

# Influence of fat content on the dry ripening of sirloins from Simmental cattle

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**How to obtain safe and high quality dry aged meat is a big issue for the meat industry. In this study, the influence of the fat content on dry aging was investigated. Therefore, sirloins from Simmental cattle with fat grade 2 and 4 were dry aged for nine weeks at 2 – 3 °C and 75 % relative humidity. The fat content did not affect microbial growth or color. However, the weight loss of the sirloins with a lower fat content was about 4 % higher. Upon ripening firmness decreased whereas tenderness, evaluated by sensory panelists, increased.**

**The fat content impacted dry aging, which proofs that ripening conditions need to be selected depending on meat characteristics to obtain high quality dry aged beef.**

**Key Words –dry aged beef, process conditions, tenderness**

## I. INTRODUCTION

The production of dry aged beef has become popular in the last few years as noticeable in the media and in scientific literature [1, 2]. However, dry aging is still an extremely complex process because of naturally variations. Currently, there is a certain risk, particularly, due to a lack of knowledge in regard of process conditions such as time, temperature and relative humidity. Thus, research is necessary to gain detailed insights into the characteristics of “dry aged beef”, in particular, the sensory quality, safety and the ideal process conditions. Therefore, an international project between Germany and Belgium focuses on a comprehensive and integrated evaluation of the microbiology status, sensory profile and physically impacts during ripening to determine process conditions and ideal ripening time [3]. In this study, we investigated the impact of the muscle’s fat content on weight loss, moisture content, color, texture and microbiology upon dry aging of sirloins from Simmental cattle. The hypothesis was the higher the fat content, the better the ripening process because of the encasing fat.

## II. MATERIALS AND METHODS

Meat from Simmental cattle was provided by Müller Fleisch (Birkenfeld, Germany). According to the regulation in Germany [4] sirloins with fat grade 2 have a low fat cover, most parts of the muscles are visible (Fig. 1). Therefore they were compared with fat grade 4, high fat cover (Fig. 1).

From the same sirloin, the left and right side was placed into a RC 462 ripening fridge from Gaggenau (Bosch, Munich, Germany). Sirloins were ripened for 9 weeks at 2 – 3 °C and 75 % relative humidity, both logged with a testo 480 (Testo, Lenzkirch, Germany) and evaluated with Easy Climate Software from testo. *Weight loss* of the sirloins was determined every 3 weeks from each sirloin. *Color* of lean meat was determined using a CM-600d chromameter (Konica Minolta, Tokyo, Japan). *Firmness* of raw and cooked steaks was measured with a TA-XT2 texture analyser from Micro Stable Systems (Guildford, UK) using a Warner Bratzler shear force test (speed: 3.3 m/s) on slices with a wide of 1 cm. For the *sensory test* 12 trained panelists evaluated samples from week 0 (11 d wet aged) 3, 6, and 9 from the same animal. To determine the *microbiological growth* during the ripening a sterile cut from the surface of the lean meat (5 cm<sup>2</sup>) and the fat tissue (25 cm<sup>2</sup>) was sampled to detect total plate count, lactic acid-forming bacteria, *Enterobacteriaceae*, *Pseudomonas* spp., *B. thermosphacta*, fungi and yeasts.

## III. RESULTS AND DISCUSSION

The temperature and the relative humidity vary in the first 4 weeks slightly (data not shown). Weight loss of the sirloins as a function of time is shown in Fig. 2. A significant difference in the weight loss was observed between the fat grades. Fat grade 2 had a weight loss greater than 4 %. The higher fat cover around the sirloin acted as a barrier. Consequently, the evaporation of water was retarded. This effect was more pronounced during the first weeks of ripening where, because of the wet surface, the humidity gradient is the highest. The results of the physical analysis are shown in Tab. 1. Although differences between the fat grades would be expected, no differences in the redness,



Fat grade 2      Fat grade 4  
Fig. 1: Examples of the used fat grades.

represented by the  $a^*$ -value, were measured. Surprisingly,  $a^*$  was also not affected by ripening showing only slight distinctions that were not statistically significant. Firmness of the raw meat from both fat grades, Tab. 1, fluctuated but exhibited no significant differences whether upon ripening nor between different fat grades.

