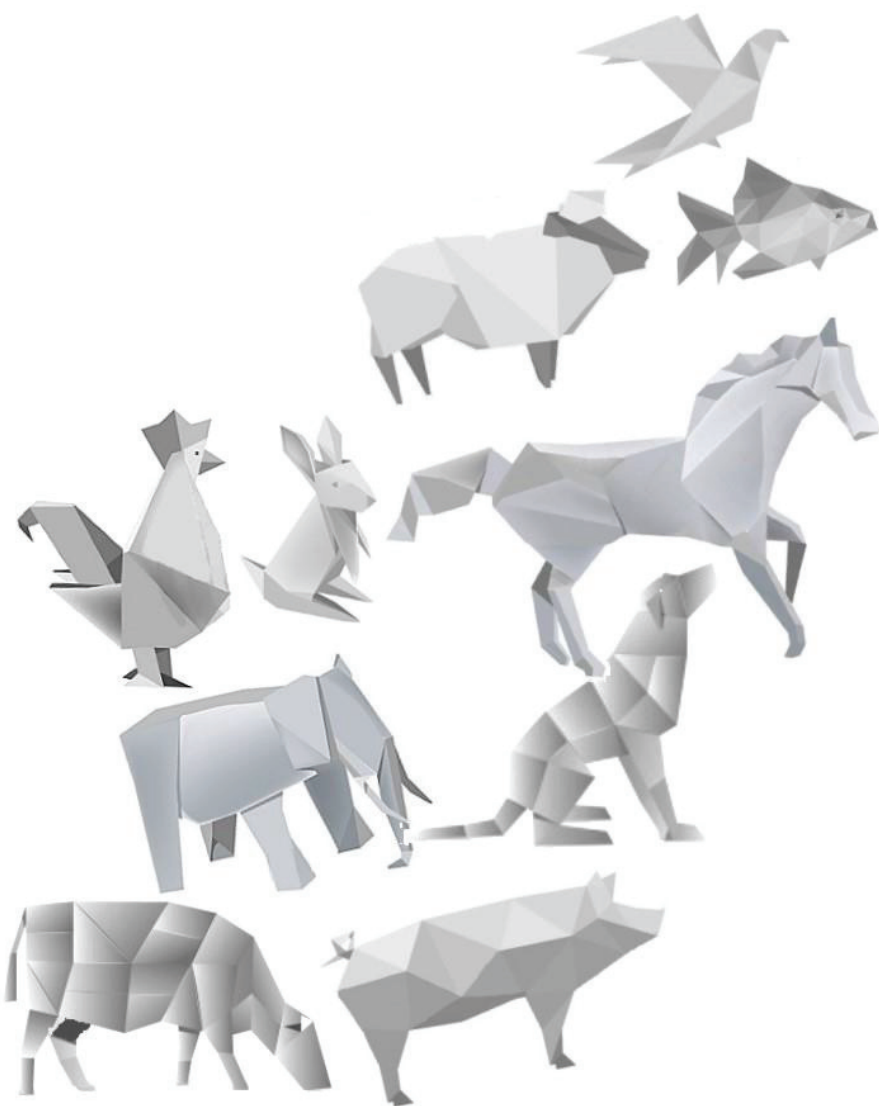


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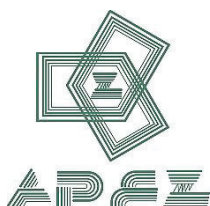
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INFLUENCE OF TRADITIONAL AND INNOVATIVE FEED ON FINISHING BÍSARO PIGS IN A HOOP BARN WITH OUTDOOR ACCESS

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INTRODUCTION

A growing interest has been presented in outdoor swine production systems due to the lower initial investment cost such as facilities, buildings and equipment (Araujo *et al.* 2016; Cerqueira *et al.*, 2016). In the North of Portugal an example of sustainable production systems can be seen in Bísaro pig, whose production system shows some diversity: small traditional farms, intensive outdoor and semi-extensive. In this breed there is a great tradition in fattening and finishing pigs into a variety of traditional products some of them protected through European quality protection systems as PGO and PGI.

Traditionally Bísaro pigs are fattened to an advanced age and weight (1 year of age or 120-160 kg or more) and during their life, two growing phases are considered: the first one characterized by an accelerated growth up to about 80 kg LW and the second one a slower growth phase with traditionally foodstuff and variable diets depending on the availability of local food resources on each farm and region: flour cereals, fruits, vegetables, tubers, grass chestnuts and acorns (Santos Silva and Tirapicos Nunes, 2013).

