

EFFECT OF THE HOUSING SYSTEM ON THE MEAT PRODUCTION OF TURKEY

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ABSTRACT

The aim of our investigations was to study the ability of heavy type turkey genotypes developed for intensive systems using semi extensive (aviary) and extensive (free-range) systems and the effect of the different environment on the performance. The semi extensive conditions appeared to be well adapted to the technology of producing high performance heavy type turkey and it does not cause decrease in the production parameters. In the case of the carcass yield also disadvantageous changes are prognosticable. The live weight of the intensively and semi extensively reared groups did not differ significantly prior to slaughtering, but in the case of male turkey the outdoor keeping achieved a 40% lower bodyweight in a 4 weeks longer period than the males in the other two systems. In the case of females the difference was lower but the performance also showed a 20% decrease in the outdoor system. The carcass yield showed a decrease in both of sexes of the free-ranged turkeys but it was statistically significant ($P < 0.01$) only in the case of females. The ratio of the breast fillet of the female turkeys in the free-range system was higher than in the other groups. The heart – as an important organ of the maintenance of the physiological functions – weight ratio was not affected by the rearing conditions but compared to the grill – ready body weight it was found to be incredibly low. Our results confirm the hypothesis that the heavy type hybrids are able to adapt to the extensive environment but a longer rearing period results only in a significantly lower final bodyweight. Regarding the carcass yield disadvantageous changes are predicted in the case of both sexes.

Keywords: turkeys / meat production / housing systems / free-range system / aviary system / intensive system

VPLIV NAČINA UHLEVITVE PUR NA PRIREJO MESA

IZVLEČEK

Namen raziskave je bil proučiti sposobnost pur težkih tipov, namenjenih intenzivnim načinom rej, za rejo v polintenzivnem (voljere) in v ekstenzivnem sistemu (prosta reja) ter vpliv različnega okolja na njihovo učinkovitost. Polintenzivni pogoji reje so se izkazali kot dober sistem za rejo pur težkega tipa, v katerih se proizvodni parametri niso poslabšali. Neželene spremembe je mogoče napovedati tudi za klavnost. Telesna masa živali pred zakolom se med skupinama intenzivna reja in polintenzivna reja ni statistično značilno razlikovala. Purani iz skupine prosta reja, ki so jih pitali 4 tedne dlje, so dosegli 40 % manjšo telesno maso kot purani iz drugih dveh sistemov rej. Razlika med skupinami pur je bila manjša, vendar je bila učinkovitost v prosti reji za 20 % zmanjšana. Klavnost se je pri obeh spolih v sistemu proste reje zmanjšala, vendar pa je bila statistično značilno ($p < 0,01$) manjša samo pri purah. Delež prsne mišice pur iz skupine prosta reja je bil večji kot pri ostalih skupinah. Srce ima pomembno fiziološko funkcijo. Na delež srca pogoji reje niso vplivali, v primerjavi z maso trupov, pripravljenih za pečenje na žaru pa je bil delež zelo majhen. Rezultati potrjujejo predpostavko, da se težki tipi pur lahko prilagodijo ekstenzivnemu okolju, pri čemer pa imajo živali kljub daljšemu pitanju statistično značilno manjšo končno telesno maso. Tudi za klavnost je mogoče pričakovati negativne spremembe pri obeh spolih.

Ključne besede: purani / meso / prireja / sistemi uhlevitve / prosta reja / voljere / intenzivna reja

INTRODUCTION

Majority of the worldwide produced turkey meat originate from heavy type turkey hybrids reared intensively on a basis of intensive nutrition. The actual final live weight at the age of 20 weeks (20–22 kg and 12–14 kg in case of male and female, respectively) is the result of a strenuous genetic selection of the last decades. According to Horn *et al.* (2000) the heavy type turkey males realise 74% higher final live weight at the age of 20 weeks than 30 years ago. Also the female's performance has shown a 75% increase compared to the status in 1973. In the next 10 years as the result of the high genetic progression the heavy type turkeys would be able to realise 24 kg at the 21st live week (Nixey, 2002). However, the genetical process could be demandable if the environmental conditions are also taken into consideration since these modern turkey hybrid genotypes are more sensitive than the ancestors some decades before.

