



Effect of finishing diet on carcass characteristics and meat quality of Mos cockerel

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Abstract

Aim of study: To evaluate the effect of different diets on carcass characteristics and meat quality from Mos free-ranged cockerel.

Area of study: Galicia (NW Spain).

Material and methods: Cockerels (n=75) were allocated to 3 groups (n=25) according to finishing diets: commercial fodder (CF), 50% wheat and 50% corn (WH) and 33% wheat and 66% corn (CR). Meat quality was assessed in terms of physicochemical, and nutritional features.

Main results: The highest live and carcass weight were obtained in CF group. Meat from CF and CR groups were similar in moisture, protein and cholesterol content in drumstick cut, meanwhile in breast piece there were no significant differences ($p>0.05$) in intramuscular fat (IMF), ash, and lightness (L*). On the other hand, finishing diet affected L* and redness (a*) values, showing the highest L* values in meat samples from CF treatment (49.94 for drumstick) ($p<0.01$), whereas a* was superior in WH samples (11.30 and 4.61, for drumstick and breast, respectively) ($p<0.001$). Meat shear force test was not affected ($p>0.05$) by diets. Finally, the finishing feed affected ($p<0.05$) the fatty acid and amino acid profile in both cuts (drumstick and breast).

Research highlights: Present study allowed to characterize for the first time Mos cockerels fed with different diets. Some carcass features obtained were higher than previous studies with other Mos categories, and some autochthonous and industrial breeds. Meat from cockerels was characterized by a high protein percentage and lower IMF.

Additional key words: food quality; poultry meat; carcass yield; free-range cockerel; local breed; nutritional quality

Abbreviations used: a* (redness); AA (amino acid); AI (atherogenic index); b* (yellowness); CL (cooking loss); CF (commercial fodder); CR (diet including 33% wheat and 66% corn); FA (fatty acid); h/H (hypocholesterolemic/hypercholesterolemic ratio); IMF (intramuscular fat); L* (lightness); ME (metabolizable energy); MUFA (monounsaturated FA); NV (nutritional value); PUFA (polyunsaturated FA); SFA (saturated FA); SEM (standard error of the mean); TI (thrombogenic index); TPA (texture profile analysis); UFA (unsaturated FA); WB (Warner-Bratzler); WH (diet including 50% wheat and 50% corn).

Authors' contributions: Conceived and designed the experiments: DF, JML and DR. Animal rearing: DR, AA and JRJ. Performed the analytical determinations: MP. Analysed the data: MVR and ML-P. Wrote the paper: MVR, DF and JML. Revision: MLP and MP. All authors read and approved the final manuscript.

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Introduction

The global food system has the challenge of feeding the population with rising demand for food minimizing its

environmental impacts (FAO, 2010a). For that, this requires more efficient animal production systems and indigenous breeds to optimize the use of natural resources. Moreover, sustainable production may require more land to obtain

the same yields as conventional farms, hence studies with local breeds will be necessary to know its performance and promote their production (Seufert *et al.*, 2012).

Intensive industry of poultry meat uses industrial lines (hybrids), which reduce biodiversity and preservation of local breeds (Hoffmann, 2009). On the contrary, indigenous chickens can be a source of genes for breeding programs, to benefit local livestock farmers (De Marchi *et al.*, 2006). To promote the raise of indigenous chickens, on a large scale, it is necessary information on the carcass characteristics and meat quality to cover this specific niche market (Dyubele *et al.*, 2010). Moreover, the characteristics of raising methods commonly used for slow-grown chickens allow breeders to satisfy the consumer demands linked to terms such as organic, animal welfare and outdoor poultry.

