

INDIRECT EFFECTS OF SELECTION FOR TESTIS WEIGHT IN MICE
IN FEMALE REPRODUCTION PERFORMANCE

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SUMMARY

Selection for increasing testis weight in mice resulted in a considerable direct response. The rise in ovulation rates was also observed in selection lines. Yet, it was not accompanied by an increase in litter size, because of greater fetus losses in these lines. One of the indirect effects of selection was the increase in placenta weight and placenta volume on the 18th day of pregnancy. It was particularly significant in the line which had the highest testis weight.

INTRODUCTION

The possibility of using testis weight as an indirect selection for female prolificacy was considered by several investigators as Land 1973, Land et al 1979, Ricordeau et al 1979. The first experiment on mice showed that testis weight is an additive $h^2=0,52$ / trait and that it is correlated with ovulation rate./Islam et al 1975/.

In our institute mice have been selected for an increased testis weight over 20 generations.

MATERIAL AND METHODS

We formed 4 selection lines /K-1,K-2,S-1,S-2 / each consisting of 15 males and 45 females. Lines S-1 and S-2 /replication/ are selected for testis weight on the basis of father performance measured post mortem at 11-12 weeks of age. For further breeding we selected the sons of 4 best fathers and daughters of 12 fathers. The progeny of 3 fathers with the lowest testis weight was culled. The control line K-1 is conducted according to Hannover system as an outbred line. In the control K-2 line we used identical pattern of mating as in selection lines in order to obtain similar inbred. K-2 line is used for the determination of inbred depression.

In all the lines testis weight and body weight of males are measured, testis weight to body weight ratio calculated and females prolificacy in the first litter estimated. Lines from this experiment were used for the investigation the reproduction performance

of females in prenatal period.

We used 111 females from the XXth generation which were selected as mothers for the next generation.

On the 8th day of pregnancy laparotomy was carried out to count the number of corpora lutea, implantation places, the number of embryos and early resorption. Using these data we calculated the number of early losses /early resorption + pre-implantation losses/ being a difference between the number of corpora lutea and the number of embryos present.

On the 18th day of pregnancy females were dissected to estimate the number of living fetuses, late resorption and dead fetuses. The percentage of late resorption / resorption after 8th day + dead fetuses / was estimated in relation to the number of corpora lutea and to the number of implantation places. The weight of the 18th day fetuses and their placentae were recorded.

The size of each placenta was measured in order to determine the volume of placentae and the area of contact with uterine wall.

Statistical analyses were conducted using the one-degree variation analysis and Duncan test. The phenotypic correlations between some of the traits were also estimated.

RESULTS

The selection resulted in a considerable increase in testis weight of both selection lines. The increase in S-2 line was significantly higher than that in S-1. The increase in testis weight was not accompanied by an increase in body weight, thereby the testis weight / body weight ratio was much higher in selection lines. There was no substantial prolificacy increase in the first litter.

The potential and actual prenatal prolificacy of the investigated females were estimated. There were no distinct differences between the S-1, S-2 and K-2 lines in the number of embryos on the 8th day of pregnancy. The K-1 line had the lowest level of ovulation and differed statistically from other lines. The K-1 line had also the lowest number of embryos and the lowest percentage of early losses -both statistically insignificant. Lines S-1 and S-2 had the highest percentage of early losses and the highest percentage of females with these losses.

On the 18th day of pregnancy there were no differences in litter sizes between the lines. This was due to the increase of late resor-

ption as well as fetus mortality in lines with higher ovulation rates. The overall percentage of losses was the lowest in K-1 and the highest in selection lines.

There were significant variations in fetus and placenta weight among the lines. Fetuses from control lines were heavier than those from selected lines / 919 and 912 mg in K-1 and K-2, 883 mg in S-1 and S-2 , $p < 0,01$ /. Placenta weight ,its volume and the area of contact with uterine wall were significantly greater in S-2 than in other lines / 127 mg,108,88 in S-2 respectively,117,95,81 in S-1, 118,92,78 in K-2,114,87,76 in K-1, all $p < 0,01$./ It may be considered as an indirect effect of selection.

The correlation between the mean value of the above traits of females and the testis weight of their fathers were not significant. In K-1 line correlations of fetal weight and placental weight were close to zero. Whereas the correlations of placenta volume and the area of contact with uterine wall were negative. In S-1 and S-2 correlations / with the exception of placenta volume in S-1 being close to zero / were positive / approximately 0,3/. For S-2 all correlations were negative. The results obtained are difficult to interpret because of the small number of observations. However these results may have physiological interpretation and therefore they should undergo further investigation.

DISCUSSION AND CONCLUSION

As was expected the direct result of the selection was an increase in testis weight different in the two selection lines. It is consistent with the opinion of Falconer /1977/ that reactions to selection are unrepeated.

In both selection lines as well as in the inbred K-2 line we observed the increase of ovulation rate as compared with K-1 line. However it did not influence the litter size due to greater fetus losses in S-1,S-2 and K-2 lines. Similar observation were made by Wirth-Dzięciołowska /1973/,Bradford /1979/.

The decrease in fetus weight in both selection lines is difficult to interpret. The most interesting indirect selection response was the change in placenta weight on the 18th day of pregnancy.In S-2 line,in which the testis weight was highest,we also found the biggest and heaviest placentae / $p < 0,01$ /.These results may have physiological explanation and should be further investigated.

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