The overall objectives of these experiments are to examine the impact of traditional and innovative feed resources on growth/finishing of this breed.

MATERIAL AND METHODS

A total of 30 pigs (15 castrated males and 15 females) of the Bísaro breed, aged 3 months old, were equally divided in number and gender in three batches, placed in a hoop barn with dimensions of 3m²/animal indoor and 200 m²/animal outdoor (free access).

The study comprised two phases: during phase 1 (98 days of length, 20 kg of initial LW) all the animals were fed with a starter concentrate diet for 21 days (1.5 kg/pig/day) followed by a concentrate growth diet (1,5 kg/pig/day) and corn meal (0.3 to 0.4 kg/pig/day) until they reached 80 kg of LW; during phase 2 (finishing phase, from 80 to 120 kg LW: three experimental batches were differentiated in the form of the diet: D1 – Barley germinated seeds, commercial concentrate feed and corn meal; D2 – raw potatoes, commercial concentrate feed and corn meal; D3 - commercial concentrate feed + corn meal. The concentrate growth diet was maintained (1.5 kg/pig/day), and the corn meal was increased (0.6 kg/pig/day).

The dry matter (DM), digestibility energy (DE) and crude protein (CP) content of diet ingredients are presented in Table 1.

Every 14 days, animals were individually weighted. Feed consumption per batch was measured on a daily basis. Growing performance was evaluated calculating Average Daily Gain - ADG (kg/day) and Food Conversion Rate - FCR (Dry Matter Feed Intake – DMFI, kg Live Weight Gain - LWG, kg).

Treatment effects on traits were evaluated by ANOVA, with IBM-SPSS for Windows program (version 22.0), using the following model: $Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk}$, (1) where α_i , β_j represent the “main effect” of the i-th and j-th levels of Diet (1, 2, 3) and Sex (1, 2), respectively, $(\alpha\beta)_{ij}$ is the effect of the interaction in that combination of levels, and ε_{ijk} is the error term of the k-th observation in that combination.

Growth of the animals was modelled by linear regression of weight against time, and the coefficient estimates were used to calculate average daily gain (ADG) during the test.

RESULTS AND DISCUSSION

Feed intake and food conversion ratio

A summary of the results for DMFI, LWG, FCR, in growing and finishing phase, according to different diets are present on Table 2. During the first growth phase up to 80 kg, all animals (N = 30) ingested the same amount of daily feed, on average 1.57 kg DM of concentrate feed. From the 80 kg PV the animals started the finishing phase and were fed differently according the diets. At the end of the experiment the daily feed intake per animal were 1.61, 1.85 and 1.96 kg/kg DM for D1 (germinate), D2 (potatoes) and D3 (concentrate), respectively. Diet fed groups D1 and D2 ingested -18% and -6% DM animal/day relative to concentrate-fed animals, respectively.

FCR was different between growing phases but not between groups: in the first growing phase FCR was 2.82; 2.92 and 2.79 kg/kg MS for D1, D2 and D3, respectively. In all diets, this ratio was higher in the finishing phase with 4.26 kg/kg, 4.15 and 3.76 kg/kg on D1, D2 and D3 diets (Table 2). The total value of FCR obtained during the experiment in the different groups of animals (D1=3.39; D2=3.46; and D3=3.22 kg/kg) show the effectiveness with which teste occurred and evidences the efficiency of the pigs Bísaros in the use of forage and traditional food resources (in this case, germinated barley and potatoes). The energy and protein intake during the experimental phase (Table 3) may explain the different performances between diets. Energy intake was lower in D1 (24.3 MJ /day vs D2 with 28.3 MJ/day), presenting D3 the highest average daily intakes of ED (29.8 MJ/day) and protein (CP 289.1 g/day).

