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ORIGINAL ARTICLE

Effect of nutritive level on carcass traits and meat quality of IHDH foals

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ABSTRACT

The present work describes the effect of nutritive level on horse carcass traits and on meat quality. Eighteen male Italian Heavy Draught Horse (IHDH) breed foals were employed in the study. Soon after foaling they were randomly subdivided into three groups according to three nutritive level classes: 150%, 180% and 200% of maintenance requirements. Live weight, hot carcass weight and dressing percentage of each animal were recorded. After slaughtering, meat samples were collected from Longissimus dorsi muscle. The right half carcass of each animal was then divided into cuts. Each one was subdivided into lean, fat and bones. Live weight, carcass weight and dressing percentage were not affected by nutritive level ($P > 0.05$). Horses fed with the lower nutritive level showed a higher incidence of lean and a lower incidence of fat ($P < 0.01$). Moreover, fatty acid profile was not affected by nutritive level ($P > 0.05$). Probably the tendency of IHDH foals to concentrate adipogenesis in the subcutaneous district could explain the lack of influence of nutritive level on meat quality parameters and its influence on carcass and cut composition, which tend to be richer in fat.

Key words: *fatty acid profile, horse, meat quality, nutritive level.*

INTRODUCTION

Italian Heavy Draught Horse (IHDH) foals were traditionally raised in Italy as working horses. Mechanization and industrialization in agriculture in the 20th century shifted IHDH raising to meat production. For many years, in Italy horse meat consumption has been the highest among all European Community countries (Martuzzi *et al*. 2001). Currently the production of horse meat in Italy is mainly obtained from heavy breeds such as the IHDH. The horse's suitability for meat production is also justified by good dressing percentages that this species has shown (Martin-Rosset *et al*. 1980; Robelin *et al*. 1984; Catalano *et al*. 1986; Manfredini *et al*. 1992; Badiani *et al*. 1993; Tateo *et al*. 2008; De Palo *et al*. 2013). Moerover, many studies on this horse breed demonstrated that this breed is particularly suitable for both meat (Tateo *et al*. 2005, 2009, 2013; De Palo *et al*. 2013) and milk production (Centoducati *et al*. 2012). Although horse meat is commercialized in a minority market, particularly developed in Italy (Tateo *et al*. 2008) and Spain (Franco & Lorenzo 2014), it has excellent nutritional properties, that is, it is low in fat if compared to beef, rich in iron (Franco *et al*. 2011) and with a high content of unsaturated fatty acids (Badiani *et al*. 1997; De Palo *et al*. 2013). There are many ways to improve the carcass weight, such as increasing slaughtering age (De Palo *et al*. 2013) or including a finishing period (Franco *et al*. 2013). Carcass and horse meat quality can be influenced by many factors, such as by breed (Juarez *et al*. 2009), finishing feeding (Sarriés & Beriain 2006) and age at slaughtering (De Palo *et al*. 2013).

The aim of this work was to study how different nutritive levels, applied from weaning to slaughtering age, could affect slaughtering parameters, carcass traits, cuts incidence and meat quality of IHDH foals slaughtered at 11 months.

MATERIALS AND METHODS

Animals

A total of 18 male IHDH breed foals were employed in the study, all of them born at the same farm. Soon after foaling

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Table 1 Chemical composition (%DM) of diet fed to horses

Item	Concentrate	Oat hay
Chemical composition		
DM	87.6	88.4
Crude protein	13.5	11.6
Crude fibre	10.8	33.4
Ether extract	3.2	2.9
Ash	7.0	11.1
NDF	27.9	54.5
ADF	13.2	40.9
ADL	2.5	7.2
Horse FU (n/kg of DM)	0.82	0.50
DP (g/kg)	104.2	21.5

ADF, acid detergent fibre; ADL, acid detergent lignin; DM, Dry matter; DP, digestible protein; FU, horse forage units calculated according to Martin-Rosset *et al*. (1994); NDF, neutral detergent fibre.

they were subdivided randomly into three groups, differing in nutritive levels administered from weaning to slaughtering. The foals assumed colostrums and were suckled naturally and, from their second day of life, they followed their dams to the grazing areas for almost 6 h per day. The foals were weaned at 4 months old, and then were kept in three indoor stalls (one for each experimental group), with a surface area of 6 m^2 per head. Each group received a ration subdivided into three daily meals. The composition of the feed administered was the same for all the experimental trial and for the three groups and it was composed of 35% oat hay and 65% commercial feed (Table 1). Three different nutritive levels were calculated on the basis of maintenance requirements assessed in relation to metabolic live weight (Martin-Rosset *et al*. 1994) recorded every 2 weeks. The amount of dry matter of the experimental ration administered to the different groups was calculated to ensure the following nutritive levels: NL150 = 150%, NL180 = 180% and NL200 = 200% of the maintenance requirements.

