SZENT ISTVÁN UNIVERSITY

ADAPTABILITY OF TEMPERAMENT AS A PRODUCTION TRAIT IN SHEEP BREEDING

Thesis of Ph.D. dissertation

Pajor Ferenc

Gödöllő

2011

Data of the Doctoral School

Name: Animal Husbandry PhD School

Filed of science: Animal Husbandry

Head of school: Dr. Mézes Miklós
full professor, member of the Hungarian Academy of Sciences,
Szent István University, Faculty of Agricultural and Environmental Sciences, Institute of Basic Animal Sciences, Department of Animal Nutrition

Supervisor: Dr. Póti Péter
associate professor, PhD
Szent István University, Faculty of Agricultural and Environmental Sciences, Institute of Animal Husbandry, Department of Cattle and Sheep Breeding

…… ……

Approval of the head of the PhD school

Approval of the supervisor

1. INTRODUCTION

1.1. The interest of temperament in animal husbandry

To increase competitiveness of Hungarian Merino breed continuous development is required in breeding work, including the improvement of production traits. Presenly this work is focused particularly on maternal and meat production traits (e.g. sold litter weight, weight gain during suckling period, and slaughter traits).
Besides, studying the behaviour of animals is also of meanful importance since they are in permanent interaction with their environment (including humans as well), and both economical and animal defence considerations support the fact that they should tolerate a certain keeping technology well.
Temperament is defined as the animal's behavioural response to handling by humans and keeping technology (*Burrow*, 1997). Temperament of livestock species can be measured by objective methods, such as docility test and flight speed (or flight time) test; and also, using subjective assessment like temperament score test (*Burrow*, 1997).
Importance of focusing on temperament was supported by several studies. *Burrow* and *Dillon* (1997) and *Fell* et al (1999) found a negative correlation between temperament and live weight of cattle: cattle of calm temperament grew faster during fattening than nervous ones. Several authors (e.g. *Murphy* et al, 1994; *Neindre* et al, 1998) found that lamb mortality was lower in calmer ewe herds, and calmer ewes had better maternal traits compared with nervous ones. In dairy sheep breeds *Ivanov and Djorbineva* (2003) found that calmer temperament was paired with better fertility. Several studies have reported relationships between dairy temperament score and milk production traits in cows. *Mushra et al.* (1975), *Arave* and *Kilgour* (1982) revealed a linear relationship between temperament score and daily- and total milk yield, but the relationship with lactation length was not clear. In sheep, *Ivanov* and *Djorbineva* (2003) found that calmer ewes produced more milk by machine milking ($P<0.05$) than nervous animals during the whole milking period. The importance of theme in cattle and sheep breeding is supported by number of similar international efforts. Temperament is being added as a new trait to the Australian beef genetic evaluation model (Breedplan) (*Burrow*, 2003). Also, the Sheep Genetics Australia is planning to offer Australian Sheep Breeding Values for temperament in the near by future to Lambplan and Merinoselect customers (*Collins and Conington*, 2005).

1. 2. Objectives

The aims of the study were as follows:

1. Evaluation of temperament of sheep and investigation of some factors affecting temperament (breed, sire, sex and birth type).

2. Evaluation of relationships between temperament and some blood parameters in ewes and lambs.

3. Evaluation of relationships between temperament and fattening traits (live weight at the end of fattening, weight gain) and slaughter traits (carcass weight, *longissimus d.* depth, fat thickness) of lambs.

4. Evaluation of relationships between temperament and some maternal traits (lamb rearing ability, milk production) of ewes.

2. MATERIALS AND METHODS

2.1. Evaluation of temperament of sheep and investigation of some factors affecting temperament

Experiments were carried out in Kétegyháza (German Mutton Merino, n=26 rams, n=55 ewes), in Törtel (Hungarian Merino, n=10 rams, n=22 ewes; German Mutton Merino, n=13 rams, n=19 ewes; German Blackheaded, n=12 rams, n=16 ewes) and in Solt (Tsigai, n=22 rams, n=21 ewes).
During the investigation effects of gender, litter size, sire and genotype on lambs' temperament were evaluated. Lambs were put into self performance test. Temperament of lambs was assessed using temperament score and flight speed tests at weaning and at the end of the self performance test.
Statistical analysis was processed by SPSS 14.0 program package (Mann-Whitney test, Kruskal-Wallis and Dunn tests).

2.2. Evaluation of relationships between temperament and some blood parameters in ewes and lambs

This study was carried out in Solt (Bács-Kiskun County, Hungary). N=31 Tsigai ewes and n=22 ram and n=21 ewe lambs were put into the experiment. Relationships between temperament and blood triglyceride, non-esterised fatty acid, lactic acid and cortisol concentrations were calculated. Effects of ewes' temperament on lambs' temperament and cortisol concentration were examined as well. Blood samples were collected from ewes at weaning of lambs, and from lambs at the start and at the end of self performance test, from *v. jugularis* into tubes containing heparin. Lambs were put into self performance test. Temperament of lambs (at weaning and at the end of the self performance test) and ewes (at weaning of lambs) was evaluated using temperament score test.
Statistical analysis was processed by SPSS 14.0 program package (Kolmogorov-Smirnov test for normality, F and t tests, Levene's test for equality of Variances, ANOVA test, LSD and Tukey tests, Kruskal-Wallis and Dunn tests, Pearson simple- and Spearman- correlations, linear regression).

