

# EFFECTS OF LAMB PRODUCTION SYSTEMS ON CARCASS CHARACTERISTICS

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**Abstract – The aim of this study was to evaluate effects of four different production models for weaned lambs on live weight gain (LWG), carcass quality and meat quality: i) indoor feeding (grass silage *ad libitum* + 0.8 kg concentrate/day/lamb), ii) grazing on cultivated pasture with or iii) without 0.3 kg concentrate/day/lamb, and iv) grazing on semi natural pasture. As expected, indoor lambs had the highest LWG (377 g day<sup>-1</sup>), followed by cultivated pasture + concentrate (287 g day<sup>-1</sup>), cultivated pasture (244 g day<sup>-1</sup>) and semi natural pasture (211 g day<sup>-1</sup>). Furthermore, lambs on semi natural pasture had lower conformation score and fat score than the other groups. There were, however, no differences in carcass pH or temperature 24 h after slaughter.**

**Key Words – live weight gain, pH, temperature**

## I. INTRODUCTION

The Swedish sheep and lamb meat production account for 30.5% of the total Swedish consumption in 2015, which means that two thirds of the total consumption was imported (Jordbruksverket, 2016; Lennhard Öberg, 2016). To satisfy the consumers' demand of lamb meat, the import of sheep and lamb meat increased a lot both in 2014 and 2015 (Lennhard Öberg, 2016). An increasing demand of high quality lamb meat produced in Sweden results in a need to know how lambs should be reared under Swedish conditions to reach a high and consistent quality of the meat. The Swedish lamb meat can today be of varying quality, both sensory and technological, which could possibly be due to the different production systems, different breeds, ages at slaughter and other factors. The aim of this study was to investigate if different production systems affect the carcass characteristics in Swedish lambs. Three typical production systems (indoor feeding, grazing on cultivated pasture or on semi natural pasture) were investigated and the carcass characteristics was compared. Further, it was also investigated whether supplementary feeding of concentrate affects the meat quality of lambs grazing on cultivates pastures.

## II. MATERIALS AND METHODS

The experiment was conducted in 2016 at Götala Beef and Lamb Research Centre, Swedish University of Agricultural Sciences, Skara, Sweden. In total, 80 crossbred intact ram lambs (Dorset x Fine Wool) were included in the study. The lambs were either 50:50 (36 lambs) or 75:25 (44 lambs) Dorset and Fine Wool, respectively. Groups of 20 animals each were assigned to one of four production models for weaned male lambs; group 1 on indoor feeding, group 2 and 3 on cultivated pasture with or without supplemented concentrate, respectively, and group 4 on semi-natural pasture. The live weight at start of the experiment were equal between groups (26.4, 26.8, 26.4 and 26.0 for group 1, 2, 3 and 4 respectively). Group 1 were housed indoors, had access to water, salt and minerals *ad libitum* and was fed a total mixed ration consisting of silage *ad libitum* and a constant amount of 0.8 kg concentrate per lamb and day. Group 2 and 3 grazed two different enclosed pastures of total 1.0 ha. In addition to grass, Group 2 got 0.3 kg of concentrate per lamb and day. Group 4 grazed a semi natural pasture and all lambs had free access to water and daily access to salt and minerals. Further, all lambs were weighed each week and hull assessment was used as a compliment to determine when each individual lamb was mature enough to go to slaughter. At slaughter, parameters as blood lactate value (at slaughter), slaughter weight, carcass conformation and fatness and pH and temperature decline over 24 hours were recorded. Lactate was measured in blood from the debleeding procedure. The pH and temperature meters were inserted in the topside in all carcasses. The GLM procedure in SAS was used for statistical evaluation with treatment as fixed effect. Differences were considered significant if  $P < 0.05$ .

## III. RESULTS AND DISCUSSION

The rearing system had a significant effect on LWG, with group 1 having the highest LWG (Table 1). Further, group 4 had lower conformation and fat scores as well as dressing percentage than the other groups. Weight at slaughter show a significant difference between groups. Group 1 had the highest weight at slaughter, significantly higher than group 3 and 4, whereas group 2 had a significantly higher slaughter weight than group 3 (Table 1). There were no significant differences between groups for blood lactate values, pH after 24 hours or the temperature after 24 hours (Table 2). The relationship between LWG and pH has been studied by others with varying results. In line with this study, some did not find any difference (e.g. Majdoub-Mathouthi *et al.*, 2013) while others have seen an effect (e.g. Hopkins *et al.*, 2005).