Slaughtering and treatment of samples

Live weight (LW) of each animal was measured 1 h before slaughtering. They were slaughtered at 11 months old in a national accredited slaughterhouse, according to current EU regulations (Council Directive of the European Union 95/221EC).

After slaughtering, hot carcass weight (CW) was measured and dressing percentage (DP) was calculated, then carcasses were kept in a chilling room at 4°C for 48 h. Samples of Longissimus dorsi (LD) muscle between the 13th and 18th thoracic vertebrae (about 500 g for each sample) were taken for analysis. These samples were transported at 4°C to the laboratory and analyzed within 2 h. Moreover, the right half carcass was dissected into cuts and each one was subdivided into lean, fat and bones according to De Palo *et al*. (2009). The classification of the lean meat in first and second quality cuts was performed according to the traditional Italian butchers' customs: hind leg, neck, briskets and bacon were classified as second quality cuts; steaks, loin, fore leg and tenderloin were classified as first quality cuts.

Meat analysis

Meat proteins were measured with the ISO 937:1978 method (ISO 1978); intramuscular fat was determined with the ISO 1443:1973 method (ISO 1973) and ash was calculated with the ISO 936:1998 method (ISO 1998). Every muscle and subcutaneous tissue sample was homogenized with a mixture of chloroform and methanol (1:2, vol/vol) solution for the extraction of total lipids from intramuscular and subcutaneous fat, according to the method described by Bligh and Dyer (1959).

The water holding capacity (WHC) was measured using the centrifugation method, according to Bouton *et al*. (1971). A specimen of 0.3 g was collected from each sample and then was centrifuged at 30 000 × *g* for 1 h. After centrifugation, the samples were dried and weighed again, and the centrifugation loss was calculated as the difference in weight before and after centrifugation.

For cooking loss determination, cubic meat pieces with 1.5 cm per side were weighed (initial weight, Wi) and then cooked in plastic bags in a water bath at 80°C until they reached the internal temperature of 75°C, measured by a copper constantin fine-wire thermocouple fixed in the geometrical center of the sample (Model 5SC-TT-T-30–36; Omega Engineering Inc., Stamford, CT, USA). Cooked samples were cooled, dried from fluids and reweighed (final weight, Wf). The cooking loss was calculated as a percentage of weight loss: ((Wi − Wf)/Wi) × 100 (Bertram *et al*. 2003).

Post-thawing losses were calculated as the difference in weight before freezing and after thawing. Each sample was weighed before the freezing process (initial weight, Wi) and after the thawing process. The post thawing losses were calculated according the following formula: ((Wi − Wf)/Wi) × 100.

Each cooked lean sample was tested for Warner-Bratzler Shear Force (WBSF). The samples were cooked in plastic bags up to an internal temperature of 70°C for 3 min in a water bath at 85°C (measured with a copper constantin fine-wire thermocouple, Model 5SC-TT-T-30–36, Omega Engineering Inc., fixed in the geometrical center of the sample). The WBSF was measured using an Instron 1140 apparatus (Instron, High Wycombe, UK) interfaced with a computer, using a crosshead speed of 50 mm/min-1 and a load cell of 50 N. The cut sample had a cylindrical shape with a diameter of 1.27 cm. The cut was parallel to the muscle fiber direction. The force-deformation curve obtained was used to calculate meat hardness. Shear force was determined perpendicular to the fiber direction. Each sample was sheared three times and the arithmetic mean of the data registered from each sample was subjected to further statistical analysis.

Fatty acid methyl esters (FAME) were prepared by transesterification, using methanol in the presence of 3% hydrochloric acid in methanol (vol/vol). Fatty acid methyl esters were analyzed using a Trace GC Thermo Quest Gas Chromatograph (Thermo Electron, Rodano, Milan, Italy) equipped with a flame ionization detector. The derivatives were separated on a capillary column (Supelco SP-2380 fused-silica column, 30-m length, 0.25-mm internal diameter, and 0.20-mm film thickness). The injector and the detector temperatures were held at 260°C. Column oven program temperatures were as follows: T1 = 80°C hold 1 min; T2 = 150°C ramp at 15°C/min, hold 2 min; T3 = 220°C ramp at 5°C/min, hold 2 min; T4 = 250°C ramp at 15°C/min, hold 5 min. The flow rate of the carrier gas (He) was set at 0.8 mL/min. Identifications of FAME were based on the retention times of reference compounds (Sigma-Aldrich, St. Louis, MO, USA) and mass spectrometry. Fatty acid composition was expressed as the percentage of total FAME.

