# EFFECTS OF SOYBEAN MEAL REPLACEMENT WITH UREA ON BEEF QUALITY AT DIFFERENT AGING TIMES

Pâmela Gracioli Vilas Boas*[1], Cris Luana de Castro Nunes[1], Isabelle Pinheiro Siqueira[1], Jenifer Maira Lima Ramos[1], Julia Travassos da Silva[1], Sebastião de Campos Valadares Filho[1], Mario Luiz Chizzotti[1].

[1] Departament of Animal Science, Universidade Federal de Viçosa, Brazil.

*Corresponding author email: pamela.boas@ufv.br

## I. INTRODUCTION

The substitution of true protein sources for non-protein nitrogen sources, such as urea (UR), has been employed to reduce feed costs in the livestock industry. Protein-rich feeds, such as soybean meal (SB), tend to be more expensive and they can represent a high cost during the cattle finishing phase [1]. The substitution of protein for non-protein sources could affect the characteristics of carcass and meat quality. In this context, the objective of this study was to evaluate the effect of partial or total replacement of SB by UR in the diets of F1 Red Angus x Nellore cattle on the qualitative parameters of beef aged for 0 and 14 days.

## II. MATERIALS AND METHODS

Thirty F1 Red Angus x Nellore bulls, averaging 9 ± 1 months of age and 370 ± 6 kg, were randomly assigned to receive one of three experimental diets, containing different levels of replacement soybean with urea based on crude protein content, on dry matter basis: diet with 0% replacement (0% UR and 12% SB); diet with 54% replacement (1% UR and 5,6% SB); and diet with 100% replacement (1.9% UR and 0% SB). The experiment lasted 93 days (9 days of adaptation and 84 days of trial). The diet was offered ad libitum, with a forage-to-concentrate ratio 20:80, using corn silage as forage source. All diets were isoproteic, with approximately 13% crude protein/kg (DM basis), formulated for a gain of 1.3 kg/day, following the BR-CORTE [2] recommendations. At the end of the 93-day trial, the animals were harvested. After 24h of carcass chilling, a portion of the *longissimus lumborum* was extracted and divided into two properly identified and vacuum-packed portions: one was non-aged and immediately frozen, and the other aged at 2°C for 14 days. All samples, non-aged and aged, underwent freezing before being sent to the meat science laboratory, where they were cut into steaks for subsequent meat quality analyses. Meat color measurements ($L^*$, $a^*$, and $b^*$) were obtained using a Hunter MiniScan EZ colorimeter (4500L; Hunter Associates Laboratory, Inc., Reston, Virginia, USA). The wavelengths were used to determine the percentage of metmyoglobin (MMb), deoxymyoglobin (DMb), and oxymyoglobin (OMb), following AMSA equations [3]. Moreover, analyses of thawing and cooking losses, and Warner-Bratzler shear force (WBSF) were performed. Data were analyzed using SAS software (9.4; SAS Institute Inc., Cary, NC, USA). PROC GLM was employed to evaluate the effects of diet and aging and their interaction on meat quality parameters. Comparisons were performed using Tukey's test, considering a significance level of 5%.

## III. RESULTS AND DISCUSSION

There was no interaction effect between dietary treatments and aging times (Table 1). The $L^*$, $a^*$, and $b^*$ color parameters showed no difference among treatments or aging time. Also, there were no differences in the percentages MMb, DMb and OMb among the dietary treatments. However, aging times differences were observed in MMb (<0.001), DMb (<0.001), and OMb (P = 0.002), where 0-day showed lower MMb and DMb, and higher DMb compared to 14-days aged beef. Furthermore, there were no differences among the dietary treatments (P = 0.080) for WBSF. However, differences were observed among the different ageing periods (<0.001), with 14-day aged steaks presenting a better tenderness than 0-day. The lack of differences among the dietary treatments aligns with studies that found no significant impact of urea on carcass composition [1,4], indicating that urea in the diet does not alter meat quality. The differences observed at different aging times were expected due to proteolysis and oxidation, which enhance tenderness and change the myoglobin chemical states [5].

Table 1 – Color parameters, water losses, and shear force values of beef evaluated for partial or total soybean meal replacement with urea at different aging times.

| Treatments[1] | Diet | | | Aging | | *P-value* | | |
|---|---|---|---|---|---|---|---|---|
| | 0% | 54% | 100% | 0 d | 14 d | Diet | Aging | D*A[2] |
| Parameters | | | | | | | | |
| *L** | 40.48±4.21 | 37.76±4.26 | 36.78±3.52 | 38.17±4.07 | 38.72±5.19 | 0.131 | 0.535 | 0.980 |
| *a** | 14.24±1.98 | 13.84±1.46 | 13.31±1.77 | 13.76±1.69 | 14.56±1.65 | 0.945 | 0.374 | 0.950 |
| *b** | 12.30±2.52 | 10.94±1.81 | 10.50±1.85 | 11.16±2.07 | 12.39±2.65 | 0.325 | 0.100 | 0.943 |
| MMb (%) | 15.37±2.06 | 16.95±1.81 | 16.68±1.76 | 16.41±1.93 | 22.88±7.08 | 0.327 | <0.001 | 0.068 |
| DMb (%) | 34.08±8.67 | 35.47±6.64 | 39.82±7.27 | 36.64±7.44 | 20.25±12.20 | 0.313 | <0.001 | 0.777 |
| OMb (%) | 50.55±10.12 | 47.58±7.62 | 43.50±8.14 | 46.96±8.53 | 56.87±9.78 | 0.581 | 0.002 | 0.873 |
| Thawing Loss (%) | 7.02±2.20 | 8.10±2.44 | 6.25±2.46 | 7.09±2.31 | 5.62±1.94 | 0.748 | 0.058 | 0.150 |
| Cooking Loss (%) | 11.82±2.88 | 12.75±3.96 | 11.92±2.32 | 12.19±3.16 | 10.25±3.41 | 0.913 | 0.066 | 0.290 |
| WBSF (N) | 40.40±8.77 | 54.72±21.41 | 42.38±7.90 | 45.83±15.11 | 30.69±8.73 | 0.080 | <0.001 | 0.155 |

[1]0% = 0% replacement of soybean meal with urea; 54% = 54% replacement of soybean meal with urea; 100% = 100% replacement of soybean meal with urea; 0 d = 0 day of aging; 14 d = 14 days of aging. [2]D*A = interaction effect between dietary treatments and aging times.
Means followed by standard deviation.

## IV. CONCLUSION

This study indicates that the partial or total replacement of soybean meal with urea maintains beef quality attributes. This finding supports the viability of using urea as a cost-effective alternative to soybean meal in beef cattle diets without compromising meat quality.


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