PE1.60 Leptin and carcass composition in beef cattle 380.00

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***Abstract* - The aim of this study was to determine if leptin could be a predictor of body fat in Podolian young bulls. At the beginning of the finishing period (about 14 months of age), 24 animals were divided into 3 groups of 8 subjects, according to rearing system and dietary protein level: 1) indoor group (IND); 2) grazing animals receiving a supplementation with 15% of crude protein (OUT 15); 3) grazing animals receiving a supplementation with 12% of crude protein (OUT 12).. Blood samples, were collected on d 22, 51, 85, 119, 156, 172 d for leptin and metabolic profile evaluation. Growth performance and carcass composition were determined. Leptin level significantly increased (P<0.05) with age, whereas it was unaffected by rearing system and protein level. Positive correlation between plasma leptin concentration and average daily gain (r= 0.861, P<0.001), blood glucose level (r=0.977, P<0.001) were observed, whereas NEFA and triglycerides were not significantly correlated with leptin concentration. Intramuscular lipid content of *longisimus dorsi*, *semitendinosus,* and *semimembranosus* muscles was significantly correlated with plasma leptin before slaughtering (r=0.77, P<0.01; r=0.67, P<0.01, r=0.79, respectively).Correlations between plasma leptin and intramuscular fat were found starting from 18 months of age for *longissimus dorsi* (r=0.44; P<0.05), and from 19 months for *semimembranosus* (r=0.56; P<0.05), and *semitendinosus* (r=0.58; P<0.05). These data provide suggest that leptin may represent a suitable predictor for body fat starting from one month prior to slaughtering**.

***Index Terms* — plasma leptin, podolian cattle, protein level, rearing system.**

I. INTRODUCTION

The utilization of hormones as predictors of production characteristics has been discussed over several years [1]. Leptin is a protein secreted by adipocytes and correlated with body composition, food intake, and adipose tissue mass [2]. Furthermore, due to the associations between leptin concentrations and body fat, leptin could be used as an indicator for the evaluation of carcass composition in breeding programs [3].

Podolian cattle are one of the most important Italian breeds such as Chianina, Romagnola, Marchigiana and Maremmana. This cattle, is a rustic breed, reared in Southern Italy and adapted to the difficulty of the surrounding environment. Although these animals exploit pasture, the use of protein supplementation is necessary to increase cattle body weight due to low summer rainfall and poor pasture quality in most areas of southern Italy (< 6% CP, DM basis).

The present study aimed to verify the possibility of using plasma leptin level as a predictor of body fat in Podolian young bulls.

II. MATERIALS AND METHODS

The experiment involved twenty-four Podolian young bulls, aged 415 days ± 9.35 SE and with a mean body weight of 337.5 kg ± 16.51 SE. The animals were allotted for the finishing period (172 days) to 3 groups of 8 subjects, according to rearing system and dietary protein level: 1) indoor group (IND); 2) grazing animals receiving a supplementation with 15% of crude protein (OUT 15); 3) grazing animals receiving a supplementation with 12% of crude protein (OUT 12).

Animals were individually weighted at fortnightly intervals in order to estimate the average daily gain (ADG, g/day). Blood samples were collected by coccygeal venipuncture on 22, 51, 85, 119, 156, 172 days before feeding for metabolic profile and plasma leptin evaluation. In the laboratory, samples were centrifuged at 1400 x *g* for 15 min. at room temperature and plasma aliquots were stored at -20 °C before analyses. Plasma leptin was determined using double antibody radioimmunoassay procedures. Briefly, plasma leptin concentration was measured using a "multispecies" RIA supplied by Linco (XL-85K, St.Charles, MO). Analysis was performed according to a double-antibody method using guinea pig multispecies leptin antibody, human [125I] leptin, and human leptin as standards. Glucose, triglycerides, NEFA, were determined on plasma using automated analyzer (Polimak PM model M 10), according to the insert supplied by

the kit manufacturer. Animals were slaughtered according to the industrial routines used in Italy and to the EU rule n. 119/1993. The carcasses were graded for conformation and fatness according to the EUROP beef carcass classification. Minced tissue samples from *Longissimus Dorsi* (LD), *Semimembranosus* (SM) and *Semitendinosus* (ST) muscles were weighted and dried mixed with sand at the temperature of 103 ± 2°C. Lipid content of dried sample was determined using a Soxhlet extractor [4].