Collagen was extracted following the Sörensen (1981) method. Determination of 4-hydroxyproline was performed according to the procedure suggested by Kindt *et al.* (2003) using electrospray mass spectrometry (LCQ Thermo Electron, CA, Waltham, MA, USA) to avoid any derivatization step.

Statistical analysis

The collected data were subjected to analysis of variance (ANOVA) using the GLM by SAS software (SAS 1998), according to the following model:

$$y_{ij} = \mu + NL_i + \varepsilon_{ij}$$

where y_{ij} represents the carcass and meat qualitative patterns, the dependent variables; μ is the mean; NL is the effect of the i^{th} nutritive level ($i = 1, \ldots, 3$), the independent variable; ε_{ij} is the error term.

Moreover, a post hoc test was performed using a Bonferroni test to compare means.

The results here reported are expressed as least square means and mean standard errors. The significance level was assessed to $P < 0.05$.

RESULTS AND DISCUSSION

Slaughtering performances are reported in Table 2. No effect of NL was evidenced on LW, CW and DP. LW and CW tended to increase with the increasing of NL but there was no statistical difference ($P > 0.05$). Franco *et al.* (2013), studying the effect of finishing diet in horses slaughtered at 15 months old, obtained similar results. They found an increasing trend of these parameters with the increasing of finishing diet but no statistical differences. Results reported are similar to that reported by De Palo *et al.* (2013) in IHDH foals slaughtered at 11 months, but higher if compared to other horse breeds like Barguete (Franco *et al.* 2013), Sanfratellano and Haflinger (Lanza *et al.* 2009) and Lusitano (Sarriés & Beriain 2005).

Considering carcass composition, horses fed with a higher NL showed a higher incidence of the fore quarter and a lower incidence of the hind quarter ($P < 0.001$). Moreover, animals fed with lower NL showed higher incidence of lean and lower incidence of bone ($P < 0.01$). In contrast, other authors observed no influence of NL on fore and hind quarter incidence (Franco *et al.* 2013). In addition, these authors observed that there was no effect of feeding level on meat incidence and that animals fed with higher NL showed lower percentage of bone. Fat incidence, instead, increased with the increasing of NL, as observed by Franco *et al.* (2013).

Values registered for IHDH foals slaughtered at 11 months are similar to those reported in the literature in the same horse breed (Tateo *et al.* 2008; De Palo *et al.* 2013). IHDH foals showed the higher lean incidence (74.48% to 78.96%) in horse meat production if compared to results reported in other horses like Polish horses (60.63% to 68.45%) (Znamirowska 2005; Znamirowska & Stanislawczyk 2005) or Galician Mountain horses (69.70% to 70.15%) (Franco *et al.* 2013). Observing first quality cuts incidence on the entire carcass there is no influence of NL ($P > 0.05$). Instead, horses fed with 200% of NL showed a first cuts incidence on fore quarter and hind quarter, respectively, lower ($P < 0.001$) and higher ($P < 0.05$).

Observing tissue composition (Table 3) of various meat cuts of the IHDH carcass it is clear that in all cuts fat incidence tended to increase with the increasing of NL ($P < 0.001$), except for bacon which showed a the higher fat incidence in NL180% foals and lower in the NL200% foals ($P < 0.001$). In contrast, meat and bone incidence tended to decrease with the increasing of NL ($P < 0.001$), except the fore leg which showed no influence of NL on this parameter ($P > 0.05$). Moreover, bacon showed a different trend of meat incidence;

Table 2 Live weight (LW), carcass weight (CW), dressing percentage (DP), carcass composition and first quality cuts incidence of foals fed with low nutritive level (150%), medium nutritive level (180%) and high nutritive level (200%)