Growing and finishing performances

A summary of the growth performances in the two phases are present on Table 4. From the results obtained by the linear model, no effect diet*sex was observed on the growing performances of the animals. In the first phase (20-80 kg LW) the 3 groups of animals started with the same LW and age, shared the same environment and were fed with the same diet (only concentrate), and therefore, they reached 80 kg LW at the same time, without differences on ADG animals (P>0.05). In the finishing phase the pigs were

submitted to different diets, being slaughtered as they reached 120 kg LW. Thus, for slaughter LW no differences ($P>0.05$) were recorded between diets. Considering the finishing phase, there were differences ($P<0,01$) between diets with ADG of pigs covered a 0.145 kg/day *range* from 0.385 kg/day (D1), to 0.530 kg/day (D3). An second growth analyses with linear regression (Figure 1) revealed similar ADG and high correlation coefficients, more than 0.90. The sex affect ($P<0.05$) the ADG in both phases with inferior values for females: -12.8% and -14.5% for the first growing and second finishing phase, respectively. The growth differences between diets reflect the difference in nutritional value of the different ingested foods and their metabolic utilization by the pigs. The comercial concentrate is the most efficient food and with a better growth response, whereas traditional and innovative foods, when replacing the concentrate, cause a reduction of ADG. This tendency and values observed in this experiment do not differ much from those obtained in other tests carried out in the Bísara breed, in which other traditional foods were used apple, corn silage (Santos Silva *et al.*, 2000, 2006), and grass (Figueiredo *et al.*, 2007). The results of feeding ingestion make it possible to design production costs.

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Table 1. Digestible energy (DE) and crude protein (CP) content of the feeds (on DM basis)

Feed	DM (%)	DE (MJ/kg)	CP g/kg
Barley germinated	11.0	13,64	209
Comercaial	90.0	14,56	167
Corn meal	87.0	16,67	97
Potatoe	22.0	15,45	82

Table 2. Dry matter feed intake and Food conversion rate according the Bísaro pigs diet.

Phase	Diet	D1	D2	D3
Growing (20 kg to 80 kg LW)	Comercial concentrate	132.3		
	Corn meal (kg)	21.9		
	Feed total (kg)	154.2		
	Feed (kg/day)	1.57		
	LW gain total (kg)	54.7	52.9	55.3
	FCR (kg/kg)	2.82	2.92	2.79
Finishing (80 to 120 kg LW)	Comercial concentrate	90.7	90.7	121.0
	Corn Meal (kg)	43.9	43.9	46.8
	Barley germinated (kg)	16.6	-	-
	Potatoes (kg)	-	38.81	-
	Feed total (kg)	151.2	173.4	167.7
	Feed (kg/day)	1.61	1.85	1.96
	LW gain total (kg)	35.5	41.8	44.6
	FCR (kg/kg)	4.26	4.15	3.76
Global	FCR (kg/kg)	3.39	3.46	3.22

Table 3. DE and CP intake at the finishing phase, according the diet of Bísaro pigs

	D1	D2	D3
Total DE MJ	227.8	265.2	254.1
DE (MJ pig/day)	24.3	28.3	29.8
Total CP (g)	2282.6	2253.1	2468.5
CP (g pig/day)	243.3	240.2	289.1

Table 4. Age and weight at the growing and finishing phase and average daily gain, according the diet of Bísaro pigs

	Diet				Sex			Significance				
	D1	D2	D3		M	F						
	N=	N=1	N=1		N=	N=						
	LS	LS	LSM	SE	LS	LS	SE					
Beginning of												
Age (days)	99.5	97.7	100.	1.54	98.9	99.2	1.26	NS	NS	NS	NS	
LW (kg)	25.8	25.1	25.4	1.45	25.9	25.0	1.18	NS	NS	NS	NS	
Growing phase												
Age (days)	197.	195.	198	1.54	196.	197.	1.26	NS	NS	NS	NS	
LW (kg)	80.5	78.0	80.7	3.52	83.9	75.5	2.87	NS	0.05	NS	NS	
Finishing phase												
Age at slaughter	291.	289.	283.	4.44	284.	291.	3.62	NS	NS	NS	NS	
LW at slaughter	116.	119.	125.	3.57	126.	114.	2.92	NS	0.071	NS	0.01	
Period length	93.8	93.8	85.4	4.79	87.3	94.7	3.91	NS	NS	NS	NS	
ADG												
Growing (kg/day)	0.55	0.54	0.56	0.02	0.59	0.51	0.02	NS	0.012	NS	NS	
Finishing (kg/day)	0.38	0.45	0.53	0.02	0.49	0.42	0.01	0.00	0.012	NS	0.00	
Total (kg/day)	0.47	0.49	0.55	0.02	0.54	0.46	0.01	0.05	0.004	NS	0.00	
Total days	191.	191.	183.	4.79	185.	192.	3.91	NS	NS	NS	NS	