2.3. Evaluation of relationships between temperament and fattening- and slaughter traits of lambs

Studies were carried out in Kétegyháza (German Mutton Merino, n=26 rams, n=55 ewes), in Törtel (Hungarian Merino, n=10 rams, n=22 ewes; German Mutton Merino, n=13 rams, n=19 ewes; German Blackheaded, n=12 rams, n=16 ewes), in Gödöllő (Hungarian Merino, n=27 rams) and in Solt (Tsigai, n=22 rams, n=21 ewes). Effects of temperament on fattening traits (weight gain

during fattening, live weight at the end of fattening) and slaughter traits (slaughter weight, carcass weight, fat thickness, ribeye area) of lambs were evaluated. Lambs were put into self performance test. Hungarian Merino lambs went under ultrasound measurements and their slaughter traits were recorded as well. Temperament of lambs was assessed using temperament score and flight speed tests at weaning and at the end of self performance test.
Statistical analysis was processed by SPSS 14.0 program package (Kolmogorov-Smirnov test for normality, Levene's test for equality of Variances, ANOVA test, LSD and Tukey tests, Kruskal-Wallis and Dunn tests, Pearson simple- and Spearman- correlations, linear regression).

2.4. Evaluation of relationships between temperament and some maternal traits of ewes

Studies were carried out in Törtel (Hungarian Merino, n=25 ewes; German Mutton Merino, n=10 ewes) and in Solt (Tsigai, n=46 ewe). Effects of temperament on ewes' prolificacy ratio and milk production and on lambs' weaning weight and weight gain until weaning were evaluated. Temperament of lambs (at weaning and at the end of the self performance test) and ewes (at weaning of lambs) was evaluated by temperament score test.
Statistical analysis was processed by SPSS 14.0 program package (Kolmogorov-Smirnov test for normality, F and t tests, Levene's test for equality of Variances, ANOVA test, LSD and Tukey tests, Kruskal-Wallis and Dunn tests, Pearson simple- and Spearman- correlations, linear regression).

2.5. Applied temperament tests

Temperament score test

Temperament score test was developed by *Trillat* et al. (2000). Behaviour of animals is assessed in a 5-score scale at weighing, while they spend 30 sec. on the weighing scale:

1: calm, no movement;
2: calm with occasional movements;
3: calm with some more movements, but without shaking the scale;
4: abrupt episodic movements without shaking the scale;
5: permanent episodic movements and shaking the scale.

Flight speed test

In this test the time the animal needs to move to a set distance (1.7 m) after exiting the weighing scale into an open yard is measured (*Burrow*, 1988).

2.6. Blood parameter investigations

Blood samples were collected from n=31 Tsigai ewes (at weaning of lambs) and from n=20 lambs (at beginning and at the end of the self performance test) from *v. jugularis* into two tubes: one of them contained heparin, the other was empty. Samples were immediately transported to laboratory and centrifuged at 3500 f/m for 10 min. Plasma was stored at -70 ^{0}C until further analyses.

Glucose and lactic acid assay:
Glucose and lactic acid content of samples were analysed by enzymatic method using commercial kits (Diagnosticum Zrt, Budapest; Lactate PAP, BioMerieux, Marcy-l'Etoile, France).

Cortisol assay:
For the cortisol assay a direct radioimmunoassay method, developed in the laboratory of Szent Istvan University, Faculty for Veterinary Science (Budapest, Hungary) was applied.

Non-esterised fatty acid and triglyceride assay:
The non-esterised fatty acid and triglycerides were analysed by enzymatic-colorimetric method using commercial kits (NEFA kit, Randox test kit, Randox Laboratories, Cork, Ireland; triglyceride kit, colorimetric test kit, Diagnosticum Zrt., Budapest).

2.7. Self performance tests

Self performance tests were carried out according to the rules of Sheep Performance Testing Codex. Lambs were kept in groups; each lambs had 1 m^2 space. During performance test, the lambs were fed on *ad libitum* concentrate mix by self-feeder and 0.2 kg hay/day. They were supplied by fresh water, litter and salt.
Each lamb was weighed by 0.1 kg precision at weaning and at the end of the test. Daily weight gain was calculated in grams.

2.8. Ultrasound and slaughter measurements

In vivo ultrasound measurements were performed by Falco 100 real-time ultrasonic device (Pie Medical: 18 cm linear transducer, 7.5 cm depth, 3.5 MHz wave) between the 12^{th} and 13^{th} ribs perpendicular to the vertebral column. Maximal measuring depth was 30 cm. Fat thickness and *m. longissimus dorsi* area were recorded.
After ultrasound measurements, lambs were transferred to slaughter house and slaughtered. After 24 h chilling of carcasses, meat samples were taken from *m. longissimus dorsi*. *M. longissimus dorsi* area was also drawn onto folia sheet and measured three times using Placom KP-90N digital planimeter.

2.9. Recording of milk production

After weaning, ewes were hand milked during the lactation period of 106 days (from 15^{th} April to 30^{th} July). During this period animals were kept on pasture and supplied by alfalfa hay and concentrate mix (approximately 300 g/day). Milk production was measured by regular official milk recording system. At the first and last official milk recording occasion fat content was measured individually by a spectrophotometer (Combi Foss 5000, Foss Electric, ÁT LTD, Gödöllő).

3. RESULTS

3.1. Evaluation of temperament of sheep and some factors affecting temperament

No significant difference was detected between temperament scores of the two genders in any of the breeds involved in the experiment (Hungarian Merino, German Mutton Merino, German Blackheaded and Tsigai).
Temperament of lambs was significantly influenced by litter size: twin lambs had calmer temperament than single ones ($P < 0.01$).
During fattening, temperament of lambs of different genotypes differed significantly: mutton breeds were calmer (German Blackheaded: 2.50 score) than Hungarian Merino lambs (3.38; $P<0.05$).
Results supported the effect of sires on temperament of lambs during fattening since there were significant differences between temperament scores of different progeny groups ($P<0.05$).
Strong rank correlations were revealed between temperament scores given by two independent judges (German Mutton Merino lambs: $r_{rank} = 0.94$; $P < 0.001$; ewes: $r_{rank} = 0.85$; $P < 0.001$).

