Early Egg Loss in Chinchilla [1]

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THIS PAPER on *Chinchilla* is restricted to a study of that loss of eggs or early blastocysts which occurs prior to the time when their presence might be detected by a pregnancy reaction due to an implanting blastocyst or indicated otherwise by a normal or abnormal embryo. Although there are several papers dealing with reproduction in Chinchillidae (Dennler, 1940; Hillemann and Tibbitts, 1955*a*, 1955*b*; National Chinchilla Breeder, 1954, 1955; Pearson, 1948, 1949), none of them bring any information to bear on this point of early egg loss.

Materials and Methods

The 30 pregnant female chinchillas forming the basis of this study were obtained exclusively by gift from ranchers in California, Oregon, Washington, and scattered points elsewhere in the nation. These animals were domestic hybrids of *Chinchilla lanigera* Bennett, *C. brevicaudata* Waterhouse, and *C. intermedia* Hansen.

The ovaries were removed from the animals at sacrifice, weighed individually and fixed in Bouin's fluid. Animals received deep-frozen, and which either had been pelted or died from various causes, were given similar treatment on arrival. All uteri were carefully opened and a record made of the number and site of pregnancy reactions, and of the embryos both normal and abnormal. All embryos were measured (crown-rump), weighed, processed with the alizarian technique, and stored for projected later studies. Some of the uteri and placentae were fresh-fixed in Bouin's and stored in 70-per-cent ethanol, while others were injected intravascularly with colored latex, preserved and set aside for later use.

All ovaries were sectioned at 10-15 microns, mounted on 2 inch by 3 inch slides, stained with hematoxylin and eosin, and studied under the microscope as well as on the screen. A count was made of all corpora lutea of gestation and accessory corpora lutea of gestation. A careful distinction was made between the two kinds of corpora lutea on the basis of size. Corpora lutea held over from previous cycles were excluded on the basis of their involutional histology.

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For each female, a record was kept of the number and uterine horn site (whether right or left) of the pregnancy reactions and embryos, along with the number of corpora lutea of gestation and accessory corpora lutea and their respective ovarian site, whether in the right or left. From the number of corpora lutea of pregnancy for each ovary, the number of embryos or loculi in the corresponding uterine horn was subtracted to give a figure representing the number of eggs unaccounted for that ovary. By dividing the number of embryos by the number of corpora lutea of pregnancy, a quotient was obtained representing the percentage yield; and this figure subtracted from 100 gave the percentage of early egg loss for each ovary. Only one case of suspected diovular follicle was found, and a correction was made for this so that in all cases, each corpus luteum represented one egg only.

The numbers of corpora lutea of pregnancy for the two ovaries of all animals were then lumped, and so also the loculi. On this basis an over-all percentage loss of eggs was calculated for the average ovary, whether right or left.

And finally, by dividing the total number of corpora lutea of gestation on the one hand, and the total number of loculi on the other, by the number of animals, the average number of corpora lutea of pregnancy per animal, and the average number of loculi per pregnant animal was obtained. With these figures it was possible to calculate the average percentage of early loss of eggs per mother.

Any embryo or loculus appearing in either uterus was assumed to arise from an egg ovulated from the corresponding ovary on the same side, for although egg migration across the coelom is possible with the ovarian bursa open to the coelom (as in viscacha, Pearson, 1949), this phenomenon is known to be of rare occurrence. Such a migrating egg hazards the chance of being permanently lost in the coelom. Migration through the cervix of one uterus into the vagina and then through the other cervix and into the other uterus was discounted as having occurred. Presumably any egg leaving through one of the cervices of this uterus duplex is permanently lost in the vagina. It is of interest to note in this connection, however, that Runner (1951) found one instance in which a genetically tagged embryo migrated from the right to the left uterine horn internally in the mouse by way of the small fundus uterus posterior to the uterine horns. Pearson (1949) considered transmigration of blastocysts possible from one uterine horn to the other through the corpus uteri of the bipartite uterus in a related genus of chinchillid, the mountain viscacha (*Lagidium peruanum* Meyen), since as he further states, uterine fluid can pass readily from one horn to the other at estrus. But the uterus of *Chinchilla* is duplex.

Observations and Discussion

In these 30 pregnant animals, the number of corpora lutea of pregnancy ranged from 0 to 4 in the left ovary, and from 0 to 6 in its mate, or from 2 to 8 for the animal. The number of accessory corpora lutea ranged from 0 to 16 in the left ovary, and from 0 to 20 in its mate, or from 0 to 32 for the animal. The number of embryos ranged from 0 to 4 in each uterus, or from 1 to 7 for the animal. The number of unaccounted eggs ranged from 0 to 3 in the left uterus, and from 0 to 4 in its mate, or from 0 to 5 for the animal. Accordingly, the per cent loss of eggs ranged from 0 to 100 in each uterus, and from 0 to 75 for the animal.

From Table 1 it may be seen that the average numbers of corpora lutea of pregnancy for the right and left ovaries are 2.1 and 1.8, respectively. In the matter of embryos or loculi, there is an average of 1.4 in the right and 1.3 in the left uterus. The number of unaccounted eggs in the right uterus is 0.66 and 0.43 in the left, and in percentage this is 31 per cent and 24 per cent, respectively.

