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Administration of high amounts of two solid feeds to veal calves: effects on growth performance and slaughter traits

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ABSTRACT - The study aimed at assessing the effects on growth performance and slaughter traits of two type of solid feeds (Maize grain *vs.* Mix) administrated to veal calves in amounts exceeding the minimum recommended by the welfare legislation. Fifty Polish Friesian calves, housed in 5 group pens per each experimental treatment, were fed the same milk replacer diet twice a day. After milk distribution a growing amount of solid feed was distributed through the fattening period. The type of solid feed did not affect calves final body weight and average daily gain although intake of solid feed was higher in calves fed the Mix diet. Carcass weight and dressing percentage were no significantly affected by the two diets. Despite the higher haemoglobin level resulted with the Mix diet, no relevant differences between the two feeding treatments were observed regarding carcass colour parameters that were suitable for the meat market.

Key words: Veal calf, Solid feeds, Growth performance, Slaughter traits.

Introduction - Many studies have been carried out to evaluate the effect of the provision of solid feeds to veal calves for welfare purposes on their performance, behaviour and health status (Morisse *et al*., 1999; Gottardo *et al*., 2000; Cozzi *et al*., 2002). The traditional diet of veal calves, consisting mainly on the provision of milk replacers, is nowadays becoming less economically viable due to the rise in price of skimmed milk powder. Consequently, there has been a growing interest in the formulation of diets with a high solid feed content which allows the partial substitution of milk replacers. In this context, this research aims at evaluating the effects on growth performance and slaughter traits of veal calves fed two type of solid feeds administrated in excess to the minimum recommended by the calves welfare legislation (Commission Decision 97/182/EC).

Material and methods - The present study compared two type of solid feeds provided to veal calves in addition to the milk replacer diet. The two experimental diets were: Maize grain, administered with the addition of water, and a mixed solid feed (Mix), composed of maize grain (57%), carobs (17%), wheat straw (10%), roasted whole soybean seeds (8%), glycerol (5%) and minerals (3%). The trial, lasting 184 d, was carried out in a commercial farm using fifty Polish Friesian calves. The animals were allotted according to their initial body weight (71.8 ± 4.9 kg and 31 ± 8.1 d of age) into 5 group pens per each experimental treatment. All the calves were fed twice a day the same milk replacer diet distributed in an individual bucket. Starting from the second week of fattening they received a growing amount of solid feed distributed in a common trough. Sample of the solid feeds were monthly collected and analysed for chemical composition and iron content (AOAC, 1990). Animal average daily gain was calculated by weighting the calves at the beginning and at the end of the experimental period. Milk replacer and solid feed intake were calculated

daily as difference between distributed and leftover. Individual blood samples for plasma haemoglobin concentration were taken at the beginning, at day 60, 120 and at the end of the fattening period. At the slaughterhouse, carcasses were weighed in order to calculate individual dressing percentage and graded for conformation and fatness according to the European grading scheme (OFIVAL, 1984). An evaluation of carcass colour was made by visual observation of the visible external muscular tissue using a three point scale and by instrumental tests with a portable colorimeter. Experimental data were processed using the PROC GLM (SAS, 2001) adopting a linear model which consider the effect of type of solid feed and the nested effect of pen within type of solid feed. The nested effect was used as error term.

Results and conclusions - The chemical composition of the two solid feeds administered to the veal calves is shown in table 1. Maize grain is a concentrate feed extensively used in veal calves because of its low cost and iron content. The Mix had a comparable protein content to the Maize grain while the iron level was more than three times higher, mainly due to the presence of ingredients rich in this mineral. Structured carbohydrates fraction (NDF and ADF) was also higher in the Mix diet due to the presence of fibrous feed such as straw.

Table 1. Chemical composition of the solid feeds.

