BELLY QUALITY OF PIGS FED WITH DDGS-ENRICHED DIET

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I. INTRODUCTION

Brazil, a key player in agricultural and animal product exports, faces increasing pressure to adopt sustainable practices. We suggest incorporating distiller's dried grains with solubles (DDGS) into pig feeds, potentially replacing corn and soybean meal without compromising belly quality. Our study examines the impact of DDGS inclusion on belly quality attributes and lipid profile, crucial for bacon quality, given the overlap of Brazil's corn production, pig farming, and agroenergy sectors.

II. MATERIALS AND METHODS

The study registered under FZEA CEUA nº 6260270223 involved 500 piglets (250 females and 250 immunocastrated males) on a commercial farm, with an average age of 23 days and weight of 6.5 kg at the start, which were distributed in randomized blocks according to sexual condition and initial weight. Five treatments were administered to ten replicate pens, each with ten animals, over a 147-day experimental period, covering the nursery, growing, and finishing phases. For T1, DDGS was not included in the diet (T1: 0%). For T2 to T5, DDGS was included from 14 days and maintained until the experiment's end, replacing corn and soybean meal in the isoenergetic diets, according to the following proportions: T2: 10%; T3: 20%; T4: 30%; and T5: 40%. To evaluate belly quality variables, two pigs weighing closest to the average weight of the pen, per experimental unit, were slaughtered. The belly of each left half carcass was assessed for its length, width, average thickness, and flexibility [1] [2]. For belly fat quality analyses, lipid profile analysis was performed after lipid extraction [3], followed by the methyl ester preparation process [4]. The determination of the fatty acid profile was carried out by gas chromatography. The iodine value was calculated in g/100g of fat [5]. The effect of treatments was analyzed using regression with the REG procedure. Data were subjected to linear and quadratic regression analyses to determine the optimal level of DDGS inclusion. Differences between mean values were considered statistically significant at $P < 0.05$.

III. RESULTS AND DISCUSSION

Table 1 presents belly quality and fatty acid profile results. With the increase in DDGS inclusion, a decreasing linear effect was observed in belly weight ($P = 0.0002$), thickness ($P < 0.0001$), SFA ($P < 0.0001$), MUFA ($P < 0.0001$), and PUFA n3 ($P = 0.028$). Additionally, a quadratic effect was observed in external ($P = 0.021$) and internal ($P = 0.025$) belly flexibility, with the lowest external flexibility estimated at 37% DDGS inclusion and the lowest internal flexibility at 38% DDGS inclusion. An increasing linear effect was observed in PUFA ($P < 0.0001$), PUFA/SFA ($P < 0.0001$), PUFA n6 ($P < 0.0001$), n6/n3 ($P < 0.0001$), and iodine value ($P < 0.0001$). These changes are due to the high unsaturated fatty acid content in DDGS [6], as pigs, being monogastric, alter their fatty acid composition based on their diet.

Table 1 – Effects of experimental treatments on belly quality and belly fat fatty acid profile.

Traits	Treatments (DDGS inclusion)					SEM	P value	
	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T5 (40%)		Linear	Quadratic
Belly weight[1], kg	6.26	5.99	5.83	5.77	5.58	0.225	**0.0002**	0.595

Belly length, cm	58.2	57.5	57.5	58.4	57.9	0.733	0.855	0.566
Belly width, cm	29.6	29.6	29.6	29.8	29.3	0.335	0.738	0.515
BEF[2], cm	19.1	15.6	13.5	12.5	12.2	2.110	<0.0001	**0.021**
BIF[3], cm	27.6	23.3	20.3	19.3	18.6	2.933	<0.0001	**0.025**
Belly thickness[4], cm	3.82	3.55	3.43	3.40	3.23	0.131	**<0.0001**	0.381
SFA[5], %	35.2	34.5	33.8	33.3	33.0	55.44	**<0.0001**	0.310
MUFA[6], %	52.2	51.1	49.6	48.7	46.8	35.96	**<0.0001**	0.492
PUFA[7], %	12.1	14.2	16.4	17.9	20.4	74.64	**<0.0001**	0.921
PUFA/SFA[8]	0.35	0.41	0.49	0.54	0.63	0.018	**<0.0001**	0.792
PUFA n3[9], %	7.31	6.99	7.00	6.69	6.24	0.402	**0.028**	0.627
PUFA n6[10], %	11.06	13.05	15.17	16.6	19.1	71.20	**<0.0001**	0.799
n6/n3[11]	1.49	1.89	2.32	2.56	3.16	1.461	**<0.0001**	0.674
IV[12], g/100g	65.2	67.5	69.7	71.5	73.9	61.04	**<0.0001**	0.911

SEM: standard error of the mean; BEF: belly external flexibility; BIF: belly internal flexibility; SFA: total saturated fatty acids; MUFA: total monounsaturated fatty acids; PUFA: total polyunsaturated fatty acids; PUFA/SFA: ratio of PUFA to SFA; n3: omega 3; n6: omega 6; n6/n3: ratio of n6 to n3; IV: iodine value. [1]Significant linear regression: $y = 6.1993 - 0.01581x$, $R^2 = 0.9596$; [2]Significant quadratic regression: $y = 19.0311 - 0.3734x + 0.005045x^2$, $R^2 = 0.9985$; [3]Significant quadratic regression: $y = 27.5203 - 0.4765x + 0.006353x^2$, $R^2 = 0.9963$; [4]Significant linear regression: $y = 3.7487 - 0.01331x$, $R^2 = 0.9234$; [5]Significant linear regression: $y = 35.117 - 0.5811x$, $R^2 = 0.9788$; [6]Significant linear regression: $y = 52.287 - 1.3125x$, $R^2 = 0.9888$; [7]Significant linear regression: $y = 12.101 + 2.0502x$, $R^2 = 0.9954$; [8]Significant linear regression: $y = 0.3456 + 0.006894x$, $R^2 = 0.9965$; [9]Significant linear regression: $y = 0.73422 - 0.02457x$, $R^2 = 0.8898$; [10]Significant linear regression: $y = 11.061 + 1.9757x$, $R^2 = 0.9954$; [11]Significant linear regression: $y = 14.8394 + 0.4004x$, $R^2 = 0.9852$; [12]Significant linear regression: $y = 65.256 + 2.1347x$, $R^2 = 0.9982$.

IV. CONCLUSION

A higher incorporation of DDGS in the diet increased polyunsaturated fatty acids and raised the iodine value. This suggests that the belly fat oxidizes more quickly and becomes more flexible. Although this may reduce the bacon's slicability, it indicates a healthier fat profile for human consumption.

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