3.2. Evaluation of relationships between temperament and some blood parameters in ewes and lambs

At weaning, no significant relations were found between lambs' temperament score and blood plasma cortisol concentration and live weight. At the end of fattening period, close positive rank correlation was revealed between temperament (measured by the temperament score test), and blood cortisol concentration of lambs ($r_{rank} = 0.81$, $P < 0.001$). Similar correlation was obtained between cortisol concentration change (difference between measurements at weaning and at the end of trial) and temperament score ($r_{rank} = 0.82$, $P < 0.001$).
Ewes with calmer temperament had lower cortisol levels than nervous ones ($r_{rank} = 0.79$, $P < 0.001$). Relationship between temperament score and blood lactate concentration of ewes was at medium-level ($r_{rank} = 0.53$, $P < 0.01$). Thus, calmer temperamented mothers had lower blood cortisol and lactic acid concentrations than nervous ones.
After weaning, temperament of lambs was significantly influenced by temperament of mothers ($r_{rank} = 0.55$, $P < 0.01$). Lambs from calmer ewes had lower ($P<0.05$) temperament score (2.13 score) than those from nervous ones (3.14 score).

3.3. Evaluation of relationships between temperament and fattening- and slaughter traits of lambs

German Mutton Merino lambs with nervous temperament had lower fattening performance parameters, such as live weight at the end of fattening (29.5 kg) and weight gain during fattening (255.85 g/day), compared with the calmer group of lambs (36.3 kg; 392.34 g/day, respectively; $P < 0.05$).
During the one- and two-years long investigation period, calmer German Mutton Merino ewes had greater growth ability than nervous ones.
Lambs descending from calmer ewes had larger live weight at the end of fattening (39.3 kg) and higher daily weight gain during fattening (464.90 g/day) than lambs reared by nervous ewes (34.6 kg; 385.80 g/day, respectively; $P<0.05$).
Results of slaughter showed that Hungarian Merino ram lambs with calmer temperament had higher carcass weight (13.7 kg), larger *longissimus dorsi* area (20.05 cm^2), and lower fat thickness (0.13 cm) than lambs with nervous temperament (11.18 kg; 14.10 cm^2; 0.21 cm, respectively; $P < 0.05$).

3.4. Evaluation of relationships between temperament and some maternal traits of ewes

Lambs descending from nervous ewes had lower weaning weight than those from calmer ewes (single: 18.1 kg and 22.0 kg, respectively; $P < 0.01$; twins: 18.7 kg, and 23, 1 kg, respesctively, $P < 0.001$). Weight gain until the weaning was also lower in case of lambs reared by nervous ewes (single: nervous=200.7 g/day; calm=244.0 g/day, $P<0.01$; twins: nervous=207.5 g/day; calm=252.7 g/day, $P<0.001$).
Calmer Tsigai ewes - kept under extensive conditions after weaning - had significantly higher milk production (52.4 l, 0.49 l/day) than the more nervous group of ewes (46.1 l, 0.44 l/day $P < 0.001$) during the lactation period of 106 days.

4. CONCLUSIONS

4.1. Evaluation of temperament of sheep and some factors affecting temperament

There is no remarkable difference between temperament scores given by two practiced independent judges which was proven by the strong relationship between the scoring results of the judges.
The applied tests (temperament scale test, flight speed test), are easy to be learned and practiced so can be integrated into the keeping technology of sheep breeds well.
No significant difference was revealed between temperament scores of the two genders, while temperament of lambs was influenced by genotype and sire. Results show that mutton breeds were calmer than Hungarian Merino.
Temperament of lambs was influenced by litter size, at the end of fattening period twin lambs were calmer than single ones. The significant difference may be a result of the changed environment (indoor housing in groups during self performance test) and the changed situation in obtaining feed. In the first case, the higher stocking rate, in the other one the competition for food could play a role in formation of differences.

4.2. Evaluation of relationships between temperament and some blood parameters in ewes and lambs

No significant relations were found among the lambs' temperament score and blood plasma cortisol concentration and live weight at weaning. This can be caused by the fact that until weaning, behaviour of lambs is strongly influenced by mother-lamb bond, and weaning weight mainly depends on maternal milk production. The lambs' own genetic abilities are shown rather in the post-weaning period.
At the end of fattening period, close positive rank correlation was revealed between temperament (measured by the temperament score test), and blood cortisol concentration of lambs. Calmer ewes had lower blood cortisol and also lower lactic acid concentrations than the nervous ones. High cortisol concentration has unfavourable effect on metabolism and production results.
Temperament of lambs was influenced by their mother's temperament in the post-weaning period as well, since lambs descending from calmer ewes had lower temperament score than those from nervous ones.

4.3. Evaluation of relationships between temperament and fattening- and slaughter traits of lambs

Lambs with nervous temperament had lower fattening performance parameters, (e.g. live weight at the end of fattening, weight gain during fattening) when compared with the calmer group of lambs.
During the one- and two-years long investigation period, calmer German Mutton Merino ewes had greater growth ability than the nervous ewes. Difference in live weight was present at all ages, so calmer animals reached mature weight earlier.
Lambs of calmer ewes had more favourable fattening results than those descending from nervous ones.
Hungarian Merino ram lambs with calm temperament had better fattening and slaughter traits than nervous ones.
All these results call the attention to the improvement housing and nutrition technologies, since a good level and quality of economical production can be expected only from animals kept under circumstances that regard the demands of different species and breeds. .

4.4. Evaluation of relationships between temperament and some maternal traits of ewes

Lambs descending from calmer ewes were found to have higher preweaning weight gain and weaning weight compared with lambs from more nervous ewes. Lower weaning weight of lambs can be related with lower maternal milk production. Calmer ewes produced significantly more milk during the lactation period than nervous ones.

4.5. Proposals

It is suggested to apply temperament tests (scale test, flight speed test) and regard their results as a production trait in the practice of sheep breeding.
Tests are suggested to be carried out at weaning of lambs and at the end of self performance test.
It is suggested to keep the calm lambs for further breeding, while nervous lambs should be culled.