Mos chicken is a native breed of Galicia (Spain) resistant to diseases that tends naturally to live in freedom (MAPA, 2020). In addition, Mos zootechnics characteristics are perfectly fitted to commercialization standards for poultry meat in Europe relative to chickens as “open-air farm” or “free-range” according to Commission Regulation CE n° 543/2008 (OJEU, 2008), that must be carried out with a slow-growing genotype and slaughter age never lower than 81 days. Carcass characteristics and meat quality depend on many factors, such as genotype, nutrition and housing system (Puchala *et al.*, 2015), but genotype may be the most important. Specifically, in carcass performance, previous studies have indicated higher percentages for noble cuts (drumstick, thigh and wing) in Mos breed than in commercial genotypes (Sasso T-44), both in roosters (Franco *et al.*, 2012a) and young hens (Pateiro *et al.*, 2018). In the same line, concerning meat composition and considering breed effect, Mos roosters show higher levels of polyunsaturated fatty acids (FA) than Sasso T-44 hybrid line (Franco *et al.*, 2012b).

In Galicia (NW Spain), small-medium exploitations produce a category of chicken classified as a free-range cockerel, an immature male chicken raised in a free-range system and fed with different finishing diets based on feed produced on the farms. This poultry meat is placed between broiler and rooster/capon meat, occupying an empty market niche. In the last years, studies with Mos breed have been published to evaluate carcass yield, meat quality (physicochemical, nutritional and sensorial) according to several factors such as slaughter age, finishing diets, gender or caponization effect (*e.g.* entire roosters, capons or young hens) (Franco *et al.*, 2012a, 2016; Pateiro *et al.*, 2018) but there is no information about free-range cockerel meat quality.

Local breeds have particular sensory and nutritional values in comparison with industrial lines, but many of these features need further studies to elucidate factors that influence these parameters (Jayasena *et al.*, 2013). Overall, free-range cockerel can offer cost-effective meat of a local breed, since it can be slaughtered at younger ages than other categories (< 18 weeks) with higher meat quality but

are necessary studies to confirm it. Therefore, this research aimed to characterize the carcass characteristics and meat quality (breast and drumstick) of Mos free-ranged cockerel fed with three different finishing diets: commercial fodder and two combinations of wheat and corn at different levels.

Material and methods

Experimental design and sample collection

A total of 75 cockerels were used in this study. Birds were allocated to 3 groups (n=25) according to finishing diets, as following: commercial fodder (CF), 50% wheat and 50% corn (WH) and 33% wheat and 66% corn (CR). Table 1 shows the determined chemical composition of CF and cereals (corn and wheat) used. Cockerels were reared under extensive indoor (barn-reared) conditions according to the Commission Regulation n° 543/2008 (EC, 2008). From birth to the fourth week, birds were housed in a pen provided with central aisles, several floors, and natural ventilation with a density of 12 birds/m². At the sixth week of life, birds were sexed and moved to the definitive poultry house, remaining until slaughter, with a density of 4 and 6 birds/m² (interior and exterior of the pen, respectively). As a heat source, heaters of 250 W heating power at the ratio of 1 per 40 chicks were used. Heaters were partially removed at 4 weeks and completely after 6 weeks. Up to the fourth week of life, birds were fed *ad libitum* with a starter fodder (21% protein and 3,000 kcal of metabolizable energy (ME)/kg), afterwards until to 8 weeks with a growth standard fodder (19% protein and 2,900 kcal ME/kg). Finishing diets were provided in the last 2 weeks before slaughter. Birds were slaughtered in an accredited abattoir by manual exsanguination, and then plucked and eviscerated. Afterwards, carcasses were refrigerated for 24 h at 4°C and carcass weight, dressing percentage, and main commercial cuts were determined. From the refrigerated carcasses, the head, neck, legs, edible viscera (heart, liver, gizzard) and fat (perivisceral, perineal, and abdominal) were removed to obtain the main valuable commercial cuts (drumstick, thigh, wing, and breast). Drumstick (*peroneus longus*) and breast (*pectoralis major*) were used for pH, chemical composition, nutritional value, colour parameters and sensory analysis, meanwhile, the water-holding capacity measured by cooking loss (CL) and textural traits were assessed only in breast samples.

