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Effect of Temperament on Some Blood Biochemical Parameters and Growing Traits of Lambs During Fattening

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ABSTRACT

Aim of this work was to evaluate the effect of temperament on certain metabolic parameters (cortisol, glucose, serum fructosamine, triglyceride, albumin, total protein, urea), as well as daily weight gain in fattening lambs. Eight calm (score 1) and eight nervous (score 4 and 5) German Mutton Merino ram lambs were involved in the investigation on a sheep farm. Lambs' temperament was evaluated by a temperament test (movements of animals wereassessed in 5-score systemduring weighing – from 1: calm, to 5: nervous - while spending 30 sec on the scale) at three times: 1st, 20th and 40th days of the 40-day experiment. The blood samples were takenimmediately after temperament scoring. The calmer lambs had lower ($P<0.05$) concentrations of plasma cortisol (17.11 nmol/l), serum fructosamine (346.53 µmol/l), triglyceride (0.214 mmol/l), and urea (3.31 mmol/l) as well. In addition calm lambs had higher ($P<0.05$)daily weight gain (466.67 g/day), compared to the nervous animals (25.13 nmol/l, 503.76µmol/l, 0.275 mmol/l, 5.51mmol/l and 345.36 g/day, respectively). These results suggested that lambs' blood biochemical parameters influenced by temperament, nervous and calm lambs differ in carbohydrate, lipid and protein metabolism, demonstrated by an increase in urea, triglyceride and serum fructosamine in nervous lambs.

Keywords*:* Lamb, temperament, metabolites, cortisol, fattening

Analysing behaviour traits such as temperament of animals is a growing research area in animal husbandry. Temperament is generally declared as the behavioural response to humans' handling (Burrow, 1997). Earlier studies reported relations between animals' temperament and fattening and meat production traits in sheep. According to these results, calmer animals have higher weight gain (Voisinet *et al.* 1997; Pajor *et al.* 2008) and better meat quality (Dodd *et al.* 2014). Temperament has been related with cortisol concentrations in sheep; nervous animals have greater cortisol concentrations (Curley *et al.* 2008; Pajor *et al.* 2013). Elevated cortisol concentration influences the animals' metabolism, one of the biological responses means increased catabolic processes. Previous studies reported that different type of temperament has altered effects on the weight gain and cortisol concentrations, nevertheless the relation between temperament and metabolic parameters in meat type growing lambs has scarcely been reported.

In addition, the use of fructosamine in the investigation of the carbohydrate metabolic status is limited in lamb. The glycated proteins are largely unaltered by acute stress events and nutrition conditions (Latimer *et al.* 2003).

The aim of this study was to investigate certain metabolic parameters (cortisol, glucose, serum fructosamine, triglyceride, albumin, total protein, urea) of meat type lambs belonging to different temperament categories, during fattening period.

MATERIALS AND METHODS

Experimental design

The trial was executed in a sheep farm in Törtel (Pest County, Hungary). The fattening period lasted for 40 d. The keeping and experimental procedures complied with Institutional Animal Care and Use Committee guidelines of SzentIstvan University.During the experimentalperiod, temperament of lambs werescored on the 1st, 20th and 40th days. Lambs' temperament was evaluated by a five-score system at weighing, whilstanimals spending 30 sec on the scale (Trillat *et al.* 2000): 1.) calm, no movement; 2) calm with occasional movements; 3) calm with a bit more movement, but without shaking the scale; 4) abrupt episodic movements without shaking the scale; 5) permanent episodic movements and shaking the scale. Based on temperament ranking at the beginning of trial, 16 lambs (8 calm, and 8 nervous) were randomly selected from a pool of 40 German Mutton Merino single weaned male lambs (age: 76 days) for the investigation. The animals were housed in stable on strawlittering (1 m^2 per lamb) and were fed *ad libitum* water and concentrate mix (15.5 % of DM crude protein, 7.70 MJ/kg NE_m and 5.15 MJ/kg NE_g). Lambswere weighed on the first and final days, average daily weight gain the lambs made during the trial was calculated.

Analytical procedures and assays

Blood samples were taken from lambs (n=16) at three times immediately after temperament scoring from *v. jugularis*, between 8^{00}–9^{00} am in to two tubes: one containing heparin (glucose and cortisol), and another one without added anticoagulant. The blood samples were centrifuged at 3500 rpm for 10 min. The fructosamine level was analysed by method of (Oppel *et al.* 2000). Briefly, 20 µL serum and standard samples were pipetted into the wells of 96-well ELISA microplate in 3 parallels. Followed by a pipetting of 200 µL nitroblue tetrazolium chloride (NBT) (Sigma-Aldrich, USA) reagents (50 mg NBT in 244.6 ml 0.5 mol/l sodium-carbonate buffer, pH 10.11) and incubated for 5 min at 37°C. Absorbance values were measured in automatic microplate auto-reader (Humareader) at 550 nm immediately and then 5 min later. The concentrations of the samples were determined from the differences of the two values of absorbance, and compared with the known standard value.

