Acta Agraria Kaposváriensis (2006) Vol 10 No 2, 223-227
Kaposvári Egyetem, Állattudományi Kar, Kaposvár
University of Kaposvár, Faculty of Animal Science, Kaposvár

# Animal welfare aspects of goose liver production without force feeding: selection possibilities for behaviour forms

**M. Molnár, I. Nagy, T. Molnár, F. Bogenfürst**
University of Kaposvár, Faculty of Animal Science, Kaposvár, H-7400 Guba S. u. 40.

***ABSTRACT***

*The objective of our experiment – accomplished between 2003–2004 – was to analyse the basic behaviour forms of the domestic geese (feed intake, playing, social behaviour, preening) in order to determine the selection possibilities for these behaviour forms. Because of the small dataset genetic parameters were estimated using Bayesian statistics through animal model. The heritability of certain behaviour forms was low which suggests that the analysed behaviour forms are mainly determined by environmental factors consequently small selection response can be expected. However, the time spent with feed intake (which is the most important trait from our viewpoint) showed heritability of 0.27–0.28 and might be a suitable selection criterion.*
(Keywords: goose, behaviour, heritability, feeding, animal welfare)

## INTRODUCTION

During the last years foie gras production has been increased worldwide but the majority of the production is confined to a few countries. From the 17000–18000 tonnes fatty liver (geese, ducks and mulard) annually produced worldwide (in the recent years) France is the largest producer sharing 80% of the total production. Concerning foie gras production in gees, Hungary is the largest producer giving 60% of the world's production (that is 9% of the world's total foie gras production; *Guy* és *Guémené*, 2004). The Hungarian production is export oriented (75–80%), the main target countries are France (65%) and Japan. In Hungary the conventional technology of fatty goose liver production is force-feeding (*Bogenfürst*, 1992). Because of the effective lobby of the animal welfare organisations, foie gras production based on force-feeding has to be replaced by alternative methods by 2015. The SCAHAW (1998) published a report in December 1998 on the welfare aspects of the production of foie gras in ducks and geese. In this report force-feeding was rejected as the suitable method of foie gras production. The final conclusion of the report was that force-feeding in its present form – as it damages the liver – was an unsuitable technology from the animal welfare aspects. Implementation of force-feeding was also unsuitable from animal welfare aspects due to the inconveniences caused by the pipe inserted into the oesophagus. Although experimental results of Hungarian researchers disproved the assumption that force-feeding damages the liver (*Locsmándi et al*., 2004) intensive research is being conducted aiming the replacement of this technology in order to produce foie gras (*Bogenfürst et al*., 2000). One alternative is the phased feeding that showed very promising results. However, application of this technology requires a goose genotype that not only responds favourable to phased feeding from the aspects of liver development but also

capable to alter its feeding pattern and willing to consume large amount of feed in a relatively short time.

The objective of the present study was to examine the possible differences of the behaviour forms among the various goose genotypes and to estimate their heritability (especially for feed intake).

## MATERIALS AND METHODS

Methodology of the present study was developed acoording to *Reiter* and *Bessei* (1995) and *Molnár et al*. (1998, 1999). The experimental work could be divided to three parts. The identity of parents of the studied individuals was crucial thus in the first phase of the experiment introduction of the breeding stock, individual egg collection and pedigree hatching were accomplished. Subsequently in the second phase of the experiment the hatched goslings were placed, their behaviour forms were determined, monitored and evaluated. Finally in the third phase of the experiment heritabilities of the various behaviour forms were estimated.

The breeding goose were placed to pens having a basic area of 1.3×2.5 m and the adjacent pens were divided by wire net. The applied stocking density was 0.8 $m^2$ which decreased to 0.54 $m^2$ after placing the nest to the pens. The applied technology corresponded to the intensive technology generally applied (*Bogenfürst*, 1992). The animals were feed with a commercial pellet. Hay was used for litter material, pellet and water were available from feeding-trough and open surface drinkers, respectively.

Hatching of the produced eggs was accomplished in three turns. The goslings with known parents could be placed to 16 pens. Five goslings were placed into a pen. Until the age of four weeks the goslings were placed to pens having a basic area of 1.5×1.5 m and OSB (Oriented Strand Board) lateral panels then they were moved to pens described above (3×2.5 m). Thus it was possible to maintain the stocking density defined by the keeping technology.