pH, chemical composition and colour

The pH was measured with a digital portable pH-meter (Hanna Instruments, Eibar, Spain) equipped with a penetration probe. A portable colorimeter (Konica Minolta CM-600d, Osaka, Japan) with the next settings machine (pul-

Table 1. Chemical composition and fatty acid profile of commercial fodder and ingredients used for finishing diets formulation

	Commercial fodder	Corn	Wheat
Moisture (%)	8.82	9.20	8.80
Crude protein (%)	19.00	8.01	13.40
Ash (%)	8.57	1.26	1.95
Fat (%)	3.82	4.89	2.08
Carbohydrates (%)	59.79	76.64	73.77
Gross energy (kcal/100g)	349.54	382.61	367.40
Fatty acid composition (% with respect total fat)			
C16:0	29.30	10.67	16.52
C18:0	3.29	2.65	1.39
C18:1n7	0.87	0.00	0.83
C18:1n9	29.70	34.70	15.72
C18:2n6	33.10	49.20	59.25
C18:3n3	1.74	1.29	3.87
C18:3n6	0.00	0.01	0.01
C20:0	0.32	0.53	0.20
C20:1n9	0.22	0.25	0.83
SFA	32.91	13.85	18.11
MUFA	30.79	34.95	17.38
PUFA	34.84	50.50	63.13
PUFA:SFA	1.05	3.64	3.48

SFA: \sum saturated fatty acids (C16:0 + C18:0 + C20:0). MUFA: \sum monounsaturated fatty acids (C18:1n7 + C18:1n9 + C20:1). PUFA: \sum polyunsaturated fatty acids (C18:2n6 + C18:3n3 + C18:3n6).

sed xenon arc lamp, angle of 0° viewing angle geometry, standard illuminant D65 and aperture size of 8 mm) was used to evaluate meat colour in the CIELAB space (CIE, 1976). Moisture, protein and ash were quantified according to the ISO recommended standards 1442:1997, 937:1978 and 936:1998, respectively (ISO 937, 1978; ISO 1442, 1997; ISO 936, 1998). The intramuscular fat (IMF) was extracted according to the AOCS Official Procedure Am 5-04 (AOCS, 2005). For total cholesterol determination, the saponification, extraction, and simultaneous identification of cholesterol in meat were performed in normal phase following the procedure described by Domínguez *et al.* (2018). The HPLC system used was an Alliance 2695 model equipped with a 2475 scanning fluorescence detector (Waters, Milford, MA, USA). Empower 2 advanced software (Waters, Milford, MA, USA) was used to control the system operation and results management.

Water holding capacity, and texture analysis

Water holding capacity and texture traits (Warner-Bratzler test-WB and Texture Profile Analysis test-TPA) were performed following the procedures described by

Pateiro *et al.* (2013). The water holding capacity was measured as CL. Briefly, breast cuts were cooked placing it into vacuum-packaged bags in a water bath with automatic temperature control (JP Selecta, Precisdg, Barcelona, Spain) until they reached an internal temperature of 70°C, controlled by thermocouples type K (Comark, PK23M, UK) connected to a data logger (Comark Dilligence EVG, N3014, UK). After cooking, breast samples were cooled in a circulatory water bath set at 18°C for 30 min, and the CL percentage was recorded by measuring the weight difference between the cooked and raw samples.

To carry out WB test all samples were cut perpendicular to the muscle fibre direction at a crosshead speed of 3.33 mm/s in a texture analyzer (TA.XT.plus of Stable Micro Systems, Vienna Court, UK). Three meat pieces of 1 × 1 × 2.5 cm (height × width × length) were removed parallel to the muscle fibre direction and they were completely cut using a WB shear blade with a triangular slot cutting edge (1 mm of thickness). Three pieces of meat of 1 × 1 × 1 cm (height × width × length) parallel to the muscle fibre direction were removed for TPA test. Textural parameters were measured by compressing to 80% with a probe of 19.85 cm² of surface contact. Between the first and second compression, the probe waited for 2

seconds. Hardness, cohesiveness, springiness, gumminess and chewiness were obtained.

