EFFECT OF WET DISTILLERS GRAINS PLUS SOLUBLES-BASED FEEDLOT DIET IN PRODUCTION AND BEEF QUALITY PARAMETERS

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Abstract – Wet distillers grains plus soluble co-product (WDGS) are being introduced in animal feeding as an alternative to corn. The aim of the present study was to evaluate the effect of the incorporation of 30% of WDGS in the finishing diet of steers on both production parameters and meat quality traits. Results showed that isoenergetic diets only differed in the fat and fat-soluble antioxidant vitamins contents. Regarding production parameters, animals displayed comparable values, excepting for the conversion rate. This parameter was increased ($p < 0.05$) in 30% of WDGS-fed animals. Quality traits of *Longissimus dorsi* ~~LD~~[rw1] muscles showed no significant differences between treatments, excepting for fat soluble vitamins levels of alpha-tocopherol and beta-carotene. In general terms, results obtained indicate that the incorporation of 30 % of DDGS does not affect neither production parameters of animals nor the quality of obtained meat.

Key Words – WDGS, fatty acid, meat quality

I. INTRODUCTION

Corn-based ethanol industry has significantly increased in the last years. It is estimated a theoretical production capacity of 484,500 cubic meters of ethanol per year [1]. Related wet distillers grains plus soluble (WDGS) co-product is being introduced in animal diets. It is known that the nutritional composition of these products may be influenced by several factors like grain type and quality, milling process and the extent of the fermentation, among others. Few related research about its effect has been done under controlled conditions. Thus, the aim of the present study was to evaluate the effect of the incorporation of WDGS in the diets of steers on the production parameters and meat quality.

II. MATERIALS AND METHODS

The study was carried out at the Agricultural Experiment Station of INTA Marcos Juárez, Córdoba, Argentina. Thirty six British steers averaging 207±19.9 kg were randomly assigned to two diet treatments after a period of adaptation of 4 weeks with high-concentrates diets: a) T1 (control diet) consisted of 10% hay, 15% soybean meal, 74% cracked corn and minerals, and b) T2, similar composition than T1 with 30% WDGS (DM basis) partially replacing soybean meal and corn. Both diets were isoenergetic (2.95 Mcal / kg DM) and isoproteic. The evolution of individual live weight and feed intake in each experimental unit was recorded during the experience.

Consumption was determined by the difference between the amount offered and the remainder at 24 h. Conversion was determined as the ratio of daily consumption of DM and average daily gain (ADG).

Animals were slaughtered at a commercial slaughterhouse once they achieved the status and weight required by market after 70 days of experimental feeding. Carcasses were individually graded and chilled at 2 °C. Forty eight hours after slaughter, a rib section encompassing the 10th to 13th ribs was removed from the left side of each carcass. The rib sections were individually identified, vacuum packed and frozen at -20 ºC until analysis.

Quality traits: Steaks obtained from the 13th rib were used for determination of Warner-Bratzler shear force (WBSF). Cooking loss was determined as a rate between the weight loss during cooking and the pre-cooked weight, and was reported as a percentage. Intramuscular pH was measured in the[rw2] *Longissimus dorsi - LD-* section of steaks from the 12th rib. Instrumental color determination was performed prior to processing for shear force analysis on the rib eye section and on the outside fat layer of steaks from the 13th rib. A Minolta colorimeter (CR 400-Konica Minolta®) was used with CIE Lab, which provided the values of color components: L*, a* and b*.

Fat and antioxidant vitamin analyses: total fat content of diets and *LD* muscles was determined by Soxhlet method (AOAC Official methods of analysis, 1990). On the other hand, lipids extracted according to Folch *et al.* [2] were prepared according to Pariza *et al.* [3] and analyzed by GC (Varian CP 3800, CA, USA) in order to obtain the fatty acid profile. Analytic results were expressed as percentages of total fatty acids.

Alpha-tocopherol, gamma-tocopherol and beta-carotene were extracted as described by Descalzo *et al.* [4]. All samples were analysed by reverse phase high-performance liquid chromatography (HPLC).

The results were analysed by ANOVA and means were compared by Duncan´s method (α = 0.05).

III. RESULTS AND DISCUSSION

Table 1 shows results from production parameters and some quality traits. As can be seen, ADG values were according with the energy levels of diets. Neither ADG nor DM consumption presented significant difference. Even tough, a better conversion rate was seen in animals fed with T1.

Dietary treatment that includes a moderate level of WDGS incorporation did not alter marbling score in the present study. A similar result was recently reported by Mello *et.al.* [5]. Meat and fat color, and pH did not vary between treatments. Even though, a higher variation in the L* parameter of beef and fat was observed for T2. Beef WBSF tended to increase in T2.

Table 1. Production parameters and meat quality traits recorded in animals fed with T1 (0% WDGS) and T2 (30% WDGS) diets.

