INFLUENCE OF PRE-HARVEST WITHDRAWAL PERIOD AT ZILPATEROL HYDROCHLORIDE SUPPLEMENTATION ON CARCASS TRAITS, SPEED FALL pH AND WATER HOLDING CAPACITY OF FEEDLOT HEIFERS

Torrentera* O.N, Carrasco J. R., Arrizón G. A., Álvarez A. E., A. Plascencia

Universidad Autónoma de Baja California, Mexicali. B.C. México

ABSTRACT. Water holding capacity (**WHC**) of retail meat cuts in Baja California, Mexico; represent important economic lost, until a 5% of weight in the final product, because the quality characteristics of fresh meat can be altered and reduces its life of shelf. Habitually zilpaterol hydrochloride (**ZH**; Zilmax®; Intervet Schering-Plough Animal Health Intervet) is added into finishing diet of bovines by 30 d period. For that in packing plant have attributed that the presence Zilmax can to induce changes in the speed fall of pH **(SFpH)** causing reduction on WHC and meat quality. Crossbred heifers (64; 451 ± 23 kg) were used in a 42-d feeding trial to evaluate the influence of withdrawal period pre-harvest zilpaterol by hydrochloride supplementation on carcass traits, SFpH and WHC. Treatments were: 1) (**NZ)**, no hydrochloride zilpaterol supplementation; The remaining treatments, was added Zilmax® (0.15 mg/kg BW d^{-1}) during 30 d. in the diet with **2)** 3 days (**Z3d**); **3)** 6 days (**Z6d**) and **4)** 12 days (**Z12d**) of withdrawal period to slaughter, respectively. After finishing, heifers were slaughtered, and chilled (±4°C) during 48 h and carcass traits were measured. The pH and temperature were recorded at 1, 3, 6, 12, 24 and 48 hours postmortem into the *Longgisimus toracis muscle* (**LT**) between 8th and 10th rib. To determine the SFpH a linear model was applied (P<0.05). Treated groups with ZH increased HCW (4.5%) on average compared with the group NZ. SFpH and WHC values were not affected (P>.05) by Zilmax addition and days of retirement previous at slaughter.

Key words: β-agonist, pH postmortem, water holding capacity

I.INTRODUCTION

Zilpaterol hydrochloride is a β-adrenergic agonists (**βAA**) pharmaceutical approved in México (SAGARPA, 1999) and USA (FDA, 2006). Several studies reported (Casey et al.1997; Avendaño-Reyes et al. 2006; Montgomery et al; 2009;) that ZH improved feed efficiency and increased feedlot steer ADG, dressing percent, HCW, and LM area while carcass fat decreased (Rathmann et al, 2009). Evidently the use of βAA to improve production, but without appropriate management some βAA can have a negative effect on meat quality, especially tenderness (Dikeman, 2007). Even, the use of ZH in Holstein steers will have minimal effects on purge, thaw, or cooking loss (Nichols et al., 2009). Otherwise, due to its rapid elimination (>95% in 72 h), the supplementation period of zilpaterol hydrochloride affected growth performance and carcass traits. Vasconcelos et al. (2008) reported that according the supplementation duration increased from 20 to 40 d, DMI decreased and G:F increased linearly in steers Also the efficacy of ZH may be affected by extended withdrawal period before slaughter (Holland et al., 2010). Various factors effect water-holding capacity such as accelerated pH decline and low ultimate pH (Huff- Lonergan and Lonergan, 2005). However, limited data are available concerning the effect of supplementing ZH on postmortem fall speed of pH and water holding capacity. The purpose of this study was to evaluate the preslaughter withdrawal extending period (for 3 or 9 additional days) on carcass traits, fall speed of pH postmortem and water holding capacity of feedlot heifers supplemented with zilpaterol

II.MATERIALS AND METHODS

All procedures involving live animals were conducted within the guidelines of approved local official techniques of animal care (NOM-051-ZOO-1995: humanitarian care of animals during mobilization of animals NOM-024-ZOO-1995: animal health stipulation sand characteristics during transportation of animals NOM-EM-015-ZOO-2002: technical stipulations for the control use of β agonists in animals; and NOM-033-ZOO-1995, humanitarian care and animal protection during slaughter process).