Analysis of fatty acid and amino acids

Before analysis, IMF was extracted from 5 g of ground meat. Lipid extracts were evaporated to dryness under vacuum at 56 °C and stored at -80 °C until analysis of FA methyl esters. FA identification was carried out with gas chromatography with flame ionization detector, according to Domínguez *et al.* (2015b). Briefly, separation and quantification of the FA methyl esters were carried out using gas chromatography equipment (Agilent 6890N, Agilent Technologies Spain, S.L., Madrid, Spain) endowed with a flame ionization detector and an automatic sample injector HP 7683, and using a Supelco SPTM-2560 fused silica capillary column (100 m, 0.25-mm i.d., 0.2- μ m film thickness; Supelco Inc., Bellefonte, PA, USA). Nonanoic acid methyl ester (C9:0) at 0.3 mg/mL was used as an internal standard. Individual FA methyl esters were identified by comparing their retention times with those of authenticated standards. The FA were expressed as a percentage of total FA identified.

For amino acid (AA) determination, the hydrolysis of the protein, derivatization, and identification of hydrolysed AA was carried out following the procedure described

by Domínguez *et al.* (2015a). The HPLC system used was an Alliance 2695 model equipped with a 2475 scanning fluorescence detector (Waters, Milford, MA, USA). Empower 2 advanced software (Waters, Milford, MA, USA) was used to control the system operation and results management. Data regarding AA composition were expressed in g/100 g of protein.

Statistical analysis

For the statistical analysis of the results of carcass and meat quality, an Analysis of Variance (ANOVA) using the SPSS package (SPSS 23.0, Chicago, IL) was performed for all variables considered in the study. Normal distribution and homogeneity of variance were previously tested (Shapiro-Wilk). Duncan's test was used to separate least-square means with a significance level of $p < 0.05$.

Results

Effect of diet type on carcass features

The carcass characteristics of cockerels are shown in Table 2. Feeding system did not affect dressing

Table 2. Effect of finishing diet on carcass yield and proportion of commercial cuts of carcass of the cockerels slaughtered at 18 weeks

Parameters ^[1]	Treatments ^[2]			SEM ^[3] (n=25)	p-value
	CF	WH	CR		
Live weight (kg)	3.33 ^a	2.75 ^c	3.03 ^b	0.041	<0.001
Carcass weight (kg)	2.51 ^a	2.10 ^c	2.31 ^b	0.031	<0.001
Dressing percentage (%)	76.40	76.83	77.05	0.261	0.605
Remainder of carcass (%)	22.49 ^a	23.17 ^a	20.17 ^b	0.288	<0.001
Commercial cuts (% with respect of carcass)					
Drumstick (%)	15.09	15.65	15.44	0.098	0.052
Drumstick skin	1.69 ^a	1.33 ^b	1.42 ^b	0.030	<0.001
Drumstick meat	9.84 ^b	10.63 ^a	10.25 ^{ab}	0.095	0.001
Drumstick bone	3.47	3.62	3.54	0.051	0.482
Thigh (%)	17.55	18.16	18.46	0.162	0.069
Drumstick + thigh (%)	32.64 ^b	33.81 ^a	34.11 ^a	0.205	0.007
Wing (%)	11.58 ^a	10.90 ^b	11.33 ^a	0.074	<0.001
Breast (%)	14.72 ^b	16.43 ^a	14.09 ^b	0.181	<0.001
Head (%)	3.54 ^b	3.54 ^b	4.02 ^a	0.049	<0.001
Neck (%)	6.65 ^a	6.28 ^b	6.79 ^a	0.058	0.001
Leg (%)	4.71	4.75	4.88	0.056	0.480
M/B	2.88	2.98	3.01	0.052	0.570

^[1] M/B: meat/bone drumstick. ^[2] Treatments: CF: commercial fodder; WH: 50% wheat and 50% corn; and CR: 33% wheat and 66% corn. ^[3] SEM: standard error of the mean. ^{a-c} Means of the same row with different letters differ significantly by the Duncan's test ($p < 0.05$).

percentage, drumstick percentage, drumstick bone, thigh percentage, leg percentage, and meat/bone drumstick ratio. The highest live and carcass weight were obtained in CF group and the lowest in WH group, but on the contrary cockerels from WH treatment showed the highest value for breast percentage, with respect to carcass weight. The CF and WH groups were the most different in carcass parameters and only carcass percentage, thigh and head percentage were similar ($p<0.05$).