		Type of solid feed	
		Maize Grain	Mix
Dry matter (DM)	%	88.1±0.32	87.2±0.80
Crude protein	% DM	9.0±0.10	9.3±0.77
NDF	"	10.6±0.34	19.1±1.29
ADF	"	1.9±0.24	7.7±1.07
NFC*	"	75.2±0.33	64.4±1.99
Iron content	ppm DM	32.5±9.50	100±57.19

**NFC= 100 – (NDF+CP+EE+Ash).*

The type of solid feed did not affect calves final body weight and average daily gain, however intake of solid feed was higher in the Mix diet (Table 2). This result is in agreement with findings by Suárez *et al*. (2006) which showed that the provision of concentrate feed such as maize grain to calves could provoke acidosis, impairing the intake. Moreover, the present work is in agreement with Gottardo *et al*. (2000) confirming that calves under an ordinary milk replacers feeding plan are still motivate to eat solid feed in an amount that clearly exceeded the minimum recommended by animal welfare regulation directives (50-250 g/d of FM). Starting from the control carried out at 120 days of fattening the average level of haemoglobin was always higher for animal fed the Mix diet, likely due to the higher iron content of this solid feed and to its higher intake. At the end of the growing period haemoglobin was therefore higher in the Mix diet group but it was compatible with an adequate carcass colour parameters. According to Morisse *et al*. (1999) and Cozzi *et al*. (2002), the additional iron intake from solid feeds should result in an increased haemoglobin concentration even if there is not a linear correlation between the two parameters. The NDF content of the solid feed seems to be able to reduce the bioavailability of the mineral. Carcass weight and dressing percentage were no significantly affected by the two feeding treatments (Table 3). Consistently with Cozzi *et al*., (2002) the provision of concentrate feeds significantly increased the reticulorumen weight, whereas more fibrous nutrients produce a heavier omasum. At the slaughterhouse, instrumental measurements of carcass colour showed higher value of lightness for Mix diet, while redness was similar between feeding treatments. Colour judgement performed by the expert did not detect difference in carcass colour due to the feeding plan adopted (Table 3). In conclusion, the provision of great amount of solid feeds did not interfere with the milk replacers intake and led to a satisfactory growth performance of the calves. In particular, the administration of solid feed with a higher content in roughage and iron did not show a worsening in growth performance and carcasses colour considering that iron provided by fibrous feed such as straw, is likely bound by NDF fractions and therefore scarcely bio available for the calves.

Table 2. Growth performance and haemoglobin level in veal calves.

		Type of solid feed			
		Maize Grain	Mix	Significance	S.E.
Initial live weight	kg	72.0	71.2	ns	0.80
Final live weight	kg	292.9	284.6	ns	5.39
Average daily gain	g/d	1202	1161	ns	29.42
Feed consumption:					
Milk replacers	g DM/d	1526	1497	ns	24.46
Solid feed	g DM/d	854	915	***	3.80
Feed efficiency		0.50	0.48	ns	0.009
Haemoglobin at d 0	g/dl	10.9	10.5	ns	0.40
Haemoglobin at d 180	g/dl	7.6	8.6	**	0.19

= P<0.01;= P<0.001.*

Table 3. Slaughter performance and meat quality of veal calves.

		Type of solid feed			
		Maize Grain	Mix	Significance	S.E.
Carcass weight	kg	162.1	163.0	ns	3.29
Dressing percentage	% BW	55	58	ns	1.36
Weight of reticulorumen	g	4668	3943	*	123.06
Weight of omasum	g	741	941	ns	58.30
EUROP	score[1]	4.0	4.0	ns	0.04
Fatness	score[2]	2.1	2.0	ns	0.03
Carcass colour (subjective evaluation)	score[3]	1.2	1.2	ns	0.10
Colour (instrumental measurement)					
Lightness (L)		48.7	49.6	*	0.41
Redness (a)		9.8	9.6	ns	0.26
Yellowness (b)		4.3	4.1	ns	0.12

**= P<0.05. [1]1= Poor- to 5= Excellent; [2]1= Minimum to 3= Maximum; [3]1= White to 3= Dark pinks.*

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