For the plasma cortisol concentration was determined by ^{3}H-RIA method, as described by Csernus (1982). The total protein and albumin were analysed by colorimetric method, the urea was analysed by enzymatic method and the glucose and triglyceride levels were analysed by enzymatic-colorimetric method (Diagnosticum Zrt., Budapest).

Statistical analysis

Data were evaluated by the SPSS 22.0 software package. The Shapiro-Wilk's test was used for testing the normality distribution. In case of blood parameters, the Repeated Measures ANOVA was used and statistical significances between groups were calculated by Tukey's post-hoc test (P <0.05). In case of live weight and weight gain, the significance of differences was assessed by t-test. Alpha level was 0.05.

RESULTS AND DISCUSSION

The blood parameters of German Mutton Merino lambs by temperament categories is shown in Table 1.

Table 1 : **Least squares means ± standard error of lamb blood metabolic parameters by temperament categories**

Investigated traits	Temperament+			
	Calm	Nervous	SEM	P*
Cortisol (nmol/l)	17.108	25.130	1.80	0.043
Glucose (mmol/l)	3.829	4.350	0.119	0.047
SEFA (µmol/l)	346.529	503.755	25.439	0.008
Triglyceride (mmol/l)	0.214	0.275	0.014	0.041
Total protein (g/l)	68.838	69.497	0.938	0.730
Albumin (g/l)	25.926	25.930	0.297	0.994
Urea(mmol/l)	3.314	5.510	0.278	0.001

+= Based on scoring at beginning of fattening; SEFA: serum fructosamine; *= Statistics are based on the Repeated Measures ANOVA

Calm lambs had lower (P<0.05) concentrations of cortisol and serum fructosamine compared to more excitable lambs. Earlier reports (Curley *et al.* 2008; Pajor *et al.* 2013) demonstrated that nervous animals have higher cortisol concentrations compared to calm ones. Raised cortisol concentration caused higher glucose concentrations in animals' blood plasma. The elevated cortisol values shows adrenergic stimuli on carbohydrate metabolism. Glycated proteins are among the stable indicators of glucose level. The blood glucose bounds permanently to plasma proteins (SeFa), and the protein part of the haemoglobin (GHb), in proportion to its concentration in the blood (Suhonen *et al.* 1989). The glycated blood parameters (GHb, SeFa) are perfectly suitable for evaluating the carbohydrate metabolism of the examined animals.

The accretion of triglycerides was detected in the nervous animals. The mean triglyceride concentration for calm lambs was 0.215 mmol/l and for temperamental animals was 0.276 mmol/l. High concentration of triglycerides indicates an adrenergic stimulus of fat mobilization and lipolysis. The elevated values reflected the increased lipid utilization in the peripheral tissues.

The concentrations of total protein and albumin did not show any significant difference between the temperament categories. The total protein, urea and albumin values observed in this study were within normal arrays, indicating an admissible nutritional status and normal liver function in lambs during the experiment. The mean concentration of urea was higher in calm animals ($P<0.05$). As mentioned by Laborde *et al.* (1995), blood urea concentration was often used as a marker of nutritional and physiological status of protein metabolism of animals and that changes in urea concentrations were a reflection of changes in protein metabolism. Mortimore and Pösö (1987) reveals that increased urea concentration indicates increased amino acid catabolism, moreover (Bremmers *et al.* 1988) found that decrease in urea concentration in blood would be consistent with a more efficient utilization of absorbed N for protein synthesis.

The initial and final live weights and average weight gain during the fattening of German Mutton Merino lambs by temperament categories are shown in Table 2.

Table 2: Fattening traits of German Mutton Merino lambs by temperament categories

Investigated traits	Temperament			
	Calm	Nervous	SEM	P*
Live weight on the 1st day (kg)	19.5	19.3	0.184	0.733
Live weight on the 40th day (kg)	38.1	33.2	1.211	0.042
Weight gain 1st -40th day (g day^{-1})	466.67	345.36	29.532	0.037

*= Statistics are based on the t-test.

The calmer animals had significantly ($P<0.05$) higher live weight (38.1 kg) and daily weight gain (466.67 g/day), than the nervous ones (33.2 kg, 345.36 g/day). The animals' poor temperament has negative effect on energy and protein metabolic processes. The deficiency of metabolism can exert influence on the lambs fattening performance. The inadequacy of energy and protein metabolism associated with lower growth rates in nervous lambs. This is correspondent with earlier reports (Voisinet *et al.* 1997; Pajor *et al.* 2008), where nervous animals had lower live weight and weight gain under experimental period.

CONCLUSION

The temperament of the lambs affects blood biochemical parameters. The nervous lambs had a higher catabolic metabolism of proteins and lipids, as evidenced by higher value urea and triglyceride. Nervous and calm lambs also differ in carbohydrate metabolism, demonstrated by an increase in glucose and serum fructosamine in nervous lambs.

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