Effect of diet type on chemical composition, colour and textural parameters

The mean values of the colour parameters and chemical composition (drumstick and breast samples) are shown in Table 3. For both muscles, there were significant differences by diet effect, except for yellowness (b^*) of meat. The highest pH value (6.22) was reached in drumstick cuts from CF group. Meat from CF and CR groups were similar in moisture, protein and cholesterol content in drumstick cut, meanwhile in breast piece, there were no significant differences ($p<0.05$) in IMF, ash, and lightness (L^*). The finishing diet affected L^* and a^* , showing the highest values for L^* in meat samples of cockerels finished with CF treatment (49.94 for drumstick) ($p<0.01$), meanwhile meat a^* was superior in WH samples (11.30 and 4.61, for drumstick and breast, respectively) in comparison with CF samples which presented the lowest a^* values.

Water holding capacity and textural parameters of WB and TPA-test are presented in Table 4. Meat from cockerels of CR group showed a significantly higher percentage of CL than those from the other ones (13.37, 11.82 and 11.44% for CR, WH and CF groups, respec-

tively; $p<0.05$). Regarding WB test, shear force was not affected by diet effect, meanwhile all TPA parameters of meat samples were affected by finishing diet (Table 4).

Effect of diet type on fatty acid profile

The FA profile of drumstick and breast is shown in Table 5. The finishing feed affected the FA profile in both cuts. In drumstick cut, the predominant fraction was the saturated FA (SFA), followed by polyunsaturated FA (PUFA), and monounsaturated FA (MUFA), with values that ranged between 35.51% and 36.73%. On the contrary, in breast PUFA was the most abundant (PUFA>SFA>MUFA), except for CF dietary treatment (SFA>PUFA>MUFA), with percentages between 34.54% and 38%. In breast, the CF treatment influenced significantly ($p<0.05$) MUFA, PUFA, and n6. MUFA content was the minority fraction in both pieces. Within SFA, for both cuts and all diet treatments, palmitic (C16:0) and stearic (C18:0) acids were the most abundant. It should be noted that the use of CF significantly increased palmitic acid content and consequently the nutritional atherogenic index (AI) and thrombogenic index (TI) indices in both cuts. On the other hand, the inclusion of corn and wheat in the diet (WH and CR treatments) significantly decreased SFA, except for breast samples from CR group, and increased PUFA/SFA ratio in both cuts. In relation to the AI and TI, the highest ratios were observed in drumstick and breast samples from CF diet. Concerning hypocholesterolemic/hypercholesterolemic ratio (h/H), in both cuts WH showed the highest indices, meanwhile breast from CR group presented the highest nutritional value among all samples.

Table 3. Effect of finishing diets on chemical composition and color parameters of drumstick and breast of the cockerels slaughtered at 18 weeks