	Nutritive level			Significance	SEM
	150%	180%	200%		
LW (kg)	448.13	456.45	473.15	n.s.	12.15
CW (kg)	330.60	329.42	345.41	n.s.	5.83
DP (%)	73.71	72.60	72.99	n.s.	0.65
Carcass composition (%)					
Fore quarter	37.63^{A}	35.43^{A}	39.73^{B}	***	0.33
Hind quarter	62.70^{A}	65.07^{A}	60.60^{B}	***	0.49
Lean	78.96^{A}	74.48^{B}	74.73^{B}	***	0.84
Fat	11.82^{A}	15.95^{Ba}	15.52^{Bb}	***	0.12
Bone	9.25^{A}	9.55	9.77^{B}	**	0.10
First quality incidence (%)					
1st quality† on carcass	59.26	60.57	59.65	n.s.	0.51
1st quality on fore quarter	55.13^{A}	55.78^{A}	49.15^{B}	***	0.55
1st quality on hind quarter	72.86^{a}	73.52^{a}	75.52^{b}	*	0.64

Significance: ***$P < 0.001$, **$P < 0.01$, *$P < 0.05$, n.s., not significant. †1st quality cuts: Steaks I-VIII, Loin + Steaks IX-XVIII, fore leg and tenderloin. Different letters in the same line show statistical differences (A, B: $P < 0.01$; a, b: $P < 0.05$).

Table 3 Cuts incidence (%) and their tissue composition (%) of foals fed with low nutritive level (150%), medium nutritive level (180%) and high nutritive level (200%)

	Nutritive level			Significance	SEM
	150%	180%	200%		
Hind leg	17.42^{A}	15.32^{B}	22.67^{C}	***	0.15
Meat (%)	76.73^{A}	71.27^{B}	71.47^{B}	***	0.69
Fat (%)	7.57^{A}	9.77^{B}	14.35^{C}	***	0.31
Bone (%)	16.05^{A}	19.47^{B}	14.52^{C}	***	0.28
Neck	9.53^{Aa}	8.98^{b}	8.43^{Bc}	**	0.17
Meat (%)	80.28^{Aa}	77.37^{Ab}	71.45^{B}	***	0.90
Fat (%)	5.33^{A}	11.12^{B}	16.93^{C}	***	0.35
Bone (%)	14.73^{A}	12.02^{B}	11.92^{B}	***	0.48
Briskets I-VIII	5.70^{A}	6.42^{B}	5.58^{A}	***	0.05
Meat and bone (%)	90.88^{A}	82.32^{B}	76.62^{C}	***	0.61
Fat (%)	9.45^{A}	18.18^{B}	23.72^{C}	***	0.57
Briskets IX-XVIII	7.20^{Aa}	6.85^{Ab}	5.53^{B}	***	0.08
Meat and bone (%)	77.67^{A}	77.93^{A}	73.01^{B}	***	0.66
Fat (%)	22.67^{A}	22.57^{A}	27.32^{B}	***	0.30
Steaks I-VIII	5.00^{A}	4.75^{B}	3.08^{C}	***	0.06
Meat and bone (%)	94.76^{A}	94.87^{A}	89.97^{B}	**	0.90
Fat (%)	5.56^{A}	5.63^{A}	10.37^{B}	***	0.38
Loin + steaks IX-XVIII	10.40^{A}	8.47^{B}	8.68^{B}	***	0.13
Meat and bone (%)	98.17^{Aa}	94.47^{Ab}	88.63^{B}	***	0.92
Fat (%)	2.16^{A}	6.03^{B}	11.70^{C}	***	0.42
Bacon	9.21^{A}	9.60^{A}	7.02^{B}	***	0.13
Meat (%)	56.63^{A}	49.73^{B}	64.67^{C}	***	0.68
Fat (%)	43.80^{A}	50.77^{B}	35.67^{C}	***	0.73
Fore leg	32.17^{A}	36.42^{B}	36.35^{B}	***	0.35
Meat (%)	77.58	75.88	76.80	n.s.	0.62
Fat (%)	9.21^{A}	13.32^{B}	13.38^{B}	***	0.21
Bone (%)	13.50^{A}	11.28^{B}	10.18^{C}	***	0.20
Tenderloin	2.76^{A}	2.55^{B}	2.27^{C}	***	0.04
Meat (%)	93.18^{A}	85.60^{B}	79.97^{C}	***	1.03
Fat (%)	7.15^{A}	14.90^{B}	20.37^{C}	***	0.66

Significance: ***$P < 0.001$, **$P < 0.01$, n.s., not significant. Different letters in the same line show statistical differences (A, B, C: $P < 0.01$; a, b: $P < 0.05$).

it was higher in the NL200% foals and lower in the NL180% foals ($P < 0.001$). Franco *et al*. (2013), studying two different finishing periods on 15-month-old horses observed a similar trend in the entire carcass, a higher fat incidence and a lower bone incidence in animals fed with higher NL. The same trend was observed by Vestergaard *et al*. (2007) studying the effect of length of finishing period on beef carcass characteristics. They observed an increasing trend of fat incidence and a decreasing trend of meat and bone incidence with the increasing of NL.