5. NEW SCIENTIFIC RESULTS

1. No significant difference was revealed between temperament scores of the two genders, while temperament of lambs was influenced by genotype and sire. Mutton breeds were calmer than Hungarian Merino.

2. Foundings based on analysis of temperament and some blood parameters:
   - Strong relationship was revealed between temperament and blood cortisol concentration both in ewes (r_{rank} = 0.81; P<0.001) and lambs (r_{rank} = 0.79; P<0.001) at the end of fattening period.

   - Temperament of lambs at the end of fattening showed a medium and a strong positive rank correlation with temperament score and blood cortisol concentration of mothers (r_{rank} = 0.55, P <0.01 and r_{rank}= 0.71, P <0.001, respectively).

   - There was a medium-strong correlation between ewes' temperament and blood lactate concentration (r_{rank} = 0.53, P <0.01).

3. Lambs with calmer temperament had higher weight gain during fattening, larger live weight at the end of fattening, and larger rib eye area, while they had lower fat thickness than nervous ones.

4. Lambs of calmer ewes had higher weaning weight and weight gain until weaning and also higher weight gain during fattening compared with lambs of nervous ewes.

5. For the first time in Hungary it was found that calmer Tsigai ewes kept under extensive conditions produced significantly more milk than nervous ones (52.4 l vs. 46.1 l; P <0.05) during 106 days of lactation.

Publications on the subjects of the thesis

Papers in scientific journals:

Referred papers with impact factor

PAJOR F., SZENTLÉLEKI A., LÁCZÓ E., TŐZSÉR J., PÓTI P. (2008): The effect of temperament on weight gain of Hungarian Merino, German Merino and German Blackhead lambs. *Archiv Tierzucht*, 51 (3) 247-254.

PAJOR F., MURÁNYI A., SZENTLÉLEKI A., TŐZSÉR J., PÓTI P. (2010): Effect of temperament of ewes on their maternal ability and their lambs' postweaning traits in Tsigai breed. *Archiv Tierzucht*, 53 (4) 465-474.

Referred papers

TŐZSÉR J., PÓTI P., **PAJOR F.,** SZENTLÉLEKI A., MAROS K., ZÁNDOKI R., NIKODÉMUSZ E., BALÁZS F. (2004): Ismételt mérleg tesztek eredményeinek értékelése szarvasmarha és a juh fajok esetén. *Állattenyésztés és Takarmányozás*, 53 (4) 365-371.

SZENTLÉLEKI A., **PAJOR F**. , ZÁNDOKI R., MAROS K., PÓTI P., TŐZSÉR J. (2005): Possibilities to evaluate temperament in cattle and sheep breeding. A review. *Bulletin of Szent István University*, 71- 75.

PAJOR F., SZENLÉLEKI A., LÁCZÓ E., PÓTI P., TŐZSÉR J. (2006): Evaluation of temperament in Hungarian Merino lambs using selected meat production traits. *Bulletin of Szent István University*, 19-22.

SZENTLÉLEKI A., **PAJOR F**., HORVÁTH G., GYŐRI D., TŐZSÉR J. (2006): Comparison of results of three independent scorers in assessing temperament of Hungarian Simmental cattle. *Bulletin of Szent István University*, 23-29.

PAJOR F., LÁCZÓ E., PÓTI P. (2007): Német húsmerinó tenyészjerkék temperamentumának értékelése egyéves korukig. *Animal welfare, etológia és tartástechnológia*, 3 (2) 115-126.

PAJOR F., SZENTLÉLEKI A., LÁCZÓ E., RUPCSÓ M., PÓTI P. (2007): A magyar merinó és a német feketefejű anyajuhok temperamentumának értékelése és összefüggése néhány szaporasági tulajdonsággal. *Animal welfare, etológia és tartástechnológia*, 3 (3) 219-230.

SZENTLÉLEKI A., HERVÉ J., MERÉSZ S., **PAJOR F**., TŐZSÉR J. (2007): Behaviour of dairy cows during milking in a Hungarian farm. *Bulletin of Szent István University*, 31-40.

PAJOR F., HANÓ M., LÁCZÓ E., PÓTI P. (2008): Német húsmerinó bárányok temperamentumának értékelése és kapcsolata hizlalási tulajdonságokkal. *Állattenyésztés és Takarmányozás*, 57 (3) 239-248.

PAJOR F., LÁCZÓ E., PÓTI P. (2008): Evaluation of growth for German Merino ewe lambs according to temperament. *Egyptian Journal of Sheep and Goat Sciences*, 3 (2) 9-14.

SZENTLÉLEKI A., HERVÉ, J., **PAJOR F.,** FALTA, D., TŐZSÉR J. (2008): Temperament of Holstein Friesian cows in milking parlour and its relation to

milk production. *Acta Univiversitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 56 (1) 201-208.

PAJOR F., SZENTLÉLEKI A., TŐZSÉR J., PÓTI P. (2009): Magyar merinó kosbárányok vérmérsékletének és néhány vágási tulajdonságának alakulása. *AWETH*, 5 (1) 39-48.

