on the reproductive sphere of the female body [1]. The course of pregnancy and childbirth in women with alcohol dependence is characterized by the threat of its termination, lack of water, premature discharge of amniotic fluid, rapid and rapid childbirth and birth trauma. On the part of the placenta, there are no gestational changes in the spiral arteries, and the presence of ischemic heart attacks is also characteristic. One of the negative effects of ethanol is its teratogenic effect, which allowed us to identify a symptom complex designated as "fetal alcohol syndrome" or "fetal alcohol syndrome" [6]. However, most studies do not take into account the "alcoholic history" of the mother. At the same time, experimental studies on the effect of ethanol and its metabolites on a living organism are usually conducted in rats [4, 5]. At the same time, the peculiarities of adaptation of female rats to ethanol, indicators of intrauterine and early postnatal mortality, as well as the number of their viable offspring in experiments under the influence of ethanol exposure during pregnancy and subsequent childbirth are still poorly studied.

The aim of the study - was to determine the features of adaptation of female white rats to ethanol and its effect on the duration of their pregnancy, intrauterine and early postnatal mortality of their offspring, as well as the body weight of newborn rat pups, depending on the duration of pregravidar ethanol exposure.



Research materials and methods

The study was performed on 40 female mongrel white rats of six months of age, kept in standard vivarium conditions. All animals of the experimental groups received mixed feed, and as the only source of liquid – a 10% solution of ethanol during pregnancy. Depending on the duration of alcohol intoxication in the pre-dravidar period, the experimental animals were divided into seven groups. The first group consisted of animals (n=5) that received drinking water before pregnancy. The second group included rats (n=5) that received ethanol for one month before pregnancy. Animals of the third (n=5) group received ethanol for two months before pregnancy. The fourth group included rats (n=5) treated with ethanol three months before pregnancy. The fifth group included rats (n=5) who received ethanol for four months before pregnancy. Animals of the sixth group (n=5) received ethanol for five months before pregnancy; and the seventh experimental group combined animals (n=5) who received ethanol for five months before fertilization. The control group consisted of rats (n=5) that received dry mixed feed and drinking water throughout the experiment.

To obtain reliable results, all animals were removed from the experiment in the spring period, from March to May. The animals were decapitated under anesthesia (chloroform vapor).

The adaptation of female rats to ethanol was studied by their mortality and the volume of liquid and dry food consumed during the experiment. The mortality of females in each group was calculated as the ratio $B / A \cdot 100 \%$, where A – the number of females at the beginning of the experiment; B – the number of dead females during the experiment. The volume of liquid and dry food consumed was determined daily at the same time. Five females of each group were used to determine intrauterine mortality. For this purpose, on the 20th day of pregnancy, the uterus, fallopian tubes and ovaries were removed under chloroform anesthesia in rats and the number of yellow bodies was counted under the binocular magnifier MBS-2. The number of live and dead fetuses and the number of implantation sites were determined in the uterine horns. Total embryonic, pre-implantation, and post-implantation mortality was calculated:

Total embryonic mortality (%) = $(VT - VT) / VT \cdot 100 \%$;

Preimplantation mortality (%) = $(VT - MI) / VT \cdot 100 \%$;

Post-implantation mortality (%) = $PP / MI \cdot 100 \%$,

Where VT – the number of yellow bodies; VP – the number of live fetuses; MI – the number of implantation sites; PP – the number of dead fetuses .

The mortality rate of newborn rats in the first three days of life was determined by the ratio of the number of dead baby rats to the number of live births. The obtained digital indicators were processed using the statistical package "Microsoft Excel". The t value was estimated from the Student's table. The differences between the two compared values were considered significant at $P < 0.05$.

Research results and discussion

Our study showed that adaptation to ethanol does not occur in all females, often the introduction of ethanol leads to their death. 2 periods of increased animal mortality were determined. The first one occurred in the 1st month of the experiment and was characterized by a maximum mortality of females, reaching 25 %, which, apparently, is due to the inability of the body to adapt to ethanol. Previously, it was found that in the rat population there are a significant number of individuals who completely reject ethanol. The second period of increased mortality was the 5th and 6th months of the experiment, when this indicator was 10% and was probably due to changes in the female's body due to prolonged alcohol intoxication. In experimental animals, the duration of pregnancy increased, which in the control group rats was 21 days. The gestation period was most significantly prolonged in females exposed to ethanol for six months prior to fertilization. In rats exposed to ethanol only during pregnancy, as well as for 3 and 5 months before pregnancy, labor occurred 3 days later than in control animals. In the remaining terms of the experiment – alcoholization of females during the 1st, 2nd and 4th months before pregnancy-its duration was 22 days. Apparently, this reaction to the effects of ethanol is due to the specific characteristics of the rat, whereas in humans, on the contrary, a fairly high frequency of preterm birth was revealed in women who used ethanol before and during pregnancy. Depending on the duration of alcoholization of females before pregnancy, the indicators of intrauterine fetal mortality also changed. The structure of total intrauterine mortality was



dominated by preimplantation mortality, the highest rates of which were observed in rats treated with ethanol only during pregnancy, as well as during 2 and 6 months before its onset. The maximum post-implantation mortality was recorded in females exposed to alcohol for 5 months before pregnancy. An increase in preimplantation mortality in rats exposed to ethanol during pregnancy was indicated by V. P. Ganapolsky (2008) [2].

The mortality of offspring in the early postnatal period also depended on the duration of exposure to ethanol on the body of females. This indicator gradually reached 100 % in the offspring of females who received ethanol for 3 months before and during pregnancy. Then it decreased, and by the end of the experiment (5 months of pregravidar exposure) it became minimal. At the same time, we did not find any obvious external pathology caused by the embryonic and fetotoxic effects of ethanol, such as complete organ inversion or pathology of the urinary system organs [3]. In our opinion, this can be explained by the fact that the researchers used intragastric administration of ethanol, and this method of achieving alcohol intoxication is an additional stress factor that aggravates the experimental effect.

Conclusion: Thus, it can be concluded that in alcoholized female white mongrel rats, the duration of pregnancy and mortality of their offspring depend on the duration of ethanol exposure.

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