

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

Araújo, J.P.^{1,2}, Cerqueira, J.L.^{1,3}, Pires, P.⁴, Santos Silva, J.⁵, Candek-Potokar, M.⁶

¹Agrarian High School of Ponte de Lima, Polytechnic Institute of Viana do Castelo,
4990-706, Ponte de Lima, Portugal

²Mountain Research Centre, ESA-IPVC, Portugal

³CECAV, Animal and Veterinary Research Centre, UTAD, Vila Real, Portugal

⁴Technology and Management High School, Polytechnic Instit. Viana do Castelo,
Portugal

⁵Ministry of Agriculture and Rural Development, Portugal.

⁶Kis-Agricultural Institute of Slovenia, Ljubljana, Slovenia.

Autor de contacto: pedropi@esa.ipvc.pt

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.

BIBLIOGRAPHY

Araújo, JP, Amorim, I, Santos-Silva, J, Pires, P, Cerqueira, JL, 2016. *Food Futures – Ethics, Science & Culture* 87-91. Cerqueira, JL, Silva, JS, Amorim, I, Pires, P, Durão, J, Araújo, JP, 2016, IX ISMP 48. Figueiredo, FO, Santos e Silva, J, Abreu, JM, Pires da Costa, JS, 2007. Options Méditerran.: Série A. Sem. Méditerranéens, 95-104. McDonald, P., Edwards, R, Edwards, RA, Greenhalgh, JFD, Morgan, CA, 2006. *Animal Nutrition* Ed. 6. Santos e Silva, J, Pires da Costa, 2000. *Rev Port Zoot*, 236-245. Santos Silva J, Tirapicos Nunes, JL, 2013, *Acta Agric. Slovenica*, Sup 4: 61-7. Santos Silva, J, Pires da Costa, JS, Ramalho Ribeiro JM, Abreu, JM, 2006. *EAAP* 119: 367-72.

ACKNOWLEDGMENTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 634476 (Project acronym: TREASURE). The content of this paper reflects only the author's view and the European

Union Agency is not responsible for any use that may be made of the information it contains.