Parameters	Drumstick					Breast				
	Treatments ^[1]			SEM ^[2] (n=25)	p-value	Treatments ^[1]			SEM ^[2] (n=25)	p-value
	CF	WH	CR			CF	WH	CR		
pH	6.22 ^a	6.02 ^b	6.01 ^b	0.022	<0.001	5.92 ^a	5.84 ^b	5.79 ^b	0.014	<0.001
Moisture (%)	75.40 ^a	74.88 ^b	75.32 ^a	0.076	0.007	73.65 ^a	72.76 ^c	73.28 ^b	0.078	<0.001
Protein (%)	22.78 ^a	22.38 ^b	23.03 ^a	0.082	0.003	26.06 ^a	26.67 ^b	26.54 ^b	0.083	0.004
Intramuscular fat (%)	1.27 ^a	1.17 ^a	0.85 ^b	0.051	0.002	0.07 ^b	0.19 ^a	0.11 ^b	0.012	<0.001
Ashes (%)	1.36 ^b	1.39 ^a	1.40 ^a	0.066	0.021	1.34 ^b	1.37 ^a	1.32 ^b	0.006	0.001
Cholesterol (mg/100g)	57.58 ^b	68.85 ^a	60.88 ^b	1.092	<0.001	n.d.	n.d.	n.d.	n.d.	n.d.
Lightness (L^*)	49.94 ^a	42.99 ^c	45.54 ^b	0.514	<0.001	53.44 ^a	51.08 ^b	53.12 ^a	0.314	0.002
Redness (a^*)	8.17 ^c	11.30 ^a	10.06 ^b	0.255	<0.001	1.16 ^c	4.61 ^a	3.33 ^b	0.257	<0.001
Yellowness (b^*)	14.01	14.25	13.88	0.168	0.656	17.18	18.74	16.97	0.360	0.080

^[1] CF: commercial fodder; WH: 50% wheat and 50% corn and CR: 33% wheat and 66% corn. ^[2] SEM: standard error of the mean. ^{a-c} Means of the same row with different letters differ significantly by the Duncan's test ($p<0.05$). n.d.: not detected.

Table 4. Effect of finishing diets on cooking loss and textural parameters of the cockerels slaughtered at 18 weeks

Parameters ^[1]	Treatments ^[2]			SEM ^[3] (n=25)	p-value
	CF	WH	CR		
Cooking loss (%)	11.44 ^b	11.82 ^b	13.37 ^a	0.253	0.005
Warner-Bratzler					
Shear force (N/cm ²)	13.07	15.50	13.79	0.504	0.110
TPA-test					
Hardness (N)	43.05 ^b	56.80 ^a	48.63 ^b	1.487	<0.001
Springiness (mm)	5.11 ^{ab}	5.35 ^a	4.99 ^b	0.057	0.027
Cohesiveness	4.26	4.46	4.69	0.077	0.097
Gumminess (N)	19.26 ^b	24.05 ^a	23.87 ^a	0.805	0.019
Chewiness (N mm)	9.81 ^c	15.48 ^a	12.84 ^b	0.555	<0.001

^[1] TPA-test: texture profile analysis. ^[2] CF: commercial fodder; WH: 50% wheat and 50% corn and CR: 33% wheat and 66% corn. ^[3] SEM: standard error of the mean. ^{a-c} Means of the same row with different letters differ significantly by the Duncan's test ($p < 0.05$).

Table 5. Effect of finishing diet on fatty acid profile (g/100 g of fat) of drumstick and breast of the cockerels slaughtered at 18 weeks