Sixty-four crossbred heifers (initial BW of 451 ± 23 kg) were used to evaluate the influence of zilpaterol withdrawal period (3, 6, or 12 d) on carcass traits, fall pH postmortem and water holding capacity. The trial was conducted at Universidad Autónoma, Baja California, México. On arrival into the feedlot (98 d before starting the trial), heifers were vaccinated, dewormed, vitaminized and implanted. Cattle were individually weighed at 0600 h, both at the start of the feeding trial. Treatments were 1) (**NZ**), no hydrochloride zilpaterol supplementation; The remaining treatments, was added Zilmax® (0.15 mg/kg BW d -1) for a period of 30 d.

in the diet with 2) 3 days (**Z3d**); 3) 6 days (**Z6d**) and 4) 12 days (**Z12d**) of withdrawal period to slaughter, respectively.. The total daily dose of zilpaterol was provided in the morning feeding as part of the complete mixed diet. This was accomplished by combining zilpaterol with the basal diet in a 90-kg capacity paddle mixer for 10 min before feeding to cattle. At end of feedlot period heifers were shipment to a commercial abattoir (Rastro TIF 301) located 14 km from the feedlot facility. NZ and Z3d treatments were slaughtered the same day, the Z6d and Z12d treatments were slaughtered 3 and 9 d later, respectively. All heifers were stunned by captive bolt and electrical stimulation was applied. The HCW were obtained from all heifers at time of slaughter. After, carcasses were chilled for 48 h at 0°C, air velocity of 1.5 m/s, and a relative humidity of 100%. Subsequently , the following measurements were obtained: 1) LM area, taken by direct grid reading of the muscle at 12th rib; 2) subcutaneous fat over the LM at the 12th rib; 3) KPH as a percentage of HCW; and 4) marbling score (USDA, 1997). During the cooling period the pH and temperature postmortem measures were taken on three spots on the longissimus thoracic muscle (LT) at the 8 to 10th vertebral region using a portable pH meter (Denver AP25). at 1, 3, 6, 12, 24 and 48 h.

At 2 d postmortem, steaks (2.5-cm-thick slice) were sampled from each muscle from the 8th rib region, packaged in vacuum-packaged (Ultravac® 2100) and stored at 4°C to be transported to the laboratory. The WHC was measured using the centrifuge method (Dutson et al., 1990). Three samples of 1.0 g from each steak were centrifuged (1,200 rpm during 5 min). . After centrifugation, the supernatant was discarded and the precipitate was weighed.

Carcass data were analyzed as a randomized complete block design using MIXED procedure (SAS Inst Inc., Cary, NC). The effects of zilpaterol withdrawal were tested for linearity and curvilinearity by means of orthogonal polynomials. Coefficients of polynomials for unequally spaced treatments were generated using ORPOL matrix function of the IML procedure of SAS. To determine the rate of fall of pH applied a simple linear regression model considering a significance level of 05.

III.RESULTS AND DISCUSSION

Compared with control treatment, Z3d (time of withdrawal commercially indicated) increased HCW (3.6%, P=0.03), dressing percentage (3.2%, *P*=0.02), longissimus muscle area (LM; 6.3%. *P*=0.05), and reduced trimmed fat (31%, *P*=0.03). The magnitude of the relative increase in HCW due to zilpaterol supplementation is consistent with the average of 4.9% reported by previous studies involving feedlot steers (7.5%, Avendaño-Reyes et al., 2006; 3.9%, Plascencia et al., 2008; 4.5%, Vasconcelos et al., 2008; 3.5%, Montgomery et al., 2009). Zilpaterol supplementation did not affect marbling score ($P \geq 0.49$), fat thickness ($P \geq 0.17$), or bone yield ($P \geq 0.25$).

Prolonging the period of zilpaterol withdrawal preslaughter (Table 1.) tended to decrease carcass dressing percentage (linear, P = 0.11), and percentage lean yield (linear, P = 0.11), while trimmed fat percentage was increased (P = 0.03).

The mean pH values taken at the LT muscle are shown in Table 2. The pH of Z6d group was lower (P <.05) than Z12d, Z3d and NZ during cooling. Consistent with those reported by Boakye and Mittal (1993) pH values declined in the first 6 hours and then slowly cooling in the four groups. In contrast, Brendl and Klein (1979) observed a drop in pH (5.38) rapidly during the first 24 hours remaining for 4 d. In addition, this condition increases the variation in pH value, in this study shows that the variation is low and constant for 48 h (EE = 0.018).