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	

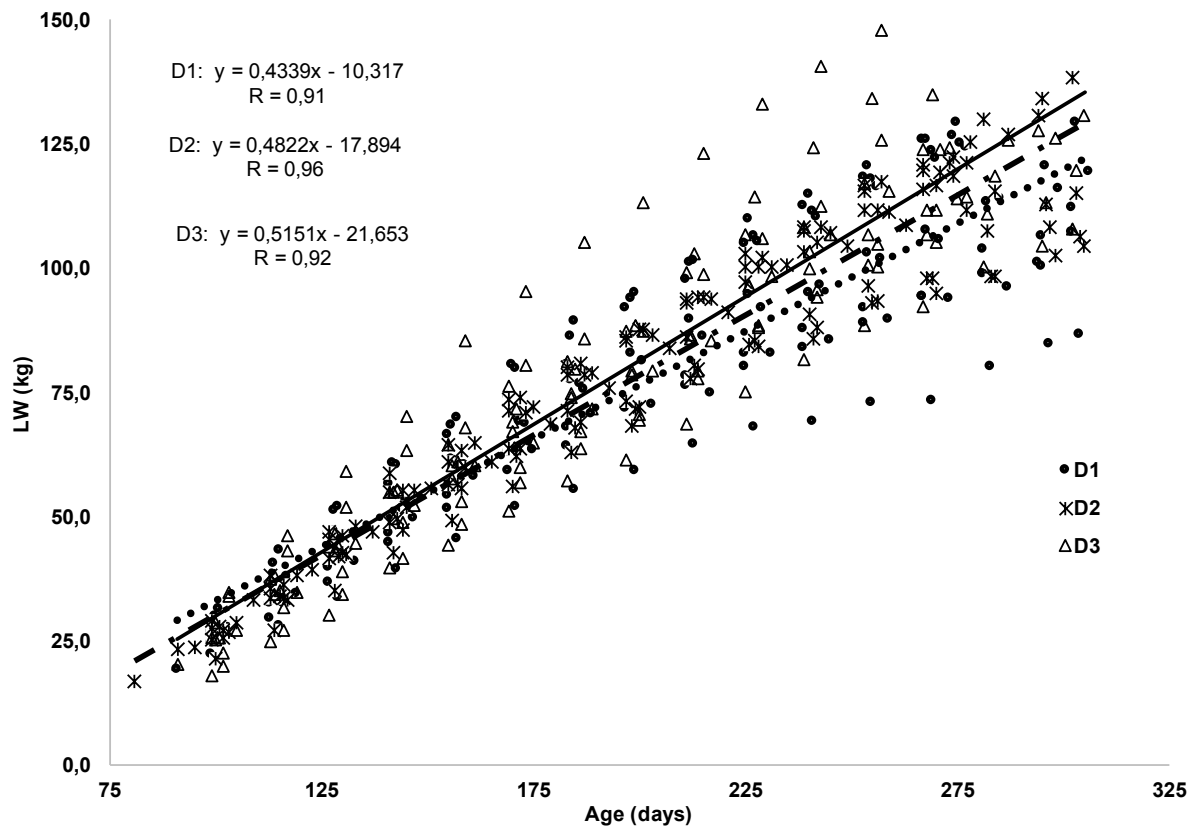


Figure 1. Growth of the Bísaro according the diets

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

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.

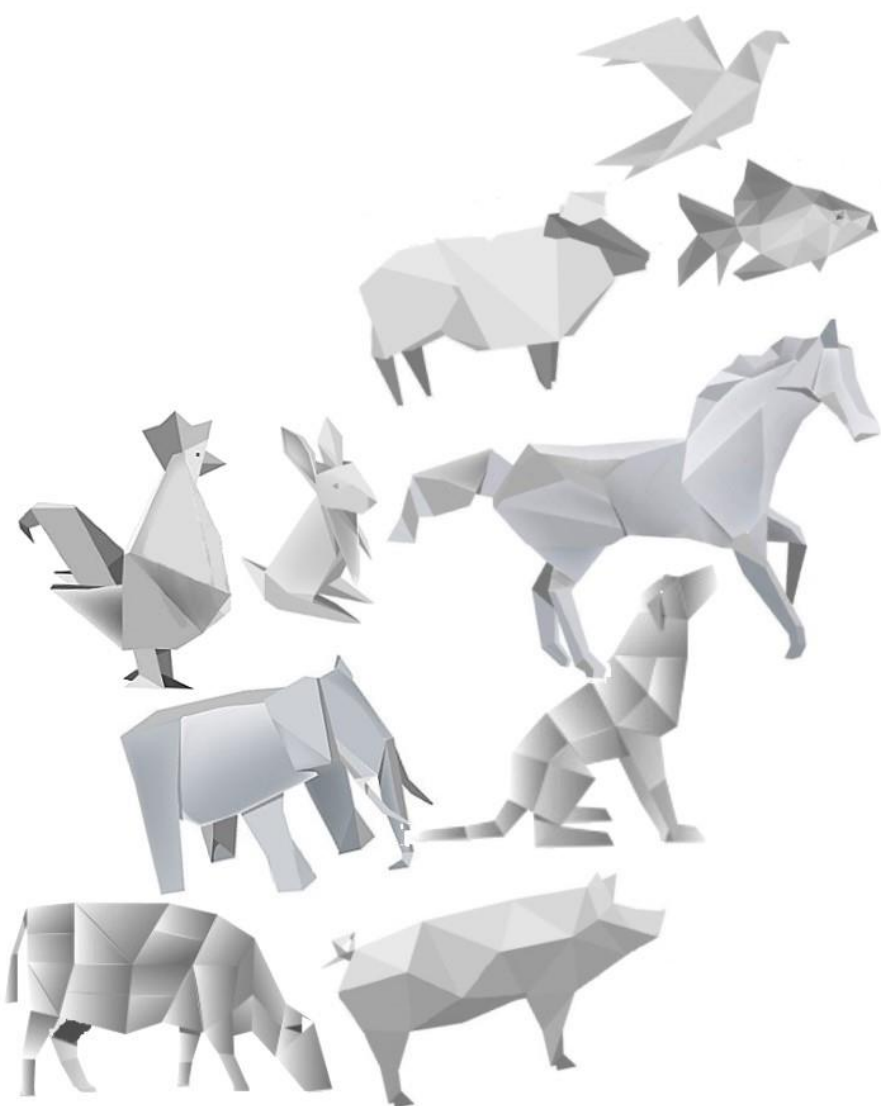
At slaughter, no differences on LW ($P>0.05$) were recorded between diets. Considering the finishing phase and the total period, there was an effect of diet ($P<0,01$) the ADG being 0.385, 0.451, 0.530 kg/day) for diets D1, D2 and D3, respectively. The growth analyses with linear regression revealed 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.