Papers on scientific conferences (proceedings):

PAJOR F., NAGY B., LÁCZÓ E., PÓTI P. (2004): Adatok a magyar merinó kosbárányok kezelhetőségének vizsgálatához. IX. Nemzetközi Agrárökonómiai Tudományos Napok. Állattenyésztés Ökonómiája szekció. Gyöngyös, 2004. március 25-26. CD kiadvány

PAJOR F., PÓTI P., NAGY B., LÁCZÓ E. (2004): Magyar merinó kosbárányok kezelhetőségi teszt eredményei. X. Ifjúsági tudományos Fórum. Állattenyésztés szekció. Keszthely, 2004. április 29. CD kiadvány

TŐZSÉR J., PÓTI P., **PAJOR F**., SZENTLÉLEKI A., MAROS K., ZÁNDOKI R., NIKODÉMUSZ E., BALÁZS F. (2004): Szarvasmarha és juh fajok ismételt temperamentum tesztjeinek értékelése. X. Ifjúsági tudományos Fórum. Állattenyésztés szekció. Keszthely, 2004. április 29. CD kiadvány

PAJOR F., SZENTLÉLEKI A., PÓTI P., NAGY B., LÁCZÓ E. (2005): Temperamentum értékelése és kapcsolata néhány termelési tulajdonsággal magyar merinó fajtában. XI. Ifjúsági tudományos Fórum. Állattenyésztés szekció. Keszthely, 2005. március 24. CD kiadvány

PAJOR F., SZENTLÉLEKI A., LÁCZÓ E., PÓTI P. (2006): Magyar merinó bárányok temperamentumának értékelése és összefüggése a hizlalási tulajdonságokkal. Kérődző állatfajok mai helyzete és perspektívái az Európai Unióban. 04 10-11, Gödöllő, 140-141. pp.

PAJOR F., SZENTLÉLEKI A., LÁCZÓ E., PÓTI P. (2006): Magyar merinó bárányok temperamentumának hatása a hizlalási teljesítményre. XII. Ifjúsági Tudományos Fórum. Állattenyésztés szekció. Keszthely, április 20. CD kiadvány

PAJOR F., SZENLÉLEKI A, LÁCZÓ E, PÓTI P, TŐZSÉR J. (2006): Relation of some production traits with temperament in Hungarian Merino lambs. Egyptian Journal of Sheep, Goat and Desert Animals Sciences, 1. 1. 255- 260. pp.

PAJOR F., SZENTLÉLEKI A., LÁCZÓ E., PÓTI P. (2006): Temperamentum értékelése és kapcsolata hizlalási tulajdonságokkal magyar merinó bárányokban. WEU III. Nemzetközi Konferencia, április 6-7., Mosonmagyaróvár. 32. CD kiadvány

PAJOR F., SZENTLÉLEKI A., LÁCZÓ E., RUPCSÓ M., Póti P. (2006): Temperamentum értékelése és kapcsolata néhány szaporasági tulajdonsággal a magyar merinó és a német feketefejű anyajuhokban. XXXI. Óvári Tudományos Napok. Mosonmagyaróvár, október 5. 51. CD kiadvány

PAJOR F., SZENTLÉLEKI A., MURÁNYI A., LÁCZÓ E., PÓTI P. (2008): Temperamentum hatása a cigája anyajuhok tejtermelésére. XXXII. Óvári Tudományos Nap, 2008. október 9., Mosonmagyaróvár, CD kiadvány

Conference abstracts:

TŐZSÉR J., PÓTI P., **PAJOR F**., SZENTLÉLEKI A., MAROS K., ZÁNDOKI R., NIKODÉMUSZ E., BALÁZS F. (2004): Ismételt temperamentum tesztek értékelése szarvasmarha és juh fajok esetén. Magyar Etológiai Konferencia, Göd, 11. 19-21.

SZENTLÉLEKI A., **PAJOR F**., FÜLLER I., BERTALAN B., TŐZSÉR J. (2005): Módszertani vizsgálat a vérmérséklet mérésének fejlesztésére egy magyartarka tenyészetben. Verseny Élesben, Európa-napi konferencia, Mosonmagyaróvár, 2005. május 5-6.

SZENTLÉLEKI A., ZENGŐ GY., **PAJOR F**., TŐZSÉR J. (2007): Tejtermelő tehenek vérmérsékletének megfigyelése fejőházban, a nyári hónapokban. Magyar Etológiai Társaság X. Jubileumi Kongresszusa, Göd, 11.30-12.01. 22.

PAJOR F., SZENTLÉLEKI A., MURÁNYI A., LÁCZÓ E., PÓTI P. (2007): Különböző genotípusú bárányok temperamentumának értékelése és összefüggése hízlalási tulajdonságokkal. Magyar Etológiai Társaság X. Jubileumi Kongresszusa, Göd, 11.30. – 12.01. 17-18.

PAJOR F., SZENTLÉLEKI A., MURÁNYI A., PÓTI P. (2008): Cigája anyajuhok temperamentumának hatása néhány anyai tulajdonságra. 50. Jubileumi Georgikon Napok, 2008. szeptember 25-26, Keszthely, 46.

PAJOR F., SZENTLÉLEKI A., MURÁNYI A., LÁCZÓ E., PÓTI P. (2008): Cigája fajtájú bárányok temperamentumának értékelése és összefüggése néhány hizlalási tulajdonsággal. I. Gödöllői Állattenyésztési Tudományos Napok, Gödöllő, április11-12, In: Animal welfare, etológia és tartástechnológia, 4. 2. Különszám, 296.

PAJOR F., PÓTI P., TŐZSÉR J. (2004): Relation of some production traits with temperament in lot-fed Hungarian Merino lambs. Joint East and West Central Europe, ISEA Regional Meeting, Tihany, Hungary, May 20-22. 21.

PAJOR F., SZENTLÉLEKI A., LÁCZÓ E., BEDŐ S., PÓTI P., TŐZSÉR J.(2005): Measurement of temperament in Hungarian Merino lambs in relation with some production traits. 4th International congress on Ethology in Animal Production, Nitra, Slovakia, 19-21 October 2005

PAJOR F., SZENTLÉLEKI A., LÁCZÓ E., PÓTI P., TŐZSÉR J. (2006): Relation of some production traits with temperament in Hungarian Merino lambs. Joint East and West Central Europe, ISEA Regional Meeting, Celle, Germany, May 18-20. 51.

PAJOR F., SZENTLÉLEKI A., MURÁNYI A., BODNÁR Á., TŐZSÉR J., PÓTI P. (2008): Evaluation of temperament of Tsigai lambs and relationship with some fattening traits. ISAE Regional meeting, Bratislava, May 15-17. 53.