Table 3 shows the linear models of pH versus time by treatment effect the rate of fall of pH, expressed as pH units per hour (β 1). Is observed that β o and β1 were similar to NZ, Z3d, and Z12d in linear model. Contrasting the rate of fall of pH values (Table 4), no significant differences (P> .05) between ZN vs. Z3d, ZN and Z12d, Z3d vs Z12d were . However, when compared Z6d with ZN, Z3d, and Z12d, treatments were highly significant differences (P <.001).

Table 5. shows effect of pre-slaughter withdrawal time (treatment) on pH and WHC of the meat. The pH in meat was similar when comparing the time of withdrawal (*P*= 0.78) although a trend was observed due to Z6d group behavior. According to expectations, the withdrawal times before slaughter Zilmax did not affect the pH neither WHC of the meat (*P* = 0.88) for any groups.

IV. CONCLUSIONS

In treated groups with ZH do reduced body fat and was increased lean muscle compared with the group NZ. SFpH and WHC values were not affected (P>.05) by Zilmax addition and days of retirement previous at slaughter.

Table 1. Treatment effects on carcass characteristics in feedlot heifers

		Days of drug withdrawal [1]				*P-value*	
Item	NZ	Z3d	Z6d	Z12d	SEM	Linear	Qua
HCW, Kg	309.0	320.1	322.4	326.2	2.94	0.18	0.94
Chilled carcass wt, kg	304.8	315.9	319.3	321.5	3.04	0.24	0.70
Dressing percentage	62.2	64.2	63.8	63.1	0.45	0.11	0.92
LM area, cm^2	93.5	99.4	94.5	98.2	1.83	0.94	0.08
Fat thickness, cm	0.85	0.64	0.80	0.75	0.08	0.53	0.29
KPH, %	2.41	2.63	2.63	2.81	0.13	0.29	0.71
Marbling score [2]	3.56	3.28	3.38	3.28	0.27	0.96	0.79
Bone, %	4.34	4.45	4.37	4.43	0.14	0.98	0.65
Trimmed fat, %	10.22	7.06	8.38	10.16	0.87	0.03	0.79
Lean yield, [3] %	65.27	67.30	65.90	65.18	0.80	0.11	0.51

[1] Zilpaterol fed daily for last 30 d of fattening at 0.15 mg of zilpaterol hydrochloride (Zilmax®, Intervet Schering-Plough Animal Health, Intervet) kg of BW daily; the codes of Zil-3, Zil-6, and Zil-12 represent that zilpaterol was withdrawn 3, 6, and 12 d before slaughter.
[2] Coded: minimum slight = 3, minimum small = 4, modest = 5.
[3] Yield of boneless closely trimmed lean yield.

Table 2. Treatment effect on postmortem carcass pH values

		Treatments				
Hour	n	NZ	Z3d	Z6d	Z12d	EE
1	16	6.67	6.75	6.08	6.52	0.018
3	16	6.40	6.39	6.07	6.21	0.018
6	16	6.05	6.02	5.96	5.75	0.018
12	16	5.88	5.91	5.59	5.83	0.018
24	16	5.88	5.95	5.72	5.76	0.018
48	16	5.87	5.94	5.75	5.79	0.018

Table 3. Linear models expressing the intercept (βo) and rate of fall of pH (β1) by treatment effect

Treatment	***Y***		**βo**		**β_1**	**X**	R^2
NZ	pH	=	6.3372	-	0.01312	Time	0.7711
Z3d	pH	=	6.3382	-	0.01151	Time	0.7240
Z6d	pH	=	5.9091	-	0.00526	Time	0.4434
Z12d	pH	=	6.1901	-	0.01165	Time	0.6983

Table 4. Comparison of postmortem fall pH standardized regression coefficients (β_1) by treatment effect

	β_1Z3d	β_1Z6d	β_1Z12d
		P =	
β_1NZ	0.4702	***0.0005	0.5039
β_1Z3d		***0.0059	0.9494
β_1Z6d			***0.0043

Table 5. Treatment effect on pH and water holding capacity of meat

	Treatment				
	NZ	Z3d	Z6d	Z12d	*P* =
pH [1]	5.57	5.58	5.54	5.59	0.78
WHC[2], %	81.13	81.73	80.51	81.14	0.88

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