Ano III, Nº1 - 2018

ISSN: 0872 - 7098

Revista Portuguesa de Zootecnia



Associação Portuguesa de Engenharia Zootécnica



Ficha Técnica

Director:

Divanildo Outor Monteiro

Editor:

Ana Sofia Santos

Editor adjunto:

Mariana Almeida

Propriedade:

Associação Portuguesa de Engenharia
Zootécnica (APEZ)

Apartado 60, 5001-909 Vila Real

Composição e Montagem:

Telma Pinto

Design Gráfico:

Mariana Almeida e Telma Pinto

Contactos:

Apartado 60,
5001-909 Vila Real

rpz@apez.pt

912 239 527



A publicação deste número foi possível graças ao apoio da Comissão Científica do XX ZOOTECH – 20º Congresso Nacional de Zootecnia.



PREFÁCIO

A Engenharia Zootécnica comemora o 40º aniversário do seu ensino formal em Portugal.

A Associação Portuguesa de Engenharia Zootécnica faz 30 anos – APEZ 30 anos.

O Congresso Nacional de Zootecnia realiza a sua 20ª edição – XX ZOOTEK.

Por si só estas comemorações são já relevantes e constituem já uma marca indelével da Zootecnia. São comemorações que muito nos honram e responsabilizam, mas também confirmam que a Zootecnia, a Engenharia Zootécnica, os seus profissionais e a investigação que se faz nesta área são mesmo importantes para Portugal. A acrescer a tudo isto, a RPZe – Revista Portuguesa de Zootecnia (versão electrónica) reafirma a sua existência e, publica na íntegra os trabalhos apresentados no XX ZOOTEK.

A Revista Portuguesa de Zootecnia foi criada e é da responsabilidade da Associação Portuguesa de Engenharia Zootécnica, ao tempo Associação Portuguesa dos Engenheiros Zootécnicos, tendo editado o seu 1º número com os trabalhos do 4º Congresso de Zootecnia que teve lugar na UTAD, em 1994, conforme Nota de Abertura então publicada e que abaixo se transcreve.

“A Associação Portuguesa de Engenharia Zootécnica (APEZ) nasceu da vontade dos Licenciados em Engenharia Zootécnica se organizarem na defesa dos seus interesses e direitos. De início e com a realização do seu I Encontro Nacional na Universidade de Évora, em 16 e 17 de 1988, verificou-se o enorme interesse da classe por estudar e aprofundar os assuntos relacionados com a Zootecnia: Etologia, Melhoramento Genético, Nutrição, Reprodução, Economia e Planeamento, Extensão Rural, Bovinicultura, Ovinicultura, Caprinicultura, Suinicultura, Avicultura, Cunicultura, Equinicultura, Piscicultura e Transformação tecnológica de produtos.

O êxito desse encontro conduziu à realização dos I, II e III Congressos de Zootecnia, realizados respectivamente: na Universidade de Trás-os-Montes e Alto Douro, na Universidade dos Açores e na Universidade de Évora. A quantidade e qualidade de trabalhos apresentados provaram que a APEZ e os seus congressos é hoje uma organização que é uma peça fundamental da Zootecnia Nacional.

Correspondendo aos anseios da APEZ, perfeitamente expressos nos seus estatutos, decidiu a Direção Nacional, promover a publicação da "Revista Portuguesa de Zootecnia, fazendo coincidir o seu primeiro número com a realização do IV Congresso de Zootecnia na UTAD, em 1994. Pretende-se assim, que este seja o espaço ideal de divulgação de artigos de carácter científico e experimental que sejam realizados no âmbito da Zootecnia, servindo a promoção e defesa das diversas ideias que constituem essa importante ciência.

Em princípio, serão publicados dois números por ano, aceitando-se não só trabalhos apresentados em congressos e encontros organizados pela APEZ, mas também quaisquer outros originais dignos de interesse para a Zootecnia.