Table 1. Live weight and age of the lambs reared in the different production models at start of the experiment and at slaughter.

| Parameters                    | Group 1 <sup>a</sup> | Group 2            | Group 3           | Group 4            | SEM <sup>b</sup> | Significance |
|-------------------------------|----------------------|--------------------|-------------------|--------------------|------------------|--------------|
| Weight at slaughter (kg)      | 50.6 <sup>a</sup>    | 50.3 <sup>ab</sup> | 48.3 <sup>c</sup> | 48.9 <sup>bc</sup> | 0.54             | 0.0112       |
| Days in experiment            | 64.7 <sup>a</sup>    | 82.4 <sup>b</sup>  | 91.3 <sup>c</sup> | 109.1 <sup>d</sup> | 2.56             | <0.0001      |
| Growth (g day <sup>-1</sup> ) | 377 <sup>a</sup>     | 287 <sup>b</sup>   | 244 <sup>c</sup>  | 211 <sup>d</sup>   | 7.92             | <0.0001      |

<sup>a</sup> Group 1 on indoor feeding, group 2 on cultivated pasture with 0.3 kg supplemented concentrate per lamb daily, group 3 on only cultivated pasture and group 4 on only semi natural pasture; <sup>b</sup> SEM = standard error of the mean

Table 2. Carcass characteristics from lambs reared in the different production models.

| Parameters                      | Group 1 <sup>a</sup> | Group 2          | Group 3          | Group 4          | SEM <sup>b</sup> | Significance |
|---------------------------------|----------------------|------------------|------------------|------------------|------------------|--------------|
| Conformation                    | 9.2 <sup>a</sup>     | 8.7 <sup>a</sup> | 8.7 <sup>a</sup> | 7.9 <sup>b</sup> | 0.24             | 0.0024       |
| Fatness                         | 7.4 <sup>a</sup>     | 7.7 <sup>a</sup> | 7.4 <sup>a</sup> | 6.5 <sup>b</sup> | 0.17             | <0.0001      |
| Dressing (%)                    | 42 <sup>a</sup>      | 42 <sup>a</sup>  | 41 <sup>a</sup>  | 37 <sup>b</sup>  | 0.40             | <0.0001      |
| Lactate (mmol L <sup>-1</sup> ) | 3.2                  | 3.7              | 3.2              | 2.9              | 0.55             | NS           |
| pH after 24h                    | 5.83                 | 5.66             | 5.77             | 5.59             | 0.10             | NS           |
| Temperature after 24h (°C)      | 3.1                  | 3.5              | 3.2              | 3.0              | 0.28             | NS           |

<sup>a</sup> Group 1 on indoor feeding, group 2 on cultivated pasture with 0.3 kg supplemented concentrate per lamb daily, group 3 on only cultivated pasture and group 4 on only semi natural pasture; <sup>b</sup> SEM = standard error of the mean

These results show that intact lamb rams can be reared under both intensive and extensive conditions and that would not negatively affect the final carcass temperature and pH. However, when it comes to conformation and fatness, a more intensive production such as group 1, 2 and 3, resulted in carcasses with a significantly higher conformation and fatness score compared to group 4, which could be profitable for the producer when animals are slaughtered. The results suggest that although group 3 were reared at lower intensity than group 1 and 2, this group could finish up for slaughter on only cultivated pasture, as there were no significant differences between group 1, 2 and 3 when comparing conformation and fatness of carcasses. Group 4, however, did not finish up for slaughter on only semi natural pasture, according to conformation and fatness of carcasses. To get this type of lambs (group 4) ready for slaughter in the fall, supplemented feeding or combining the utilization of semi natural and cultivated pasture could be beneficial for carcass conformation and fatness. Alternatively, to advance the lambing season to occur earlier in the spring to promote an earlier release on pasture.

#### IV. CONCLUSION

The results from this study indicates that intact ram lambs reared according to four different production models (indoor, cultivated pasture with or without supplemented concentrate or semi natural pasture), does not affect meat quality in terms of final pH and temperature in carcass. On the other hand, weight at slaughter, days in experiment, growth, conformation and fatness were affected by the rearing system and could be of importance in the actual production.

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