Tab. 1: Overview of the  $a^*$ -value and the firmness of raw steaks dry aged for nine weeks at 2 – 3 °C and 75 % relative humidity. (n = 3)

Parameter	$a^*$ -value ( )		Firmness, raw (N)	
	2	4	2	4
Week 0	11.76 ± 1.3	13.29 ± 1.4	57.53 ± 24.4	42.67 ± 11.9
Week 3	14.00 ± 2.0	16.55 ± 1.3	56.83 ± 25.1	71.17 ± 18.5
Week 6	13.25 ± 1.7	14.04 ± 1.1	55.13 ± 20.9	43.13 ± 10.2
Week 9	13.37 ± 1.5	14.69 ± 2.1	50.94 ± 20.2	47.27 ± 14.3

Comparing the firmness of the cooked samples measured using texture analyser with tenderness evaluated by sensory tests, a clear correlation between the firmness and tenderness could be observed (Fig. 3) which was also reported by Platter *et al.* [5]. When firmness is decreasing because of ripening, tenderness is increasing (Fig. 3) [5]. Ripening caused microbial growth on the surface (data not shown), particularly from week 3 on in *Pseudomonas* spp. and *B. thermosphacta*. Most of the time, either *Enterobacteriaceae* or yeasts exist in > 7.3 kbE/g on the lean meat as well. The fat content had no impact on microbiology on the meat surface.

### CONCLUSION

The dry aging process causes physical changes in the meat muscle resulting in a loss in firmness which affects the tenderness. This study confirmed the hypothesis that the fat content has an effect on the ripening process. However, fat content has no impact on color and microbiology. Furthermore this study showed that the process is not fully understood. More research is needed to determine the influence of process parameters affecting dry aging. Thus, process-structure-function relationships may be identified to select proper ripening conditions in dependence of meat characteristics to obtain high quality dry aged beef. With these insights, usually discarded trimmings may be valorized by dry aging to obtain a more cost-effective and more sustainable product.

### ACKNOWLEDGEMENTS

This project was financed by a grant awarded by the German Industrial Academic Research Alliance (AiF 162 EN) and the Research Association of the German Food Industries (Forschungskreis der Ernährungsindustrie - FEI).

### REFERENCES

[1] Germany Trade and Invest (2016). The Food & Beverage Industry in Germany. Berlin.  
 [2] Kim, Y. H. B., Kemp, R., & Samuelsson, L. M. (2016). Effects of dry-aging on meat quality attributes and metabolite profiles of beef loins. *Meat Science*, 111, 168-176.  
 [3] Ghent University, KU Leuven, German Institute of Food Technologies. (2016). Safe and qualitative dry aging of beef: Forschungskreis der Ernährungsindustrie. Bonn, Germany.  
 [4] Verordnung (EG) Nr. 1234/2007 des Rates vom 22. Oktober 2007 über eine gemeinsame Organisation der Agrarmärkte und mit Sondervorschriften für bestimmte landwirtschaftliche Erzeugnisse:(Verordnung über einheitliche GMO) (2007).  
 [5] Platter, W., Tatum, J., Belk, K., Chapman, P., Scanga, J., & Smith, G. (2003). Relationships of consumer sensory ratings, marbling score, and shear force value to consumer acceptance of beef strip loin steaks. *Journal of Animal Science*, 81(11), 2741-2750.

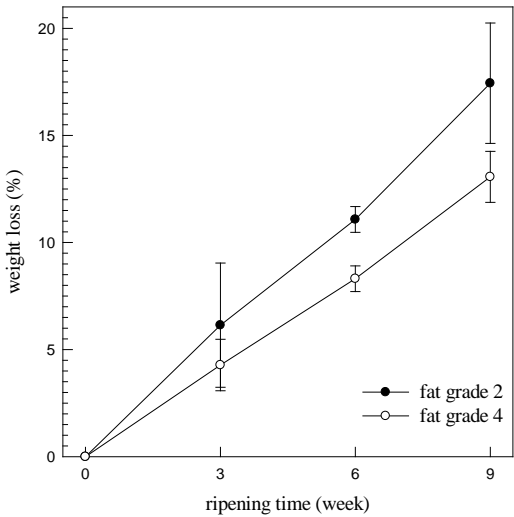


Fig. 2: Weight loss over ripening of nine weeks. (n = 5)

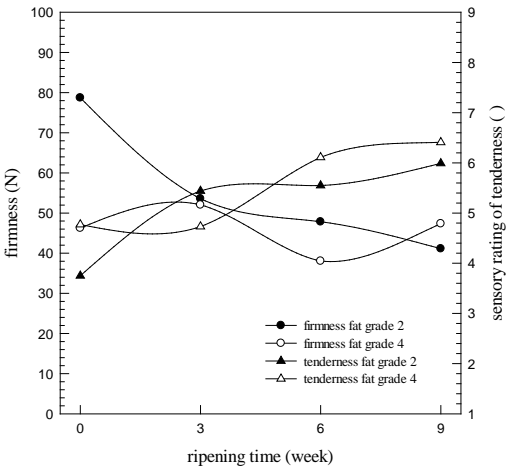


Fig. 3: Comparison of the firmness of cooked meat to the rating of tenderness, which was determined by sensory tests. (n = 3)  
 (for overview: standard deviation not shown)