A. BIOLOGICAL SCIENCES

EFFECT OF UNILATERAL OVARIECTOMY ON PREGNANCY, LITTER SIZE AND LACTATION IN THE ALBINO RAT*

CARL A. BUNDE and ARTHUR A. HELLBAUM
University of Oklahoma School of Medicine

Removal of one ovary results in a compensatory hypertrophy of the remaining ovary. This has been observed by Slonaker (1927), Engle (1928) and others. However, it is not known whether this hypertrophy results in a complete functional compensation or whether it is merely an anatomical effect. In other words, is an animal with one ovary, even though it be enlarged, as efficient in regard to reproduction as a normal animal with two ovaries.

Results of previous experiments also indicate that in the rat all of the young are found in the uterine horn on the same side as the remaining ovary. Reports on litter size of rats with one ovary are conflicting. Some state that no variation from the normal exists, while others find a decrease in the number of young per litter. However, most of these investigations compared the averages obtained from a relatively small number of litters of unilaterally ovariectomized rats with averages published elsewhere on different colonies. Such comparisons are unreliable because the average litter size may vary in different colonies.

The reproductive capacity of the female can be measured by: (1) the number of pregnancies over a given period of time, (2) number of young per litter, (3) lactation and care of young. To measure these three points has been the particular object of this experiment.

METHOD

Of 42 rats of the same weight and age, the right ovary was removed from 11 and the left ovary from 10. The remaining 21 were used as controls. Fifteen days after unilateral ovariectomy, all 42 rats were placed in cages with males and examined regularly to see if pregnancy had occurred. Pregnant animals were placed in separate cages and examined twice daily. When parturition occurred the young were counted and all in excess of 6 discarded. Twenty-two days after birth the young were again counted and in all litters where 6 survived, body weights were taken. After two weeks rest the females were again placed in with males.

After a sufficient number of litters were born and data taken, the pregnant animals were killed during the latter part of gestation and the number and position of the fetuses in the uterus were recorded, as well as the weight of the ovary, or ovaries, as the case may be, and the number of corpora lutea.

RESULTS

As seen in Table I, 39 control litters gave an average of 8.56 young per litter with a range of 6 to 13. From the unilaterally ovariectomized females, 33 litters gave an average of 8.06 young per litter with a range of 3 to 12. The control litter weight averaged 232.3 grams with a range

* Supported by a grant from the Medical Research Fund of the University of Oklahoma School of Medicine.

TABLE I

Effects of Unilateral Ovariectomy on Reproduction.

	Control	Unilaterally Ovariectomized
No. animals used	21	21
Total no. of pregnancies	39	36
Litter size	8.56 (39)*	8.06 (33)
Range of litter size	6-13 (39)	3-12 (33)
Litter weights at 22 days (6 young per litter)	232.3 gms. (19)	225.6 gms. (15)
Range of litter weights	170-272 gms. (19)	176-277 gms. (15)
No. young died before 22 days	7 (26)	2 (18)
Ovarian weight (latter part of gestation)	76.2 mgs. (10)	70.8 mgs. (14)
No. corpora lutea	10.3 (10)	10.6 (14)
No. of fetuses **	8.90 (10)	8.07 (14)
% of ova developed into fetuses	86.4	76.1

* Numbers in parentheses represent number of litters or animals on which averages are based.
** Computed only from those in which corpora lutea were counted.

of 170 to 272 grams, as compared to an average litter weight of 225.6 grams and a range of 176 to 277 grams for the unilaterally ovariectomized group. It will be noted on Table I that these weights are based on data of only 19 control and 15 experimental animals. The reason for this is that only litters in which 6 young lived through to 22 days were used because the weight of the young at weaning varies indirectly with the size of the litter raised. (Engle et al, 1937).

In 26 litters of the control group, 7 young died between birth and weaning whereas only 2 young died in 18 litters raised by the experimental females.

The data indicate a compensatory hypertrophy of the one remaining ovary to almost twice its normal size. The single ovary of unilaterally castrate rats averaged 70.8 mgs. during the latter part of pregnancy compared to an average weight of 76.2 mgs. for both ovaries of normal animals during the latter part of pregnancy. The single ovary also contains about the same number of corpora lutea as both ovaries of the control group.

It has further been observed by us that, in the unilaterally castrate females killed during pregnancy, all the fetuses are in one horn of the uterus—the horn on the same side as the remaining ovary. No crossing over occurs either of ova through the body cavity or of embryos through the cervix.

DISCUSSION

A single horn of the rat uterus can provide for the development of as many as 12 young, and the single remaining ovary in unilaterally ovariectomized animals (assuming the number of corpora lutea to be an index of ovulation) produces as many ova as both ovaries in normal females. Therefore one would not be surprised to find that animals with one ovary have almost as large litters on an average as animals with both ovaries intact. The crowding of young may increase early intrauterine death but the effect is slight since there is but little difference in the average litters of the control and experimental groups. This may be illustrated by the data on Table I which shows that 86.4% of the ovulations resulted in near-term fetuses in the controls whereas only 76.1% of the ova in the experimental group developed that far. Three unilaterally ovariectomized animals killed during very early pregnancy (1 mm. embryos) had 12, 12 and 13 embryos respectively. Since only one litter out of 33 had as many as 12 young at or near term, it is probable that in these three animals not all of the embryos would survive until term. These three animals were not included in the averages given on litter size.

Apparently lactation and care of young is in no way affected by removing one ovary since the difference in litter weight at weaning is not significant and the per cent of survival favors the unilaterally ovariectomized mothers.

In the rat both the ovary and oviduct are enclosed by a common peritoneal fold, so external migration of ova could not occur. The duplex type of uterus in the rat would make very unlikely any internal migration of fertilized ova. No instance of cross over was found by us and in this we agree with Slonaker (1927) and Crew (1927).

Since during the period of the experiment 39 pregnancies occurred in the control group of 21 females, and 36 pregnancies were obtained in the group of 21 experimental females, it can be concluded that unilateral ovariectomy has little, if any, effect on oestrous cycles and sexual activity.

When the results given here and those presented by previous authors are considered, one can but conclude that the loss in reproductive efficiency resulting from removal of one ovary is very slight indeed. One might also speculate that in animals where the two uterine horns are not completely separated as they are in the rat, the loss in reproductive efficiency would be nil.

CONCLUSIONS

Unilateral ovariectomy in the rat has no effect on oestrous and sexual activity, number of ova produced, or lactation and care of young. It causes no significant difference in size of the litter. Fertilized ova do not cross over and implant in the horn of the uterus opposite the side of their origin. The hypertrophy of the one remaining ovary is about 100 per cent.

BIBLIOGRAPHY

CREW, F. A. E. Biol. Generalis, 3: 207, 1927.
ENGLE, E. T. Anat. Rec. 37: 275, 1928.
ENGLE, E. T., R. C. CRAFTS and C. E. ZEITHAML. Proc. Soc. Exp. Biol. & Med. 37: 427, 1937.
SLONAKER, J. R. Am. Jr. Physiol. 81: 620, 1927.