Until the thermoregulation system of the goslings was developed (the first two weeks) the appropriate temperature was provided using 250 W infra lamps. The pellet was available ad libitum from feeding-troughs. Once a week behaviour of the geese was recorded by digital cameras directly to personal computer. The behaviour forms were then counted in every minute. At a given time the occurrence and the frequency of the six behaviour forms were studied.

The investigated behaviour forms were: nutrition, drinking, resting, social behaviour, preening and playing. The definition of these behaviour forms were given by *Czakó* (1985).

**Feeding** consists of exploration, recognition, approaching and consumption. Exploration can be considered as the appetitive phase of nutrition triggered not directly by the stimulus of the feed (rather than the hunger). This is followed by the selection and consumption of the feed. The smell, taste and appearance play an important role. The intensive movements of the head (forward and back) makes clear distinction of nutrition from playing (with feed) possible.

**Drinking** is one of the behaviour forms connected with metabolism, its accomplishment characterise the different species, its rhythm depends from the amount of the available water and from internal causes like dehydration of the mucous membrane of the oral cavity or the throat. Drinking is performed through series of movements characterised by geese: dips the beak into the water then stretches forward

the neck lifts up the head and using gravitation flows the water down through its throat. It helps to make a distinction between drinking and playing or bathing.

**Resting** is the rest phase of the motorium that can be identified from a special resting position. The resting period may be interrupted by preening and playing but the intensity of these behaviour forms are much lower than those times they performed separately. Adult geese rarely sit for resting in most cases they stand motionless.

**Social behaviour** can be considered as all the behaviour features that manifest among the individuals of the same population. In this study fighting, greeting and preening other individuals were classified into this category.

**Preening** is the cleaning and ordering of the integument that manifests not during resting but separately and showing high intensity. The behaviour is only classified into this category when it manifests towards the own plumage, preening other individuals are sorted to social behaviour form. Preening often coincide with bathing.

**Playing** is the collective term for various behaviour forms that play an important role in ontogenesis, development of regulating system and capability but do not have any practical purpose. In an environment of low stimuli they necessarily manifest with higher frequency. Playing can be realized with feed, water and with the equipments connected to feed and water replacement and consequently may cause wet litter. The playing caused by boredom can mainly explained by the fact that the geese kept under intensive technology cannot satisfy their grazing instinct.

Based ont he data recordings heritabilities of the various behaviour forms were estimated using Bayesian statistics (*Wickmann*, 1990) through animal model. Apart from the relationship among the individuals, genotype was also considered in the model. Heritability was determined by the posteriori distribution using Markov chain. The total number of chain elements was 60000 from which 10000 was used as burn in and only every $10^{th}$ element was taken thus the final sample consisted of 5000 elements. The statistical analysis was carried out applying the GIBBS3F90 software, and the heritability distributions were depicted with the SPSS for Windows 10 (*SPSS Inc*., 1999).

## RESULTS AND DISCUSSION

Heritability of the behaviour forms is given in *Table 1*.

**Table 1**

**Heritability estimates of the behaviour forms**

| Trait | Mean | Median | $BHD_{0.95}$ | $k_1$ | $k_2$ |
|---|---|---|---|---|---|
| feed intake | **0.2862** | **0.2737** | 0.0077 0.5440 | 0.0625 | 0.5422 |
| drinking | **0.2652** | **0.2510** | 0.0074 0.5486 | 0.0485 | 0.5481 |
| resting | 0.0691 | 0.0532 | 0.0016 0.1874 | 0.0056 | 0.1870 |
| playing | 0.0700 | 0.0540 | 0.0007 0.1846 | 0.0055 | 0.1846 |
| social behaviour | 0.1181 | 0.0977 | 0.0030 0.2911 | 0.0110 | 0.2911 |
| preening | 0.1126 | 0.9449 | 0.0050 0.2718 | 0.0130 | 0.2714 |

$BHD_{0,95}$=high posterior density interval at a 95% of probability; $k_1$=limit of the interval containing a probability of 95%, $[k_1, 1]$; $k_2$=limit of the interval containing a probability of 95%, $[0, k_2]$.

Heritability estimates of the feed intake and drinking was moderate. There are traits like egg production used as selection criterion contrary to its low heritability ($h^2$=0.15–0.20) (*Dohy*, 1999). The relatively low heritabilities found by this study may be explained that they were estimated by animal model and it was generally observed that the traits show lower heritabilities based on animal model compared to estimates based on other procedures like correlation among full-sib groups. Heritability estimates of resting, playing, social behaviour and preening were low or negligible. Selection for these behaviour forms cannot be suggested as the expected selection response would be probably low and the traits have low functional value.

