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DRY-AGED MEAT QUALITY IN VEAL CALVES FED WITH MILK WHEY

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I. INTRODUCTION

In the pursuit of sustainability and waste reduction within the human food industry, milk whey, a nutrient-rich byproduct of cheese production, emerges as a promising alternative in animal nutrition [1]. Packed with lactose, proteins, and essential minerals, whey has demonstrated its potential as a cost-effective and eco-friendly feed ingredient for livestock, fostering a circular economy in animal farming [2,3]. Given that dietary composition can influence oxidative stability, the aging process, and the sensory attributes of meat products [4], this study aimed to evaluate the use of milk whey in calf diets as a substitute for conventional milk replacers and to explore its impact on meat quality during dry aging.

II. MATERIALS AND METHODS

The trial involved 32 male Belgian Blue×Holstein calves (Approval No. 2256-III/13). The animals were randomly divided into four replicates, each consisting of 8 animals. Within each replicate, the 8 animals were further randomly assigned to one of the two experimental treatments. The control treatment (C) was fed a commercial milk replacer, while the treated one (W) received whey milk for a period of 200 days. Initial and final weight were measured. At the end of the feeding trial, the animals were slaughtered, the dressing percentage was calculated (carcass weight/final weight × 100), and the left loin was collected from each carcass. The loins were subjected to a 42-day dry-aging period in a dynamic dry aging cabinet. At the start of aging and at weekly intervals (D0, D7, D14, D21, D28, D35, D42), a steak approximately 30 mm thick was sampled from each loin for the analysis. Instrumental color, water-holding capacity (WHC) and cooking loss were estimated as described by De Palo et al. [5]. Thiobarbituric acid reactive substances (TBARS) and protein carbonyls determinations were performed as reported by De Palo et al. [6]. The ferric reducing antioxidant power (FRAP) assay was used to measure total antioxidant potential according to the method described by Dinardo et al. [7]. Textural properties were assessed using a ZI.0 TN texture analyzer (ZwickRoell GmbH & Co. KG, Ulm, Germany), following the method outlined by De Angelis et al. [8] with few modifications. The data set was tested for normal distribution and variance homogeneity (Shapiro-Wilk). Then, was subjected to analysis of variance (ANOVA), using the General Linear Model (GLM) software by SAS (2018) (version 9.3, SAS Institute Inc., Cary, NC, USA), according to the following model: $y_{ijk} = \mu + \alpha_i + D_j + A_k + (D \times A)_{jk} + \varepsilon_{ijkl}$, where y_{ijk} represents all parameters as dependent variables; μ is the mean; α_i is the single block random effect, D represents the effect of the j^{th} diet (j = 1,2), A represents the effect of the k^{th} aging time (k = 1, ..., 7), D × A represents the effect of the binary interaction between the two independent variables (jk = 1,…, 14) and ε_{ijkl} is the error. Subsequently, a Tukey test for repeated measures was carried out to evaluate the differences between the means during the aging time. For carcass traits, only the effect of diet was considered. All means were expressed as square means and mean standard error. The significance level was set to $P < 0.05$.

III. RESULTS AND DISCUSSION

Carcass traits of veal calves fed with (W) or without (C) milk whey are summarized in Table 1. Diet had no statistically significant effect on initial weight, final weight, or warm dressing percentage ($P > 0.05$). The absence of significant differences in carcass traits between calves fed with milk whey and those receiving conventional milk replacer aligns with previous findings suggesting that whey-based by-products can be a viable alternative to traditional liquid feeds without negatively impacting growth performance or dressing yield [1,3]. This is particularly relevant from a sustainability standpoint, as the use of whey—a dairy industry by-product—can reduce feed costs and environmental burden associated with veal production [1].

Table 1 – Effects of diet carcass traits of veal calves fed with (W) or without (C) milk whey.

Traits	C	W	SEM	D
Initial weight, kg	54.2	53.7	2.24	0.619
Final weight, kg	284.6	282.9	7.36	0.483
Warm dressing percentage, %	58.1	58.3	0.88	0.838

Figure 1 presents the results for pH, meat redness, and WHC during the dry-aging period of meat from calves subjected to diets with or without whey supplementation. No significant effects of either dietary treatment or aging duration were observed for any of the evaluated parameters ($P > 0.05$). The lack of significant changes in meat quality parameters throughout the dry aging period suggests that milk whey does not compromise meat quality during post-mortem maturation.

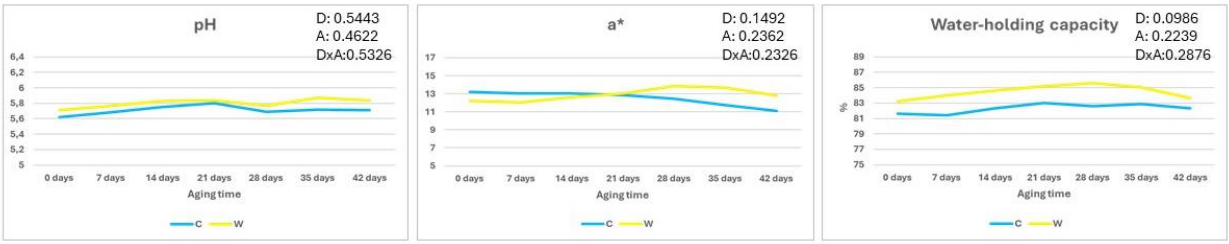


Figure 1 – Effects of diet (D), aging time (A) and their binary interaction (DxA) on pH, redness and water-holding capacity of veal fed with (W) or without (C) milk whey.

IV. CONCLUSION

Despite being preliminary, the present findings indicate that the use of milk whey as a substitute for commercial milk replacer in the diet of calves intended for veal production may represent a viable and sustainable alternative. This strategy promotes the valorization of a by-product from cheese industry, contributing to waste reduction and aligning with the principles of the circular economy. Notably, whey inclusion did not negatively affect carcass characteristics or key meat quality attributes during the dry aging process.

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