

EXPERIMENTAL DATA ON THE EFFECT OF ALCOHOL ON FERTILIZATION

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The effect of alcohol poisoning on fertilization and on the early stages of embryonic development was studied in experiments on golden hamsters. Abnormalities in the early development of the embryos arise during chronic alcohol poisoning. Poisoning with a single dose of alcohol, especially in the period of estrus and mating, leads to disturbances of fertilization and an increase in polyspermia. An experimental model is suggested for the detection and study of disturbances of fertilization and the effects not only of alcohol but also of other substances and preparations on it.

KEY WORDS: alcohol poisoning; fertilization; early stages of development.

The harmful effect of chronic alcoholism and acute poisoning in man is well known [2, 3]. Experiments on rabbits and mice have shown that alcohol affects the metabolism of the fetus, disturbs implantation, and induces spontaneous abortion [3, 6-8].

The object of this investigation was to make an experimental study of the effect of alcohol on fertilization and on the early stages of embryonic development.

EXPERIMENTAL METHOD

More than 100 golden hamsters from the laboratory nursery were used in experiments to study the action of alcohol. Alcohol was given to the animals in the form of 30 degrees ethyl alcohol for 1-2 months at intervals of 1-2 days. Addiction to alcohol developed very rapidly and the hamsters eagerly took a dose of about 1 ml from the pipet. Signs of intoxication soon developed, as shown by a sharp increase in movements, disturbances of movement coordination, and some aggressiveness.

Copulation took place in the evening. Vaginal smears were examined after 18-20 h, and the animals were then killed. The ovaries, oviducts, and uterus were fixed in 10% formalin and embedded in celloidin. The writer has suggested [1, 4, 5, 7] a special method of serial investigation of the uterine tubes twisted into a coil, so that oocytes can be found in the stages of fertilization, and cleavage and the dynamics of their passage along the oviducts analyzed. To begin with, sections were examined in glycerol under low power of the microscope. Preparations in which oocytes were found were stained with hematoxylin and eosin or with gallocyanin, and the oocytes were counted and studied.

EXPERIMENTAL RESULTS

The action of alcohol was revealed both by the study of individual hamsters and by analysis of groups of the experimental animals. Each group (control and experimental) contained 10 animals, kept under identical conditions (Table 1).

Alcohol considerably reduced the number of oocytes entering the tubes (Table 1), the number of fertilized ova was reduced, polyspermia was more marked, and the number of unfertilized and dying ova was increased.

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TABLE 1. Character of Fertilization in Experimental and Control Hamsters

Group of Animals	Total number of ova	Normal fertilization	Polyspermic fertilization	Unfertilized and dying ova
Control	80	70	8	2
Experimental: receiving alcohol for 1 month	66	42	18	6
Experimental: receiving alcohol for 2 months	65	40	19	6

The writer accepts the observations of Austin [6] that polyspermic ova and the embryos developing from them usually die. However, there is another possibility: further development of the embryos as a result of elimination of one of the additional pronuclei or of individual chromosomes. Individuals may arise with the chromosome combination $2n + 1$, $2n - 1$, or with other combinations characteristic of certain chromosomal diseases.

The results of these experiments show that hamsters are a very convenient object with which to study the action of various preparations on fertilization and early development of the embryo.

Pathological fertilization and dying zygotes were observed in the hamsters not only after chronic exposure to alcohol. Some characteristic changes were found after administration of single doses of alcohol to the females during estrus, before copulation. In these cases dying ova and zygotes also were found. Marked polyspermia was present.

These results, however, require further confirmation by special experiments. However, they emphasize the special action of alcohol during ovulation. The dynamics of passage of the ova along the tubes is modified, so that normal fertilization is disturbed and polyspermia and death of the zygote ensue.

The results of these experiments go some way toward explaining the frequency of malformation in children whose parents suffer from alcoholism, and also in children conceived in a state of inebriation.

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