Fatty acids ^[1]	Drumstick					Breast				
	Treatments ^[2]			SEM ^[3] (n=25)	p-value	Treatments ^[2]			SEM ^[3] (n=25)	p-value
	CF	WH	CR			CF	WH	CR		
C14:0	0.58 ^b	0.74 ^a	0.49 ^c	0.018	<0.001	0.41 ^b	0.46 ^a	0.33 ^c	0.012	<0.001
C16:0	23.66 ^a	20.05 ^c	21.86 ^b	0.256	<0.001	25.15 ^a	22.49 ^c	24.26 ^b	0.195	<0.001
C16:1n7	1.48	1.48	1.73	0.070	0.281	1.51 ^a	1.07 ^b	1.28 ^{ab}	0.059	0.006
C18:0	11.90 ^c	13.92 ^a	12.91 ^b	0.188	<0.001	9.56 ^c	10.58 ^a	9.93 ^b	0.093	<0.001
C18:1n9	27.13	26.07	25.68	0.286	0.105	25.82 ^a	23.57 ^b	22.40 ^b	0.342	<0.001
C18:1n7	2.06 ^b	2.36 ^a	2.55 ^a	0.057	0.002	2.57 ^b	2.68 ^b	3.08 ^a	0.046	<0.001
C18:2n6c	21.00	21.74	20.98	0.218	0.251	17.17	16.58	16.34	0.191	0.208
C18:3n3	0.80	0.78	0.66	0.025	0.060	0.51 ^a	0.41 ^b	0.36 ^b	0.018	0.002
C20:4n6	7.34	7.76	8.46	0.184	0.053	11.74 ^b	14.20 ^a	14.64 ^a	0.320	<0.001
C22:5n3	0.95	1.00	1.09	0.028	0.121	1.81 ^b	2.34 ^a	2.33 ^a	0.067	<0.001
C22:6n3	1.08 ^b	1.39 ^a	1.25 ^{ab}	0.040	0.003	2.17 ^c	3.52 ^a	2.92 ^b	0.113	<0.001
SFA	36.73 ^a	35.51 ^b	35.93 ^b	0.160	0.004	35.39 ^a	33.96 ^b	34.80 ^a	0.149	<0.001
MUFA	31.18	30.85	30.55	0.317	0.738	29.90 ^a	27.56 ^b	26.78 ^b	0.365	<0.001
PUFA	32.08	33.64	33.52	0.321	0.083	34.54 ^b	37.98 ^a	38.00 ^a	0.444	0.003
PUFA/SFA	0.87 ^b	0.95 ^a	0.93 ^a	0.011	0.008	0.98 ^b	1.12 ^a	1.09 ^a	0.049	<0.001
n3	2.90 ^b	3.26 ^a	3.10 ^{ab}	0.064	0.050	4.60 ^c	6.40 ^a	5.75 ^b	0.164	<0.001
n6	29.18	30.33	30.41	0.292	0.160	29.94 ^b	31.58 ^a	32.24 ^a	0.330	0.014
n6/n3	10.21	9.52	10.04	0.190	0.279	6.61 ^a	5.11 ^c	5.84 ^b	0.145	<0.001
AI	0.41 ^a	0.36 ^b	0.37 ^b	0.005	<0.001	0.42 ^a	0.37 ^c	0.40 ^b	0.004	<0.001
TI	0.93 ^a	0.86 ^b	0.89 ^b	0.007	<0.001	0.80 ^a	0.69 ^c	0.74 ^b	0.010	<0.001
h/H	2.21 ^c	2.60 ^a	2.37 ^b	0.030	<0.001	2.19 ^b	2.41 ^a	2.22 ^b	0.021	<0.001
NV	0.50 ^a	0.44 ^c	0.48 ^b	0.005	<0.001	0.60 ^b	0.57 ^b	0.64 ^a	0.006	<0.001

^[1] SFA = \sum (C14:0 + C15:0 + C16:0 + C17:0 + C18:0 + C22:0); MUFA = \sum (C16:1 + C18:1n7 + C18:1n9 + C20:1); PUFA = \sum (C18:2n6 + C18:3n3 + C20:2n6 + C20:3n6 + C20:4n6 + C20:5n3 + C22:5n3 + C22:6n3). AI: atherogenic index. TI: thrombogenic index. h/H: ratio hypocholesterolemic/hypercholesterolemic fatty acids. NV: nutritional value. n6/n3: ratio between the sum of n6 and n3 fatty acids. ^[2] CF: commercial fodder; WH: 50% wheat and 50% corn and CR: 33% wheat and 66% corn. ^[3] SEM: standard error of the mean. ^{a-c} Means of the same row with different letters differ significantly by the Duncan's test ($p < 0.05$).

Effect of diet type on amino acid profile

The AA profile of drumstick and breast is shown in Table 6. Arginine and methionine were the only ones not affected ($p>0.05$) by dietary treatment in both cuts. Samples of drumstick from WH group showed the highest cysteine, tyrosine, valine, isoleucine, leucine and phenylalanine amounts. On the contrary, in breast samples, this pattern was not maintained, and the highest AA contents, except for tyrosine and phenylalanine, were found in breasts from CF and CR groups. Breast samples from CF group had significant ($p<0.05$) higher aspartic, proline, cysteine, threonine, isoleucine, and leucine amount than the other ones, meanwhile CR group displayed the higher serine, glutamic, glycine and total non-essential AA levels.

