GENOTYPE X ENVIRONMENT INTERACTION – EFFECT OF REARING ENVIRONMENT ON CARCASS COMPOSITION

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Phenotype of an animal is a function of genotype and environment. The relationship between genotype and environment may be additive or non-additive. Statistically these associations between genotype and environment are respectively expressed as linear and non-linear relationship and the latter is referred to as genotype x environment (GXE) interaction. This in simple terms means that animals ranked according to their performance in one environment need not necessarily stick to the same ranking in other environments. In this situation animals selected in one environment will not bring the expected results if put for breeding in another environment.

Performance testing is widely employed in meat producing animals as an aid to selection. To increase the accuracy of the data collected, animals are usually housed in individual pens when subjected to performance testing. However the selected animals will be put to breeding, usually, in farms where the animals are reared in groups. If there is a G X E interaction between the genotype and the two environments (viz individual and group rearing) selection based on the performance in individual pens is not the best method for improvement in group rearing environment. With this idea, an experiment was set up to test, whether the expression of a particular genotype is altered by the rearing environment (individual vs group rearing). Since carcass composition is an important production character for a meat producer, the role of rearing environments in altering the carcass composition is taken up for this study.

Prof. Falconer’s Laboratory mice were used as animal model for this simulated farm oriented experiment. Although results from laboratory mice cannot be directly applied to domestic species they can certainly serve as models to test any hypothesis initially.

MATERIALS AND METHODS

‘Q’ lines of mice (Falconer, 1973) were utilised for this study. Matings were set up in harems. Females which were visibly pregnant were placed immediately in individual cages until their litter was weaned on the 21st day. Individual body weight at weaning was recorded. One animal per litter was selected at weaning and placed in individual

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cage up to the age of six weeks with roughly equal numbers for the two sexes. The remaining animals in the litter were kept in groups to a maximum of six per cage up to the same age. Both the individual cages and the cages housing groups of animal provide plenty of moving space to the animals, thereby removing the complication arising due to restriction of movement and conservation of energy in terms of fat.

On the day the animals reach six weeks of age they were weighed and slaughtered to evaluate carcass quality. For every animal slaughtered from the individual cage environment, a group housed littermate was also dissected to observe the effect of rearing environment on carcass composition. Since a livestock farmer is interested in the proportion of lean and fat content in the carcass, dissections were oriented towards obtaining these results. A simulated 'butchers cut' of the hind quarters as a measure of lean and gonadal fat as an indicator of total body fat (Hull, 1960; Allen, 1977; Eisen and Leather Wood, 1978) were dissected from every slaughtered animal and weighed.

Harvey’s (1975) least square technique was used to analyse the data. The difference in means between the two environments was tested for significance by developing linear contrasts.

RESULTS AND DISCUSSION

Mean gonadal fat and hind quarters expressed as a percentage of body weight are presented in Table I.

<table>
<thead>
<tr>
<th>Method of rearing</th>
<th>Mean (% of Body weight) ± S. E.</th>
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<tbody>
<tr>
<td></td>
<td>Gonadal fat</td>
<td>Hind quarters</td>
</tr>
<tr>
<td>A. Individually reared (142)*</td>
<td>0.76 ± 0.03</td>
<td>11.55 ± 0.21</td>
</tr>
<tr>
<td>B. Reared in groups of six (114)*</td>
<td>0.89 ± 0.08</td>
<td>12.18 ± 0.25</td>
</tr>
<tr>
<td>Superiority of the animals reared in groups (B−A)</td>
<td>0.13**</td>
<td>0.63**</td>
</tr>
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Note: * Where the litter size was larger, two or three animals from the same litter were reared individually. However at six weeks of age only one littermate from the group environment was slaughtered. No. of mice involved shown in brackets.

** denotes P < 0.01.
Animals housed in groups showed higher fat and hind quarters percentage than those reared individually. Results similar to this were also reported by Bakker et al. (1976). The observed results could be due to the fact that genes for growth in this species are better expressed under group environment or it could also be assumed that different genes are controlling the character in these two environments. On the whole it can be concluded that there exists a significant G X E interaction for carcass composition and rearing environment in mice. Further it suggests that in the domestic species such a kind of interaction could exist which need to be experimentally tested in the species of interest before being put to practice.

SUMMARY

Based on the mouse model a hypothesis is put forward that there exists an interaction between genotype and rearing environment, which needs to be experimentally proved in the species of interest.

REFERENCES