Data were subjected to ANOVA using the GLM procedure of the SAS statistical software [5]. Results are presented as the least square means of the data for young bulls in each treatment and the variability of the data is expressed as the SE of the means. When significant effects were found (at $P<0.05$), the Student's *t-test* was used to locate significant differences between means. Pearson correlation coefficients (CORR procedure) were calculated to examine the relationship between plasma leptin and average daily gain, feed conversion ratio, dry matter intake, blood metabolites, carcass composition and intramuscular fat content.

III. RESULTS AND DISCUSSION

Changes in plasma leptin concentration of Podolian young bulls from the different treatments with increasing body weights are shown in figure 1. In agreement with [6], plasma leptin levels increased ($P<0.05$) in all experimental groups as weight increased (from 4.33 to 7.51 ng/mL). The increase of plasma leptin concentration during the trial could be ascribed to adipocyte hypertrophy and hyperplasia as suggested by [7] and to an increase of adipose tissue which produces leptin. Accordingly, [6] found a significant increase of plasma leptin concentrations with age but no differences in leptin levels between steers fed with 12% CP and 16% CP of diet and rearing system. Similarly, [8] did not found an effect of diet on leptinaemia in steers fed grass or maize. Nevertheless, these authors observed a decrease in plasma leptin in grazing steers owing to an increase of □-adrenergic stimulation occurring during physical activity. The mean value of plasma leptin from the present research (6.42 ng/mL) was higher than leptin concentration reported in different beef cattle breed slaughtered at 18 months [9], wherease it was comparable with values reported in Japanese Black steers slaughtered at 28 months [10]. The high leptin content found in this study was unexpected for Podolian breed which is classified as lean breed (i.e. less than 5% intramuscular fat).

In table 1 are presented the correlations between leptin and growing performance, and blood metabolities of Podolian young bulls. Plasma leptin was positively correlated to average daily gain ($P<0.001$) confirming the influence of energy intake level on the plasma leptin. A positive relationship was found between leptin levels and plasma glucose ($P<0.001$). These results confirm that leptin could be an useful indicator of nutritional status and highlighted that glucose could play an important role in the regulation of leptin production [11]. The relationship between intramuscular fat and plasma leptin in cattle is controversial [10, 12].

In our research intramuscular lipid content of *longissimus dorsi*, *semimembranosus,* and *semitendinosus* muscles was positively correlated with plasma leptin collected before slaughtering as shown in table 2. In addition, plasma leptin was positively correlated with intramuscular fat of *longissimus dorsi* ($r= 0.444$; $P<0.05$) starting from 119 d of finishing period, whereas it was correlated with *semitendinosus* ($r= 0.58$; $P<0.05$) and *semimenbranosus* ($r= 0.56$; $P<0.05$) muscles starting from 156 d of finishing period.

Previous researches [13, 6] have shown that plasma leptin cannot be recommended as an early predictor of body fat, while plasma leptin towards slaughtering age seems to be associated with carcass traits. Our results show that plasma leptin could be considered a suitable predictor of intramuscular fat starting from one month before slaughter in cattle slaughtered at 19 months of age. For livestock production this information is relevant because it could predict if the cattle develop an adequate marbling before slaughter.

IV. CONCLUSION

The results of the present research confirm that leptin is an indicator of nutritional status in Podolian young bulls and suggest that plasma leptin could be a suitable tool for prediction of body fat starting from one month before slaughtering.