Com os desejos de um bom trabalho futuro,
Alfredo Teixeira”

Os pressupostos que levaram à criação da RPZ mantêm-se, continuando assim justificada a sua existência. Enquanto Director da RPZe, que deixarei de ser com a eleição dos novos Corpos Sociais da APEZ, não poderia ter maior satisfação na publicação deste número da nossa revista. Depois de um período turbulento com o funcionamento e encerramento do curso de Engenharia Zootécnica em algumas Escolas; depois de “Bolonha”; depois do modernismo, para ser benévolo, que se pretendeu associar à designação de Zootecnia e Engenharia Zootécnica; depois da “Ditadura do *Paper*” e do “*Paper*” em “boas” revistas, depois da transição do papel para o digital, sobrevivemos!...

Por tudo isso, este é mesmo um número muito especial!...

Assim, desejo que a revista se revitalize a cada número e que possa congrega o muito que se faz de investigação, também em Portugal, em Ciência Animal.

Divanildo Outor Monteiro

CARACTERIZAÇÃO QUÍMICA E SENSORIAL DO “CABRITO ASSADO À MODA DO ALTO MINHO”	375
DIAGNÓSTICO ESTRATÉGICO DA PRODUÇÃO DE CARNE DE CABRITO DA RAÇA ‘SERRANA’	382
DIAGNÓSTICO ESTRATÉGICO DA PRODUÇÃO DE LEITE E QUEIJO PROVENIENTES DA CABRA DA RAÇA ‘SERRANA’	389
CONSUMO DE NUTRIENTES EM VACAS MISTIÇAS ALIMENTADAS COM DIFERENTES NÍVEIS DE CAROÇO DE ALGODÃO	397
ANÁLISE BROMATOLÓGICA DE SILAGEM DE MILHO OBTIDA POR DIFERENTES MÉTODOS DE SECAGEM.....	403
DIETAS PARA BOVINOS COM DIFERENTES FONTES DE NITROGÊNIO E CARBOIDRATOS	410
AVALIAÇÃO DO TEMPO DE DURAÇÃO DO ESTRO E PERÍODO EM QUE OCORRE EM ÉGUAS NO MUNICÍPIO DE UNAÍ, MINAS GERAIS	416
OXIDAÇÃO LIPÍDICA E ESTABILIDADE DA COR NA CARNE DE BORREGOS SUPLEMENTADOS COM FONTES LIPÍDICAS RICAS EM ÁCIDOS GORDOS POLINSATURADOS	422
INDICADORES PRODUTIVOS E DE BEM-ESTAR ANIMAL EM DOZE EXPLORAÇÕES DE VACAS LEITEIRAS DA REGIÃO DE AVEIRO	429
INFLUENCE OF TRADITIONAL AND INNOVATIVE FEED ON FINISHING BÍSARO PIGS IN A HOOP BARN WITH OUTDOOR ACCESS.....	436
EFEITO DO INTERVALO ENTRE PARTOS E DA DIMENSÃO DA EXPLORAÇÃO NA VIABILIDADE TÉCNICO-ECONÓMICA DAS EXPLORAÇÕES DE BOVINOS DE LEITE NA REGIÃO SUL DE PORTUGAL CONTINENTAL.....	443
MONENSINA, VIRGINIAMICINA OU ÓLEO FUNCIONAL NA SUPLEMENTAÇÃO DA DIETA DE BOVINOS DE CORTE NO PERÍODO CHUVOSO	450
MANEIO E PROCEDIMENTOS DE ORDENHA EM EXPLORAÇÕES DE VACAS LEITEIRAS DE VILA DO CONDE.....	457
CARATERIZAÇÃO DO PESO DE CARÇAÇA E IDADE DOS VITELOS	464
DA CM-CARNE MINHOTA.....	464
PERFORMANCES REPRODUTIVA E PRODUTIVA DE UM REBANHO DE OVINOS DA RAÇA BORDALEIRA DE ENTRE DOURO E MINHO	471
CONTRASTE LEITEIRO: FERRAMENTA DE MONITORIZAÇÃO PARA UMA MELHOR EFICIÊNCIA DAS EXPLORAÇÕES LEITEIRAS - β -HIDROXIBUTIRATO	478
AVALIAÇÃO DAS CONDIÇÕES DOS CUBÍCULOS EM EXPLORAÇÕES.....	485