The physicochemical parameters of foal meat are shown in Table 4. Nutritive level had no effects on intramuscular protein and intramuscular fat content ($P > 0.05$), but affected moisture and ash content which were respectively lower ($P < 0.05$) and higher ($P < 0.001$) in horses fed with the higher NL. Few data are reported in the literature about NL and its effect on chemical composition of horse meat. In particular, contrasting results were reported about moisture content. Some authors observed no effect of finishing diet intensity on moisture content (Franco & Lorenzo 2014); other authors observed a decrease in moisture content with the increasing of finishing diet (Franco *et al*. 2013). However, moisture content reported in this study is similar to that reported in the same horse breed (Tateo *et al*. 2008; De Palo *et al*. 2013), in Barguete and Hispano-Breton foals (Juarez *et al*. 2009) and in other horse breeds (Badiani *et al*. 1997; Sarriés & Beriain 2005), but lower than what observed in Sanfratellano and Haflinger horse (Lanza *et al*. 2009), in Galician Mountain foals (Franco *et al*. 2011, 2013; Franco & Lorenzo 2014) and in Polish horse meat (Znamirowska & Stanislawczyk 2005). Intramuscular fat content did not show any variation in the three NLs considered. These results are in contrast with that observed by Franco *et al*. (2013) and Franco and Lorenzo (2014) who reported a great increasing of intramuscular fat content in animals fed with a higher finishing diet. However, intramuscular fat values reported by these authors are very low if compared to data reported in this paper, that, instead, are similar to what reported by other authors (Devic & Stamenkovic 1989; Pomianowski *et al*. 1994; Sarriés & Beriain 2005;

Table 4 Chemical composition and rheological properties of meat of foals fed with low nutritive level (150%), medium nutritive level (180%) and high nutritive level (200%)

	Nutritive level			Significance	SEM
	150%	180%	200%		
Moisture (g/100 g)	71.26[a]	71.32[a]	68.98[b]	*	0.82
Protein (g/100 g)	21.90	21.24	20.81	n.s.	0.48
Fat (g/100 g)	2.96	3.11	3.15	n.s.	0.38
Ash (g/100 g)	1.36[A]	1.38[A]	2.02[B]	***	0.08
Water-holding capacity (%)	18.05	19.49	18.80	n.s.	0.55
Post-thawing losses (%)	9.06	7.27	8.69	n.s.	0.78
Cooking losses (%)	36.33	37.92	37.78	n.s.	0.84
Collagen solubility (%)	18.52	21.46	20.41	n.s.	1.74
WBSF on cooked meat (kg)	4.78[a]	5.31[b]	5.38[b]	*	0.18

Significance: ***$P < 0.001$, *$P < 0.05$, n.s., not significant. Different letters in the same line show statistical differences (A, B: $P < 0.01$; a, b: $P < 0.05$). WBSF, Warner-Bratzler Shear Force.

Tateo *et al*. 2008; Juarez *et al*. 2009; De Palo *et al*. 2013). This lack of variation of intramuscular fat content could be explained by the tendency of horses, depending on their genetics, to concentrate adipogenesis in the subcutaneous district rather than in the intramuscular one (Rossier & Berger 1988; De Palo *et al*. 2012). Ash content tends to increase with increasing NL ($P < 0.001$). Also Franco & Lorenzo (2014) observed an effect of finishing diet intensity on ash content. Poor literature actually exists about this parameter and its variation in horse meat depending on NL; however, these values are similar to that reported by other authors (Devic & Stamenkovic 1989; Pomianowski *et al*. 1994; Sarriés & Beriain 2005; Tateo *et al*. 2008; Juarez *et al*. 2009; De Palo *et al*. 2013).

Regarding rheological parameters, no significant ($P > 0.05$) differences were found among groups and only WBSF was slightly influenced by NL. However, Boleman *et al*. (1997) suggested the following categories for beef steaks on the grounds of the shear force measured with WB test: tender from 2.77 to 3.58 kg; moderate 4.08 to 5.40 kg; and tough 5.90 to 7.21 kg. According to this classification IHDH foal meat shear force shown in the present study implies that it belongs to the moderate category.