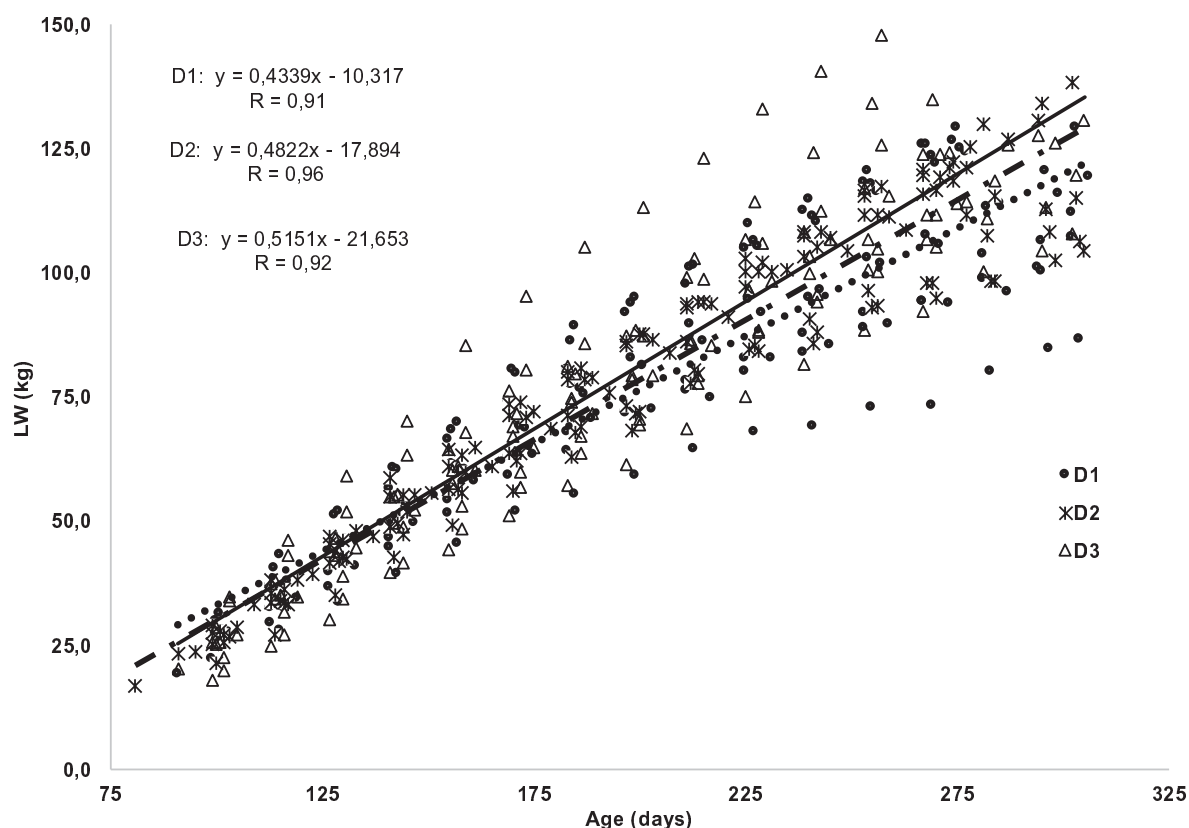


Figure 1. Growth of the Bísaro according the diets

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ABSTRACT: The goal of this study was to compare the growth performance of traditional and innovative feed resources on finishing of Bísaro breed. The pigs were reared in a hoop barn with outdoor free access. In the growing phase the diet was the same and from 80 until 120 kg LW three different diets were tested. The daily dry matter feed Intake per animal was 1.61, 1.85 and 1.96 kg for D1 (germinate), D2 (potatoes) and D3 (concentrate) respectively. FCR in the finishing phase was 4.26 kg/kg, 4.15 and 3.76 kg/kg on D1, D2 and D3.

At slaughter, no differences on LW ($P>0.05$) were recorded between diets. Considering the finishing phase and the total period, there was an effect of diet ($P<0,01$) the ADG being 0.385, 0.451, 0.530 kg/day) for diets D1, D2 and D3, respectively. The growth analyses with linear regression revealed similar ADG and high correlation coefficients, more than 0.90. The growth differences between diets reflect the difference in nutritional value of the different ingested foods and their metabolic utilization by the pigs. The concentrate is the most efficient food (FCR) and with a better growth response, whereas traditional and innovative food, when replacing the concentrate, cause a reduction of ADG.

Keywords: Bísaro, average daily gain, food conversion ratio, finishing, diets.