According to the knowledge of the authors selection based on behaviour forms of geese has not yet been published. On the contrary the behaviour of pigs was extensively analysed by several authors (*von Felde et al*., 1996; *Kalm et al*., 1996; *de Haer* and *de Vries*, 1993). In these studies the number of the recorded animals ranged between 1832–3188 and their behaviour was monitored for 10 weeks. Using computer chips for identification and special feeders made the monitoring of several behaviour forms (daily feed intake, feed intake per visit etc.) possible using group-penning. The total time spent on daily feed intake showed heritabilities of 0.24–0.45.

It has to be noted that from the several behaviour trait von *Felde et al*. (1996) suggested the total time spent on daily feed intake as a selection criterion trait as it was the only behaviour trait showed reasonable genetic correlation with daily feed intake ($r_g$=0.44) and average daily gain ($r_g$=0.32).

## CONCLUSIONS

The main advantage of the application bayesian statistics for heritability estimation is that it is a highly suitable procedure for small datasets. The conclusions can be made on exact probabilities that give a good flexibility evaluating the results and the non-normal distribution of the traits can also be taken into account.

Among the studied behaviour forms the time spent for daily feed intake and drinking showed moderate heritabilities, from which the former traits may be suitable for selection.

Based on the results further experiments are planned to accomplish where a two-way selection will be carried out for the time spent for daily feed intake and the behaviour of the animals selected upwards and downwards will be compared.

## ACKNOWLEDGEMENT

Financial support of OTKA (D45963) is acknowledged.

## REFERENCES

Bogenfürst, F. (1992). Handbook of the goose breeders. Új Nap Lap- és Könyvkiadó, Budapest.

Bogenfürst, F. (2000). Market relation of the hungarian foie gras production. A Baromfi. 3. 5. 64-69.

Czakó, J. (1985). Lexicon of ethology. Natura, Budapest.

Dohy, J. (1999). Genetics for animal breeders. Mezőgazda Kiadó, Budapest.

Felde, A., von Roehe, R., Looft, H., Kalm, E. (1996). Genetic association between feed intake and feed intake behaviour at different stages of growth of group-housed boars. Livest. Prod. Sci., 47. 11-22.

GIBBS3F90 (2003) BLUPF90 Manual

Guy, G., Guémené, D. (2004). Past, present and prospective of force-feeding and "foie gras" production in the world. VII. International Poultry Breeding Symposium, Kaposvár, 3-16.

Haer, L.C.M., Vries, A.G. (1993). Effects of genotype and sex on the feed intake pattern of group housed growing pigs. Livest. Prod. Sci., 36. 223-232.

Kalm, E., Felde, A., von Röhe, R. (1996). New traits in station testing of pigs. Züchtungskunde. 68. 474-482.

Locsmándi, L., Bogenfürst, F., Hegedüs, G., Szabó, A., Molnár, M., Romvári R. (2004). Complex studies on goose liver development. VII. Nemzetközi Baromfitenyésztési Szimpózium. Kaposvár, 17-24.

Molnár, M., Molnár, T., Bogenfürst, F. (1998). Changes in special comfort behaviours of geese between 2-7 weeks of age under intensive conditions. Acta Agraria Kaposváriensis. 2. 1. 49-56.

Molnár, M., Bogenfürst, F. (1999). Studies on the drinking and eating behaviour of gooslings under intensive conditions. 12th European Symposium On Waterfowl Adana, Turkey.

Reiter, K., Bessei, W. (1995). Behavioural comparsion of Pekin, Muscovy and Mulard duck on the fattening period. 10th European Symposium on waterfowl. Halle, 110-117.

Report of the Scientific Committee on Animal Health and Animal Welfare, 1998.

SPSS Inc. (1999): SPSS for Windows. Version 10.

Wickmann, D. (1990). Bayes-statistics. ELTE Eötvös Kiadó, Budapest.

*Corresponding author:*

**Molnár Marcell**
University of Kaposvár, Faculty of Animal Science
Kaposvár, H-7400 Guba S. u. 40.
Tel.: +36-82-314-155, fax: +36-82-320175
e-mail: molnarm@mail.atk.u-kaposvar.hu