As the result of the selection for high performance not only the increase of the final body weight but some undemanded changes also occurred in the existent hybrid turkey stocks. The phenomenon is similar to the process found in the broiler chicken where the appearance frequency of the leg malformation, lability of the cardiovascular system, increased heat-sensitivity and the functional disorder of the immune system showed an increasing tendency indicating the weakness of the constitution (Horn and Sütő, 2000)

These problems enhance the importance of the environmental factors especially the rearing condition. The extensive systems also seem to gain ground considering that the animal welfare become one of the important factors on the market (Bentley, 2002). Most of the breeding companies have developed special lines for outdoor keeping which are usually coloured. These lines could achieve only a lower (45–50%) final body weight in a longer period than the other intensive reared ones.

The aim of our investigations was to study the ability of the heavy type turkey genotypes developed for intensive systems using semi extensive (aviary) and extensive (free-range) and the effect of the different environment on the performance.

MATERIAL AND METHODS

The examinations were carried out on heavy type BUT big 6 turkey hybrids. The experimental animals were introduced into 30 pens (9.2 m²/pen) in the acclimatised, windowless rearing house of test farm of Kaposvar University. The animals were reared in deep-litter till 6 weeks of age; 50 male (5 individual/ m²) and 60 female turkeys (5 individual/ m²) were placed in a single pen.

Management

At the age of 6 week the first group of the animals was transported to the poultry farm of the Institute for Small Animal Research in Gödöllő and placed into an aviary system. The rearing management of this system was elaborated considering the EU directions which meant a minimal 6 m²/turkey ground space, and a maximum 6.25 individual/m² stocking density. The minimal slaughtering age was defined in 140 days. This housing system in conformation was between the intensive and the free-range system, the birds were free in a big place, they could move, walk and fly in a closed area without restraint, they were looking for and eating small animals and plants in the nature. Every group had a house which was opened during the day, therefore they could eat whenever they want *ad libitum* from the diets which were the same like in the intensive system.

The second group of the animals (few in number monitoring group) was introduced into an extensive, free-range system. The available area was approximately 0.8 ha/ individual including

forest and pasture allocating to the animal *ad libitum* in the whole day. Stable was available only for the nights against the predators. The rearing period was continued till the 24 weeks of age.

The third group was managed in the same intensive system than in the first 6 weeks, but the stocking density was lowered. The fattening period was continued till the 20 weeks of age.

Diets used

The same diets were used in the aviary and the intensive system, it was offered *ad libitum*; the feed intake and feed conversion ratio were counted from the daily measurements. The feeding regime of the free range system was totally different. After the introduction a conditioning period was used to change the feed from pelleted feed to the experimental feed (mainly wheat and corn and a smaller amount of tiling). This food was offered *ad libitum* but available only in the evening as a supplement of the pasturing. The food conversion ratio was not counted since the basis of the food was composed of the collected insects and other invertebrates.

Examined parameters and measuring methods

Depending on the rearing system on the 20th (intensive and aviary system) and 24th week (extensive rearing) every parameters connecting to the meat-producing ability were examined. After the slaughtering the carcass was dissected applying the standard procedures described by Jensen (1983).

Statistical analysis

The rearing and dissecting data were estimated considering to the age and sex depending on the rearing system. The analysis of variance (ANOVA) procedure was used to test main effects and interactions; the minimal significant difference ($SD_{5\%}$) between the treatment combinations was defined according to the model published by Steel and Torrie (1980). All data were analyzed using SPSS 7.5 version for Windows program package (SPSS, 1996).

RESULTS AND DISCUSSION

Live weight before slaughtering

The trends of the final live weight and the carcass yield affected by the sex and rearing system are shown in Table 1. The slaughtering was carried out on the 24th and 20th week (free-range and intensive or aviary system, respectively) according to the preparing period.

The results represent well the meat producing ability of the modern heavy type turkey genotypes: the average performance of males is 20 kg at the 20th week but the individual differences could result also approximately 24 kg live weight. It is important to emphasize that the genotype achieved this value not only in intensive system but also in aviary conditions. The live weight of females at the 20th week was founded to be lower but the tendencies were similar in the intensive and semi extensive system.

However, the live weight of the heavy type turkeys reared in intensive or aviary system is very similar, the males till the 24 weeks in the free-range system can obtain only 60% performance compared to the results of the other systems measured on the 20th week. In case of females the differences are lower: the performance of the free-range reared animals is 20% fewer than in the other systems. The differences between the free-range and the other two systems were significant at the level $P < 0.001$ in both sexes.