PAJOR F, MURÁNYI A., SZENTLÉLEKI A., BODNÁR Á, TŐZSÉR J., PÓTI P. (2008): Evaluation of welfare based on physiological and behavioural responses of Tsigai lambs under fattening condition. 4th International Workshop on the Assessment of Animal Welfare at farm and Group Level. Ghent, 10-13 September 170.

Publications on other subjects

Papers in scientific journals:

CHLEPKÓ T., PÓTI P., **PAJOR F**. (2003): Comparison of milk production traits among four goat genotypes. *Tejgazdaság*, 63 (1) 4-7.

PAJOR F., PÓTI P., LÁCZÓ E. (2004): Comparison of slaughter performance of Hungarian Merino, German Mutton Merino and German Blackheaded lambs. *Acta Agronomica Ovariensis*, 46 (1) 77-83.

ANKA J., PÓTI P., **PAJOR F**., LÁCZÓ E.(2005): Digitális képek alkalmazása a kecske tőgybimbók morfológiai tulajdonságainak megállapításához. *Animal welfare, etológia és tartástechnológia*, 1 (2) 135-145.

LÁCZÓ E., **PAJOR F**., PÓTI P. (2005): A nemesített búr kecske eredete és elterjedése (irodalmi áttekintés). *Animal welfare, etológia és tartástechnológia*, 1 (2) 121-134.

PAJOR F., PÓTI P., LÁCZÓ E., TŐZSÉR J. (2005): Real-time scannerrel végzett ultrahangos mérések hazai eredményei juh fajban. *A Hús*, 15 (3) 176-179.

PÓTI P., **PAJOR F**. (2005): Estimation of lamb carcass composition using real-time ultrasound. *Bulletin of Szent István University*, 65- 69.

PÓTI P., **PAJOR F**., LÁCZÓ E. (2005): Magyar merinó, ile de france F_1 és suffolk F_1 bárányok hizlalási és vágási teljesítményének vizsgálata. *Acta Agraria Debreceniensis*, 18 16-23.

LÁCZÓ E., **PAJOR F**., PÓTI P.(2006): Preliminary data of composition of boer goat colostrum and raw milk in Hungary. *Tejgazdaság*, 64 2 22-25.

LÁCZÓ E., **PAJOR F**., PÓTI P. (2007): Effect of some factors on several growth traits in Boer goat kids. *Bulletin of Szent István University*, 23-29.

PAJOR F., MÁTYUS B., LÁCZÓ E., PÓTI P. (2008): Magyar nemesített kecskék tőgybimbó alakulásának értékelése digitális videotechnika alkalmazásával. *Tejgazdaság*, 68 (1-2) 71-75.

PAJOR F., FEHÉR É., PÓTI P., TŐZSÉR J. (2008): Német húsmerinó jerkék hosszú hátizom területének értékelése ultrahangos módszerrel. *A Hús*, 18 (3-4) 93-96.

PAJOR F., PÓTI P., LÁCZÓ E., TŐZSÉR J. (2008): Ultrahang mérések és vágási tulajdonságok összefüggései eltérő életkorú magyar merinó kosbárányokban. *Állattenyésztés és Takarmányozás*, 57 (3) 229-238.

BODNÁR Á., SZABÓ ZS., SZENTLÉLEKI A., **PAJOR F**., KISPÁL T. (2009): Effect of weaning time on growth performance and early behaviour of artificially reared Awassi lambs. *Bulletin of Szent Istvan University*, 34-40.

NÉMETH SZ., **PAJOR F**., GULYÁS L., PÓTI P., ORBÁN M., TÓTH T. (2009): Azonos környezetben tartott különböző genotípusú anyakecskék vérmérsékletének értékelése. *Animal welfare, etológia és tartástechnológia*, 5 (3) 254-264.

PAJOR F., GALLÓ O., LÁCZÓ E., PÓTI P. (2009): Hazánkban elterjedt kecske és szarvasmarha fajták tejének ásványi anyag és zsírsav-összetétele. *Acta Agraria Kaposváriensis*, 13 (1) 57-66.

PAJOR F., GALLÓ O., STEIBER O., TASI J. (2009): Milk fatty acid contents of goats grazing on lowland pasture. *Bulletin of Szent Istvan University*, 48-55.

PAJOR F., GALLÓ, O., STEIBER O., TASI J., PÓTI P. (2009): The effect of grazing on the composition of conjugated linoleic isomers and other fatty acids of milk and cheese in goats. *Journal of Animal and Feed Sciences*, 18 (3) 429-439.

PAJOR F., LÁCZÓ E, ERDŐS O., PÓTI P. (2009): Effects of crossbreeding Hungarian Merino sheep with Suffolk and Ile de France on carcass traits. *Archiv Tierzucht*, 52 (2) 169-176.

PAJOR F., LÁCZÓ E., SLONINA N., PÓTI P. (2009): Effect of linseed supplementation on meat and fat composition in Hungarian Merino ram lambs. *Fleischwirtschaft International*, 24 (4) 56-58.

PAJOR F., NÉMETH SZ., BARCZA F., GULYÁS L., PÓTI P. (2009): Néhány tőgy és tőgybimbó morfológiai tulajdonság kapcsolata a szomatikus sejtszámmal magyar parlagi kecske fajtában. *Állattenyésztés és Takarmányozás*, 58 (4) 369-378.

PAJOR F., NÉMETH SZ., GULYÁS L., SIMÓ K., FERENTZI B. (2009): Legeltetett magyar parlagi kecskék tejének összetétele és egyes tulajdonságai. *Tejgazdaság*, 69 (2) 3-8.

PAJOR F., SLONINA N., PÓTI P. (2009): Lenmag etetés hatása a hosszú hátizom zsírsavösszetételére magyar merinó kosbárányokban. *A Hús*, 19 (3-4) 112-116.