In combining the data for both ovaries in all of the 30 pregnant animals, one finds an ovarian average of 1.95 corpora lutea of pregnancy, 1.4 embryos or loculi per uterus, 0.55 eggs unaccounted, and an over-all early loss in eggs of 28 per cent.

Finally, calculations are made for the average animal. Thus the average number of corpora lutea of gestation per animal is 3.9, the average number of loculi per animal is 2.8, and the average number of unaccounted eggs is 1.1 per mother. The calculated average percentage loss of eggs per mother in this early area of development is 28 per cent.

The average per cent early loss of ova in *Chinchilla* of 28 per cent compares favorably with the statement of Corner and Bartelmez (1954) to the effect that accumulated lethal genes are sufficient to explain the prenatal loss of one third of all the zygotes in mammalian species.

It should be noted that the figures obtained are those for animals which represent varying degrees of hybridization among three species of domesticated chinchillas, *viz., Chinchilla lanigera, brevicaudata,* and *intermedia.* All three may, in their native and unhybridized state, present a picture of early egg loss distinctly different, one from the other.

This early egg loss in *Chinchilla* provisionally is presumed to be due in great measure to defective germs and less to an inhospitable uterine environment. This proposition gains creditability from studies in other mammals such as that of Hertig *et al.* in 1954, dealing with man. These authors state that abnormal morulae are relatively common in the human uterus, and

TABLE 1. SUMMARY OF CORPORA LUTEA OF GESTATION AND LOCULI

	Total Number	*Average per Ovary*
Left Ovary and Left Uterus (30 of each)		
Number of accessory corpora lutea	219	7.30
Number of corpora lutea of pregnancy	54	1.8
Number of embryos or loculi	41	1.3
Number of eggs unaccounted	13	0.43
Percentage loss of eggs	——	24.0
Right Ovary and Right Uterus (30 of each)		
Number of accessory corpora lutea	258	8.60
Number of corpora lutea of pregnancy	63	2.1
Number of embryos or loculi	43	1.4
Number of eggs unaccounted	20	0.66
Percentage loss of eggs	——	31.7
Right and Left Ovaries, and Right and Left Uteri Combined (60 of each)		
Number of accessory corpora lutea	477	7.95
Number of corpora lutea of pregnancy	117	1.95
Number of embryos or loculi	84	1.4
Number of eggs unaccounted	33	0.55
Percentage loss of eggs	——	28.2
Average Figures per Animal (30 animals)		*Average per Animal*
Number of accessory corpora lutea	477	15.9
Number of corpora lutea of pregnancy	117	3.90
Number of embryos or loculi	84	2.8
Number of eggs unaccounted	33	1.1
Percentage loss of eggs	——	28.2

describe the defects as consisting of delays in the rate of segmentation, in the presence of necrotic cells, in the lobulation of nuclei, or in a multinucleate condition of the blastomeres, and as arising from the intrinsic defective quality of the zygote rather than from the environment. Similar work by Corner and Bartelmez in 1954 on another primate (rhesus monkey) is to the same effect, namely, that constitutional or genetic defects are an important cause of early egg loss. They point out that it is now known that the accumulation of lethal genes in mammals is amply sufficient to explain prenatal losses of one third of all the zygotes, which have been observed in many mammalian species, and that the thesis which points to genetic defects as a common cause

of prenatal mortality among mammals has been firmly established. In 1951, Runner included genetic defects along with maternal limitations as accountable for prenatal losses in polytocous mammals, *e.g.,* mice. Rafferty-Machlis and Hartman in 1953 studied early death of the ovum in the opossum and made observations on moribund mouse eggs. Romanoff, in his paper of 1949, included genetic teratism along with other considerations as being responsible for death in avian embryonic development. Evans and Burr (1927) associated the lack of vitamin E with fetal death before the 11th day. Recently Perry (1945) reported on rat embryos lost between ovulation and a few days after implantation. Since then, several strains of rats were studied by Fraser (1955) with an analysis of the factors responsible for the loss of embryos before and after the 9th day of pregnancy.

The literature on this subject of egg and embryo loss due to genetic lethal effects, among other causes, is large, and without attempting to refer to all of it, one might at least mention the review article on lethal facors in development by Salome Gluecksohn-Waelsch which appeared in 1953.

Summary and Conclusions

1. A total of 30 pregnant chinchillas were analyzed to determine early egg loss, on the basis of counts of corpora lutea of gestation and embryos or loculi.

2. The right ovary harbors, on an average, 2.1 corpora lutea of pregnancy while the left has 1.8.

3. The right uterus contains an average of 1.4 loculi as compared with 1.3 for the left.

4. The number of unaccounted eggs are 0.66 and 0.43 for the right and left sides, respectively.

5. With figures for the right and left sides grouped together, one obtains an average of 1.95 corpora lutea of pregnancy per ovary, 1.4 loculi per uterus, and 0.55 eggs unaccounted per side.

6. A statistical analysis of data gave no assurance of any functional dominance of either ovary over its mate in the numbers of corpora lutea or in the numbers of eggs lost on either side. Similarly no significant difference was found in the numbers of embryos in paired uteri.

7. For the average animal, the total number of corpora lutea of pregnancy is 3.9, total number of loculi is 2.8, and total number of eggs unaccounted is 1.1 per female.

8. The over-all average early loss of eggs is calculated at 28 per cent per pregnant *Chinchilla.*

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