Fatty acid profile is reported in Table 5. Only a few significant differences were found in fatty acid profile of intramuscular fat. In particular, horses fed with lower NL showed a higher content of C12:0, of saturated fatty acids (SFA) and higher SFA/poly-unsaturated fatty acids (PUFA) values ($P < 0.05$). However. intramuscular fatty acid profile showed a prevalence of SFA (45.36% to 47.75%). Mono-unsaturated fatty acids (MUFA) and PUFA content were similar. By studying the intramuscular fat composition of IHDH foals slaughtered at 11 months, Tateo *et al*. (2008) found the same distribution shown in the present study. These results agreed with results reported by De Palo *et al*. (2013), Lanza *et al*. (2009) and Juarez *et al*. (2009). Other authors found MUFA (Renon *et al*. 1977; Badiani *et al*. 1997; Franco *et al*. 2013) or PUFA (Payne 1971; Jankowska *et al*. 1996) as the predominant fatty acids. Palmitic acid (C16:0) was the most present in horse meat and it was the predominant one within the SFA, as observed by other authors (Tateo *et al*. 2008; Lanza *et al*. 2009; De Palo *et al*. 2013). Differences in fatty acid distribution in intramuscular fat between the different breeds investigated in the literature could be due to many factors. A hypothesis could be the differences in the activity of the desaturases and the elongase enzymes between breeds (Wood *et al*. 2008). However, horse meat showed a great quantity of UFA, and this parameter is not affected by nutritive level.

Table 5 Fatty acid profile (% of fatty acids methyl esters) from Longissimus dorsi muscle of foals fed with low nutritive level (150%), medium nutritive level (180%) and high nutritive level (200%)

	Nutritive level			Significance	SEM
	150%	180%	200%		
C 12:0	1.61[a]	1.28[b]	1.45	*	0.18
C 14:0	6.09	5.34	5.60	n.s.	0.21
C 14:1	1.40	1.36	1.40	n.s.	0.12
C 16:0	33.28	31.77	32.53	n.s.	1.08
C 16:1	1.25	1.11	1.14	n.s.	0.09
C 18:0	6.81	7.02	6.55	n.s.	0.21
C 18:1	25.80	26.01	25.44	n.s.	1.22
C 18:2	1.06	1.27	1.17	n.s.	0.09
C 18:2 n6	17.71	18.82	18.04	n.s.	0.95
C 18:3 n6	0.91	0.66[A]	1.12[B]	**	0.09
C 18:3 n3	4.48	4.50	4.31	n.s.	0.28
C 20:4 n6	0.77	0.56	0.67	n.s.	0.11
n-3/n-6	0.23	0.23	0.22	n.s.	0.03
SFA	47.75[a]	45.36[b]	46.12	*	1.43
MUFA	23.84	28.47	25.30	n.s.	1.01
PUFA	28.44	25.82	27.94	n.s.	1.56
SFA/MUFA	1.68	1.60	1.70	n.s.	0.14
SFA/PUFA	1.99[a]	1.74[b]	1.84	*	0.21

Significance: **$P < 0.01$, *$P < 0.05$, n.s., not significant. MUFA, mono-unsaturated fatty acids; PUFA, poly-unsaturated fatty acids; SFA, saturated fatty acids.

Conclusions

Generally, NL had no effect on fatty acid profiles, chemical composition and rheological properties of IHDH foal meat. Some differences were observed for carcass composition and for cuts incidence on carcass. Live weight at slaughtering, carcass weight and dressing percentage were not affected, although there was a slight live weight improvement with the increasing of NL. From data obtained on the quality of IHDH foal meat, it can be deduced that it is characterized by low intramuscular fat content and by a good UFA content. Also texture traits showed good meat tenderness in all studied theses. Carcasses of animals fed with higher NL showed a higher fat incidence and a lower lean incidence. From this study, it seems to be better to feed horses with a medium NL (180%) to obtain the better compromise for a good production from both a quality and a quantity point of view. Probably, the tendency of IHDH foals to concentrate adipogenesis in the subcutaneous district could explain the lack of influence of NL on meat quality parameters and its influence on carcass and cuts composition, which tend to be richer in fat.

All these findings in the present paper contributed to the description of horse meat physicochemical, chemical and nutritional composition and they represent another point which can be useful to extend knowledge about this product.

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