# HOW FOUR TYPICAL SWEDISH PRODUCTION SYSTEMS FOR LAMBS AFFECT SENSORY ATTRIBUTES OF THE MEAT

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## I. INTRODUCTION

In 2017, the Swedish sheep and lamb meat production accounted for only 28.1% of the total Swedish consumption. To satisfy the consumers' demand of lamb meat, with a consumption of 1.9 kg lamb meat per person annually, the import increased substantially both in 2016 and 2017 [1]. An increasing demand of high quality lamb meat produced in Sweden results in a need to know how lamb should be reared under Swedish conditions, with the goal to obtain a high and consistent eating quality. Consumers usually determine meat quality by its eating quality, where tenderness, juiciness and flavour are the most important elements [2]. The eating quality of Swedish lamb meat varies, which might be due to different production systems, including different feeding strategies. It has been shown that different diets could affect the meat quality of lamb. Different feeding strategies could be grazing contra grain feeding, that can affect the meat to appear different in for example flavour [3]. Hence, the aim of this study was to evaluate the impact of different production models on meat quality attributes.

## II. MATERIAL AND METHODS

In total, 32 crossbred weaned intact ram lambs (Dorset x Fine Wool; 75:25) were assigned to one of four production models for lambs: i) indoor fed with grass and clover silage *ad libitum* and 0.8 kg concentrate daily per lamb, ii) grazing on cultivated pasture with or iii) without 0.3 kg concentrate supplementation daily per lamb and iv) grazing on semi natural pasture. Treatment groups were balanced for live weight at weening and equal number of twins and triplets. The live weights at start of the experiment were equal between groups (26.6, 27.1, 27.4 and 26.9 for group 1, 2, 3 and 4 respectively). All lambs were weighed each week and were assessed to go to slaughter when the individual live weight was 50 kg. The days in experiment thereby differed between treatments, from 62, 77, 85 and 108 days for group 1, 2, 3 and 4 respectively. At slaughter, carcass weight, conformation and fatness as well as pH after 24 hours were recorded. After six days of ageing *M. longissimus dorsi* were sampled and immediately frozen and stored at -20°C until analyses. The samples were thawed and cooked using the *sous vide* method to an internal temperature of 65.5±1.2°C. The samples were chilled overnight and then cut in 5 mm slices. Samples were held at 70°C for 10 minutes before served. Sensory analysis was performed by a trained panel with six assessors. The sensory data was analysed by two-way ANOVA, with production system as fixed and assessors as random factors. The colour was described according to the CIELAB system in three dimensions representing brightness (L*), redness (a*) and yellowness (b*).

## III. RESULTS AND DISCUSSION

Growth rate, live weight at slaughter and carcass characteristics, as well as meat colour and sensory attributes are presented in Table 1. No meat colour differences between treatments were seen. This indicates that neither live weight gain nor age at slaughter did effect colour, nor did the supplemented concentrate or the different pasture types. Regarding the sensory attribute 'resistance to cutting', Group 3 (cultivated pasture) was scored lower compared to Groups 2 (cultivated pasture with concentrate) and 4 (semi natural pasture). There were also a strong tendency ($p$=0.051) for Group 4 being scored higher than the other groups for the attribute 'hay odour'. The more intense odour of meat from lambs grazing semi natural pasture may be related to the lower growth rate and higher age at slaughter for this group and would be of interest to investigate further. From the results in Table 1, it can be shown that regardless of the differences in growth rate and final pH after 24 hours, there were overall very small differences for the sensory attributes. According to these results it could be valid to speculate about individual differences between animals rather than differences due to the different production systems.

Normally, growth rate and pH value of the meat are considered as tools to predict sensory attributes, such as tenderness, in this study there were no clear relationships.

Table 1 Carcass and meat quality attributes from lambs reared in the different production models.

| Parameters | Group 1 | Group 2 | Group 3 | Group 4 | SEM[1] | p-value |
|---|---|---|---|---|---|---|
| Weight at slaughter (kg) | 51.8 | 50.3 | 49.2 | 50.9 | 0.71 | NS |
| Growth rate (g day$^{-1}$) | 406$^{a}$ | 303$^{b}$ | 256$^{c}$ | 224$^{d}$ | 0.01 | < 0.0001 |
| Carcass weight (kg) | 21.6$^{a}$ | 21.3$^{a}$ | 20.9$^{a}$ | 18.8$^{b}$ | 0.47 | 0.0027 |
| Conformation score[2] | 9.4 | 9.1 | 9.4 | 9.0 | 0.34 | NS |
| Fatness score[2] | 7.3$^{ab}$ | 7.9$^{a}$ | 7.8$^{a}$ | 6.8$^{b}$ | 0.26 | 0.02 |
| pH after 24h | 5.92$^{a}$ | 5.88$^{a}$ | 5.72$^{ab}$ | 5.56$^{b}$ | 0.10 | 0.059 |
| Colour Lightness (L* ) | 37.1 | 37.2 | 36.5 | 35.7 | 0.67 | NS |
| Colour Redness (a* ) | 16.9 | 16.5 | 16.6 | 16.4 | 0.27 | NS |
| Colour Yellowness (b* ) | 7.2 | 7.0 | 6.8 | 7.1 | 0.33 | NS |
| Pinkness[3] | 46 | 47 | 45 | 46 | 2.34 | NS |
| Fibre structure[3] | 37 | 35 | 35 | 33 | 1.57 | NS |
| Total lamb meat odour[3] | 48 | 48 | 49 | 49 | 1.07 | NS |
| Acidic odour[3] | 32 | 30 | 31 | 33 | 0.97 | NS |
| Hay odour[3] | 30$^{a}$ | 29$^{a}$ | 29$^{a}$ | 32$^{b}$ | 1.07 | 0.051 |
| Resistance to cutting[3] | 37$^{ab}$ | 43$^{a}$ | 33$^{b}$ | 39$^{a}$ | 1.91 | 0.017 |
| Softness[3] | 55 | 50 | 55 | 54 | 1.90 | NS |
| Tenderness[3] | 60 | 52 | 65 | 61 | 3.47 | NS |
| Crumbliness[3] | 45 | 41 | 49 | 50 | 3.31 | NS |
| Total lamb meat flavour[3] | 54 | 53 | 54 | 56 | 1.16 | NS |
| Metal flavour[3] | 38 | 42 | 41 | 43 | 1.57 | NS |
| Leafy flavour[3] | 31 | 33 | 33 | 35 | 2.43 | NS |
| Oiliness[3] | 34 | 35 | 34 | 36 | 1.16 | NS |

[1]SEM = standard error of the mean.
[a-b] Least squares mean values with different superscripts in the same row differ significantly ($p$<0.05).
NS: non-significant ($p$>0.05).
[2] EUROP-system ranging from 1 (poor conformation/very low fat) to 15 (very excellent conformation/very high fat).
[3] Sensory scores are between 0-100 (low to high).

## IV. CONCLUSION

The results from this study indicate that the four different production models, covering the Swedish lamb production, did not have a significant effect on ultimate pH or colour of lamb carcasses. Sensory meat attributes affected were ‘hay odour’ and ‘resistance to cutting’. With this in mind, it seems that the different production systems, besides having an effect on production and carcass descriptors, did not influence eating quality including tenderness and flavour which are of the most important once from a consumer perspective.

## References


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