	T1 (0%)	T2 (30%)
Initial LW, kg	222.89 (17.13)	224.00 (20.58)
Final LW, Kg	344.89 (15.96)	340.29 (11.64)
ADG, kg d^{-1}	1.705 (0.206)	1.622 (0.229)
Consumption (gDM/kgLW)	28.83 (1.60)	30.41| (1.19)
Conversion (conv/ADG)	4.80 (0.19) b	5.67 (0.21) a
Marbling score	2.1 (sa)	1.7 (sa)
pH	5.52 (0.08)	5.47 (0.13)
Muscle color		
L*	39.33 (3.6)	38.16 (4.9)
a*	15.62 (2,2)	15.43 (2.06)
b*	10.61 (1.06)	9.54 (1.5)
Subcutaneous fat color		
L*	64.47 (1.5)	62.83 (4.6)
a*	7.77 (2.3)	7.70 (2.3)
b*	13.70 (1.6)	13.86 (1.7)
cooking looses[rw3], %	32.33(1.32)	32.45(0.97)
WBSF, N	33.40 (7,8)	39.70 (9.23)

LW=life weight, ADG=average daily gain; DM=dry matter; sa: small amount; WBSF= Warner-Bratzler shear force. Row means followed by different letter, are significant different ($p < 0.05$).

Table 2 shows the levels of natural antioxidant vitamins in the two diets studied. As can be seen, the diets showed different profiles for fat-soluble vitamins. Thus, T2 diet presented higher (p < 0.05) concentration of alpha-tocopherol (1.3 times higher), gamma-tocopherol (1.7 times higher) and beta-carotene (2.3 times higher) than T1 diet.

Table 2. Levels of fat-soluble antioxidants vitamins, fatty acid composition and total fat content in T1 (0% WDGS) and T2 (30% WDGS) diets.

Antioxidants (mg/Kg DM)	T1 (0%) Mean	T2 (30%) Mean
Alpha-tocopherol	7.18 (0.44)b	9.41[rw4] (0.30)a
Gamma-tocopherol	7.89 (0.65)b	13.12 (0.29)a
Beta-carotene	0.021(3.91E-03)b	0.048 (7.67E-03)a
Fatty acid (% of total lipid)		
C14:0	0.08 (0.01)	0.09 (0.00)
C16:0	12.44 (0.38)	12.63 (0.43)
C18:0	2.49 (0.38)	1.81 (0.06)
C18:1 n-9	25.23 (1.09)	27.30 (0.36)
C18:2 n-6	51.41 (0.69)	52.06 (0.04)
C18:3 n-3	3.72 (0.95)	2.00 (0.00)
Total fat (% DM)	2.73 (0.12)b	3.53 (0.06)a

DM=dry matter
Row means followed by different letter, are significant different (*p* < 0.05).

Total fat content of diets also significantly differed (p ≤~~<~~ 0.05). Thus, T2 diet composition showed increased (p ≤~~<~~ 0.05) levels of total fat when compared to control diet. Regarding fatty acid composition, no significant difference was found between diets, demonstrating their similar lipid quality~~ of them~~.

The analysis of composition of *LD* muscles showed increased ($p < 0.05$) levels of beta-carotene in muscles from animals fed with T2. This finding would be consistent with the contribution of the moderate replacement of WDGS in this diet. This replacement is reflected in the increased supply of beta-carotene in the diet T2 and consequently greater estimated daily consumption per steer (0.20 mg *vs* 0.50 mg). On the other hand, alpha-tocopherol presented a significant decrease ($p < 0.05$) in *LD* from animals fed with T2. This apparent selective response of muscle composition to these diets will be studied in further research.

Regarding lipid analysis of *LD*, (Table 3) no significant difference was found for total intramuscular fat content or FA profile. Despite diets contained different amounts of total fat, their effect on the lipid content and fatty acid composition of LD muscles were comparable in both feeding treatments.

Table 3. Levels of fat-soluble antioxidants vitamins, fatty acid profile and intramuscular fat content of *LD* of animals fed with T1 (0% WDGS) and T2 (30% WDGS) diets.

Antioxidants (µg/g fresh beef)	T1 (0%) Mean	T2 (30%) Mean
Alpha-tocopherol	0.58 (0.08)a	0.30 (0.05)b
Gamma-tocopherol	1.00 (0.38)	0.66 (0.10)
Beta-carotene	0.01 (2.59E-03)b	0.02 (3.76E-03)a
Fatty acid (% of total lipid)		
SFA	35.49 (1.97)	37.39 (2.96)
MUFA	40.73 (5.04)	35.70 (3.20)
PUFA	11.68 (3.85)	12.71 (2.75)
n6/n3	5.84 (0.76)	5.36 (2.60)
MUFA/ SFA	1.14 (0.09)	0.96 (0.06)
PUFA/ SFA	0.33 (0.13)	0.35 (0.10)
IMF (%)	2.08 (0.82)	2.00 (0.73)

IMF=intra-muscular fat
Row means followed by different letter, are significant different (*p* < 0.05).

IV. CONCLUSION

The incorporation of 30% of WDGS to feedlot finishing diets of steers modified its composition, but did not affect neither production parameters of animals nor the quality traits of ~~obtained ~~their meat.

According to the present results, the utilization of moderate levels of WDGS in animal feeding would represent an interesting way for decreasing beef production costs with the same current feeding strategies, without affecting related quality aspects.

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