This difference originates from the fact that the physiological functions of the high performance hybrids are more exploited under extensive conditions where the different stressors

occur frequently. The changes in the environmental conditions could generate decrease mainly in the high performance males. It is well established with the fact that the difference in the live weight originated from the sexual dimorphism in the aviary system is 7 kg against the 1 kg measured under extensive conditions. It suggests that the genetical development of the last 30–40 years had lower impact on the females (partly because of the smaller live weight) than on the high performance males. Therefore, the organism of the females stays closer to the original status; the constitution is better respecting the health management which is associated to a higher stress resistance. This is resulted in a lower performance decrease of the females reared in extensive system compared to other systems. On other hands the 4 weeks longer fattening period has a beneficial effect on the females' performance since they could obtain the optimal yield only some weeks later than the similar males.

Table 1. Live weight and carcass yield data affected by sex and rearing conditions

Rearing system / sex	Live weight, g		Carcass Yield, %	
	B.U.T. Big 6 (male)	B.U.T. Big 6 (female)	B.U.T. Big 6 (male)	B.U.T. Big 6 (female)
Intensive system*	19 374	12 616	77.3	83.4
Aviary system*	19 560	12 960	78.8	78.6
Free-range system**	11 520	10 320	74.5	75.0

* rearing period lasted 20 weeks, ** rearing period lasted 24 weeks

Carcass yield

The carcass yield ranged between the average 83.4% and 74.51% depending on the different groups of rearing systems and sexes. Differences were found in the comparison of the intensive and extensive reared groups but it was statistically significant ($P < 0.01$) only in the case of females. The differences between the intensive and aviary systems were not significant.

Table 2. Ratio of the high quality parts compared to the live weight affected by the sex and rearing system

Rearing system / sex	Ratio of the high quality parts, %				Ratio of the heart, %	
	Breast yield		Thigh yield			
	B.U.T. Big 6 (male)	B.U.T. Big 6 (female)	B.U.T. Big 6 (male)	B.U.T. Big 6 (female)	B.U.T. Big 6 (male)	B.U.T. Big 6 (female)
Intensive system	25.0	26.2	10.2	10.6	0.49	0.44
Aviary system	24.7	23.4	9.7	9.8	0.55	0.50
Free-range system	21.8	25.2	8.4	8.4	0.53	0.50

Ratio of the high quality parts

The changes in the ratio of the carcass and the high quality parts showed similar tendency to the change of the carcass yield. However, the changes in the breast ratio of the females accordingly to the different rearing systems are considerable. The BUT big 6 females had a 1.5%

higher breast yield in the free-range system than in the aviary system. The ratio of the thigh-fillet showed a slightly decreasing tendency from the intensive to the extensive conditions.

The ratio of the heart compared to the live weight was found to be low independently from the rearing conditions. This fact can explain the lability of the cardiovascular system and the problems originating from cardiac decompensation. Based on our results in the heart weight ratio an improving tendency was found with the increase of the extensiveness of the rearing.

CONCLUSIONS

- The live weight of the intensive and semi extensive reared groups differed not significantly prior to slaughtering, but in case of male turkey the outdoor keeping achieved a 40% lower bodyweight in a 4 weeks longer period than the males in the other two systems. In case of females the difference was lower but the performance also showed a 20% decrease in the free-range system.
- The carcass yield showed a decrease in both of sexes of the free-ranged turkeys but it was statistically significant ($P < 0.01$) only in the case of females. The ratio of the breast fillet of the female turkeys in the free-range system was higher than in the other groups.
- The heart—as an important organ of the maintenance of the physiological functions- weight ratio was not affected by the rearing conditions but compared to the grill – ready body weight it was found to be incredibly low.
- The difference in the live weight originated from the sexual dimorphism in the aviary system is 7 kg against the 1 kg measured under extensive conditions. The free-range system had lower impact on the females; resulting a lower performance decrease compared to the intensive conditions.
- Based on our results aviary rearing system appeared to be well adaptable to the technology producing high performance heavy type turkey accepting the animal welfare directions; but not eventuating a decrease in the production parameters.

The intensive system is expected to have an important role in the turkey production but the producers have to take consideration to the optimizing of the stocking density and the elimination of the different stress factors.

Our results confirm the hypothesis that the heavy type hybrids are able to adapt to the extensive environment but the longer rearing period results only a significantly lower final body weight. Regarding the carcass yield disadvantageous changes are predicted in case of both sexes.

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