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Figure 1. Plasma leptin concentrations of Podolian young bulls when reared indoor and fed with a 15% CP diet (IND) or grazing and supplemented with 12% CP (OUT12) and 15% CP (OUT15). (means ± SEM)

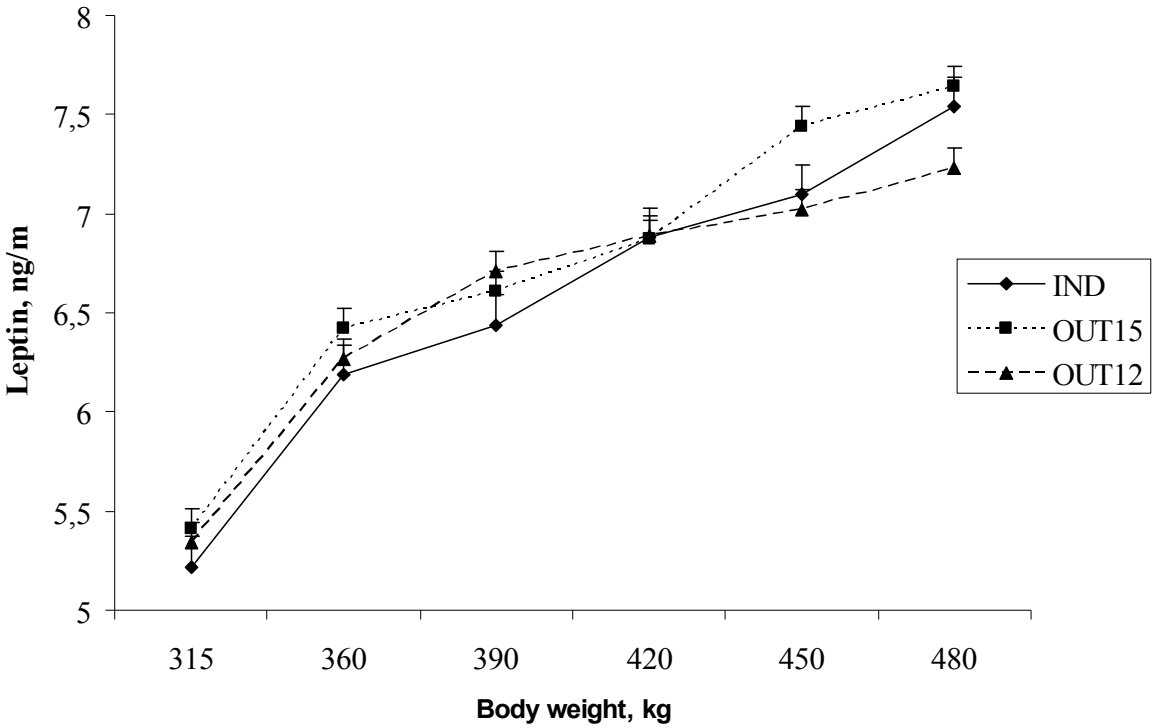

Table 1. Pearson correlation coefficients for leptin, growing performance and some blood metabolities in Podolian young bulls (n=120).

Item	ADG	Glucose	Triglycerides	NEFA
Leptin	0.861***	0.977***	-0.079	0.046
ADG		0.81***	-0.03	0.242**
DMI		0.368	-0.092	-0.09
Glucose			0.072	-0.186*
Triglycerides				0.157

* P<0.05,**P<0.01,***P<0.001

Table 2. Pearson correlation coefficients for leptin, measured at different days, and intramuscular fat in Podolian young bulls (n=24).

	Intramuscular fat		
Time	LD	SM	ST
119, d	0.44*	0.39	0.32
156, d	0.66**	0.56*	0.58*
172, d	0.84***	0.79***	0.74***

Abbreviations: LD = *longissimus dorsi* muscle, SM = *semimembranosus* muscle, ST = *semitendinosus* muscle

* P<0.05, **P<0.01,***P<0.001