PÓTI P., **PAJOR F**., BODNÁR Á., ABAINÉ H.E., BÁRDOS L. (2010): Legeltetett anyajuhok és bárányaik húsának és egyes szerveinek ólom és kadmium tartalma. *Magyar Állatorvosok Lapja*, 132 (10) 667-672.

Papers on scientific conferences (proceedings):

PAJOR F., PÓTI P. (2003): Különböző genotípusú bárányok vágási teljesítményének összehasonlítása. EU konform mezőgazdaság és élelmiszerbiztonság, Állattenyésztési szekció, SZIE Gödöllő, június 5. II. kötet 213-218. pp.

PAJOR F., BEDŐ S. (2003). A magyar merinó állományok gyapjútermelési tulajdonságainak alakulása. EU konform mezőgazdaság és élelmiszerbiztonság, Állattenyésztési szekció, SZIE Gödöllő, június 5. II. kötet 200-205. pp.

PÓTI P., **PAJOR F**., LÁCZÓ E. (2004): Comparison of fattening and slaughter performance of Hungarian Merino, Ile de France F_1 and Suffolk F_1 lambs. VII. International Conference Sheep – Goats. Seč, November 19-20. 76-78. pp.

PAJOR F., LÁCZÓ E., PÓTI P. (2005): Real-time scannerrel végzett ultrahangos mérések juh fajban. Verseny Élesben, Európa-napi konferencia, Mosonmagyaróvár, 2005. május5-6. CD kiadvány

LÁCZÓ E., **PAJOR F**., PÓTI P. (2005): A nemesített búr kecske eredetének és elterjedésének irodalmi áttekintése. Verseny Élesben, Európa-napi konferencia, Mosonmagyaróvár, 2005. május 5-6. CD kiadvány

NAGY L., PÓTI P., **PAJOR F**., LÁCZÓ E. (2005): Anyajuhok szaporulati mutatóinak alakulása és az életteljesítményre gyakorolt hatása a tenyésztésbe vételi idő és a sűrített elletés függvényében. Állattenyésztés és takarmányozás, 54. 3. 265-271. pp.

CHLEPKÓ T., PÓTI P., **PAJOR F**., LÁCZÓ E. (2006): Evaluation of milk production traits in some goat genotypes. Egyptian Journal of Sheep, Goat and Desert Animals Sciences, 1. 1. 101- 106. pp.

LÁCZÓ E, **PAJOR F**., PÓTI P. (2006): A study of some productive and reproductive traits of Boer goat in Hungary. Egyptian Journal of Sheep, Goat and Desert Animals Sciences, 1. 1. 249- 253. pp.

LÁCZÓ E., **PAJOR F**., PÓTI P. (2006): Evaluation of some productive and reproductive traits of Boer goat in Hungary. Kérődző állatfajok mai helyzete és perspektívái az Európai Unióban. 04. 10 – 11. Gödöllő, 135-136. pp.

PAJOR F., SZENTLÉLEKI A., MURÁNYI A., LÁCZÓ E., PÓTI P. (2007): Különböző genotípusú bárányok temperamentumának értékelése és összefüggése hízlalási tulajdonságokkal. Magyar Etológiai Társaság X. Jubileumi Kongresszusa, Göd, 11.30. – 12.01. 17-18. CD kiadvány

LÁCZÓ E., **PAJOR F**., PÓTI P. (2007): Composition of Boer goat colostrum and raw milk in Hungary. 25th IGA Conference, Bella, Italy, 23-26 may, 2007. 164-167. pp.

PAJOR, F., LÁCZÓ, E., KOVÁCS, A., PÓTI, P.(2007): Effect of species (goat and cow) on mineral and fatty acids contents of milk. International Conference, June 14. 2007, Brno, Czech Republic. 35-36. pp.

PÓTI P., **PAJOR. F**. LÁCZÓ E. (2007): Különböző legeltetési módok hatása a gyepnövényzetre és a juhok kondíciójára. A Magyar gyepgazdálkodás 50 éve - tanulság a mai gyakorlat számára. Gyepgazdálkodás Ankét. Gödöllő, 2007. 03. 09. 193-196.

PAJOR F., GALLÓ O., LÁCZÓ E., KOVÁCS A., PÓTI P. (2008): Effect of green maize supplement feeding on milk fatty acid composition of goats. Farmarska Vyroba V., Brno, May 15. 31-33. pp.

PÓTI P., WEIDEL W., BODNÁR Á., **PAJOR F**. (2008): A magyar nemesített kecske tejtermelési tulajdonságainak értékelése. I. Gödöllői Állattenyésztési Tudományos Napok, Gödöllő, 2008. április 11-12. In: Animal welfare, etológia és tartástechnológia, 4. 2. Különszám, 297-302. pp.

PAJOR F., SZENTLÉLEKI A., MURÁNYI A., PÓTI P. (2008): Temperamentum hatása a cigája anyajuhok tejtermelésére. XXXII. Óvári Tudományos Nap, 2008. október 9., Mosonmagyaróvár, CD kiadvány

PAJOR F., MÁTYUS B., LÁCZÓ E., PÓTI P. (2008): A laktáció szakaszainak és az ellés típusának hatása a magyar nemesített kecske néhány tőgybimbó morfológiai és tejtermelési tulajdonságára. I. Gödöllői Állattenyésztési Tudományos Napok, április11-12. CD kiadvány, 289-295. pp.

NÉMETH SZ., **PAJOR F**., ORBÁN M., TÓTH T., PÓTI P., GULYÁS L. (2009): Különböző kecskefajták tőgymorfológiai vizsgálata. LI. Georgikon Napok, október 1-2., Keszthely CD kiadvány

NÉMETH SZ., **PAJOR F**., ORBÁN M., TÓTH T., PÓTI P., GULYÁS L. (2009): Különböző genotípusú kecskék tőgymorfológiai tulajdonságainak értékelése. Magyar Buiatrikus Társaság 19. Nemzetközi Kongresszusa, október 14-17., Debrecen, 27-31. pp.

PAJOR F., GALLÓ O., STEIBER O., TASI J., KOVÁCS A., PÓTI P. (2009): Effect of different feeding systems on conjugated linoleic acid and n-3 fatty acids composition of milk and cheese in goat. Farmarska Vyroba VI., Brno, May 21. 48-49. pp.

PAJOR F, NÉMETH SZ., GULYÁS L., BARCZA F., PÓTI P. (2009): A tőgybimbó alakja és a kecsketej néhány minőségi tulajdonságának kapcsolata. II. Gödöllői

Állattenyésztési Tudományos Napok, Gödöllő, október 16-17, In: Animal welfare, etológia és tartástechnológia, 5. 4. Különszám, 218-224. pp.

PÓTI P., **PAJOR F**. (2009): Különböző legeltetési módok hatása a gyepterületek termésére és az anyajuhok kondíciójára. II. Gödöllői Állattenyésztési Tudományos Napok, Gödöllő, október 16-17, In: Animal welfare, etológia és tartástechnológia, 5. 4. Különszám, 225-231. pp.

Conference abstracts:

KOMLÓS T., **PAJOR F**., LÁCZÓ E. (2004): Juhok vágóértékének megítélése lineáris testméreteik alapján IX. Nemzetközi Agrárökonómiai Tudományos Napok. Gyöngyös 2004. március 25-26.

PAJOR F., PÓTI P. (2003): A különböző genotípusú bárányok hizlalási és vágási vizsgálata. Akadémiai beszámolók SZIE Állatorvostudományi Kar, Állattenyésztési szekció, Budapest, január 20. kötet 2.

PÓTI P., **PAJOR F**., LÁCZÓ E., ÁBRAHÁM CS. (2004): Comparison of slaughter performance of Hungarian Merino, Ile de France F1 and Suffok F1. European Association for Animal Production, Bled, Slovenia, September 5-9.

PÓTI P., LÁCZÓ E., **PAJOR F**., NIKODÉMUSZ E. (2004): Boer goat performances in two climatic environments. 8th International Conference on Goats, Pretoria, South Africa, July 4-9. 200.

PÓTI P., **PAJOR F**., LÁCZÓ E. (2004): A magyar merinó, az ile de france F1 és a suffolk F1 bárányok hizlalási és vágási teljesítménye. XXX. Óvári Tudományos Napok. Mosonmagyaróvár, október 7. 66.

PÓTI P., LÁCZÓ E., **PAJOR F.** (2004): Két eltérő környezetben tartott búrkecskék néhány értékmérő tulajdonságainak értékelése. XXX. Óvári Tudományos Napok. Mosonmagyaróvár, október 7. 65.

PAJOR F., PÓTI P., LÁCZÓ E., TŐZSÉR J. (2005): Estimation of lamb carcass composition using real-time ultrasound. 56TH Annual Meeting of European Association for Animal Production, Uppsala, Sweden 5-8 June, 275.

LÁCZÓ E., PÓTI P., **PAJOR F**. (2005): Evaluation of Boer goat performances in two climatic environments. 56TH Annual Meeting of European Association for Animal Production, Uppsala, Sweden 5-8 June, 271.

LÁCZÓ E., PÓTI P., **PAJOR F**. (2005): Evaluation of Boer goat performances in Hungary. VIII. International conference Sheep – Goats. Seč, 2004. November 11-12.

PAJOR F., PÓTI P., LÁCZÓ E., TŐZSÉR J. (2005): Results of ultrasound measurement by real-time scanner in sheep. VIII. International conference Sheep – Goats. Seč, 2005. November 11-12.

NAGY L., PÓTI P., **PAJOR F**., LÁCZÓ E. (2006): Magyar merinó anyajuhok szaporulati mutatóinak alakulása korai tenyésztésbevétel és a sűrített elletés alkalmazása esetén. Kérődző állatfajok mai helyzete és perspektívái az Európai Unióban. 04. 10 – 11. Gödöllő, 139.

PÓTI P., CHLEPKÓ T., **PAJOR F**., LÁCZÓ E. (2006): A tejtermelési tulajdonságok alakulása négy kecskefajtában. Kérődző állatfajok mai helyzete és perspektívái az Európai Unióban. 04. 10 – 11. Gödöllő, 142.

PÓTI P., BODNÁR Á., LÁCZÓ E., **PAJOR F**. (2006): Heavy metal content of forages, organs and primary products of a grazed sheep flock and its effect on human food safety. ESBIO Conference on "State of the art of Human Biomonitoring within Europe". Lisbon, Portugal. 19-21. 03. 2006.

PÓTI P., TASI J., OROSZ SZ.. LÁCZÓ E.. **PAJOR F**. (2006): Kúszólucerna takarmányozási felhasználhatósága kiskérődzőkkel. XXXI. Óvári Tudományos Napok. Mosonmagyaróvár, október 5. 54.

LÁCZÓ E., **PAJOR F**., PÓTI P. (2008): Az alpesi, a búr és a magyar nemesített kecske föcstej Fontosabb beltartalmi értékeinek alakulása. I. Gödöllői Állattenyésztési Tudományos Napok, Gödöllő, április11-12, In: Animal welfare, etológia és tartástechnológia, 4. 2. Különszám, 273.

PAJOR F., SZENTLÉLEKI A., MURÁNYI A., PÓTI P. (2008): Cigája anyajuhok temperamentumának hatása néhány anyai tulajdonságra. 50. Jubileumi Georgikon Napok, 2008. szeptember 25-26, Keszthely, 46.

GALLÓ O., **PAJOR F**., PÓTI P. (2009): A csalamádé kukorica etetés hatása a kecsketej és a kecskesajt zsírsavösszetételére. II. Gödöllői Állattenyésztési Tudományos Napok, Gödöllő, október 16-17, In: Animal welfare, etológia és tartástechnológia, 5. 4. Különszám, 168-169. (abstract)