Discussion

Effect of diet type on carcass features

Live and carcass weight varied from 2.75 to 3.33 kg and from 2.10 to 2.51 kg, respectively. These intervals were higher than those observed in Mos hens slaughtered at 20 weeks (2.05-2.30 kg and 1.56-1.80 kg for live and carcass weight, respectively) (Pateiro *et al.*, 2018). Despite the differences of two weeks in the slaughter, results could be due to the gender effect for the same breed. On the other hand, commercial breeds had higher live and carcass weights (Díaz *et al.*, 2013b). In this way, the aforementioned authors reported that Sasso X-44 hens showed slightly higher values for live and carcass weight than Mos hens (Pateiro *et al.*, 2018).

As expected, carcass weight of the heaviest cockerels (2.51 kg for CF group) was lower than those reported for Mos rooster slaughtered at 6 months (2.70 kg) (Franco *et al.*, 2012a), or for other Spanish (2.60 kg, Extremaña Azul) and Portuguese (2.80 kg, Amarela, Preta Lusitânica, and Pedrês) breeds slaughtered at 8 months (Muriel Duran, 2014; Soares *et al.*, 2015). However, other indigenous breeds from Italy and Spain slaughtered at 7 months, reached lower live and carcass weight, but similar dressing percentage (Miguel *et al.*, 2008; Cassandro *et al.*, 2015), indicating that genotype has a key role in growth performance. Comparing with other local breeds slaughtered at similar age (4 months), our results for carcass weight and dressing percentage were higher than those obtained in Black-Boned (1.10 kg and 63.7%), Thai Native (1.28 kg and 65.9%), Bresse (1.52 kg and 63.6%), and Rhode Island Red (1.58 kg and 64.4%) breeds.

Regarding cuts with high commercial value (drumstick, thigh, wing, and breast), the percentage total achieved was 62.2%. Previous studies reported that Mos breed provided a high yield of noble parts, which would satisfy the industry and consumer demands (Pateiro *et al.*, 2018).

This value was greater than those obtained for Mos roosters slaughtered at 6 months (59.89%), 7 months (59.27%), 8 months (57.7%) and 10 months (58.17%) (Sánchez *et al.*, 2005; Franco *et al.*, 2012a, 2013, 2016). Moreover, it was also higher than those showed in other Spanish local breeds of slow growth such as Castellana Negra slaughtered at 7 months or Extremaña Azul slaughtered at 8 months (Miguel *et al.*, 2008; Muriel Duran, 2014), as well as for industrial lines such as Sasso T-44 (56.01%) and Sasso X-44 (55.57%) (Franco *et al.*, 2012a, 2016). On the contrary, Soares *et al.* (2015), working with Amarela, Preta Lusitânica, and Pedrês Portuguesa breeds slaughtered at 8 months, reported higher percentages of breast, thigh, and drumstick than those obtained in the present study. This suggests that allometric growth values of these commercial cuts has relation with maturity state, proving that Mos cockerels can provide a high yield of noble parts at earlier ages.

Effect of diet type on chemical composition, colour and textural parameters

Overall, the pH values in poultry meat could be a consequence of their age, rearing management, pre-slaughter practices (resting period) or intrinsic behavior typical of indigenous breeds (Jaturasitha *et al.*, 2008). In the present study, the mean values for pH ranged between 5.79 and 6.22 for both muscles (breast and drumstick, respectively) and all dietary treatments. This pH interval was previously reported in the literature for different birds (hens, cocks, and capons). Moreover, in agreement with the results found by other authors, these values are usually higher in drumstick cut (Wattanachant *et al.*, 2004; Franco *et al.*, 2012a, 2013, 2016; Díaz *et al.*, 2013a,b; Pateiro *et al.*, 2018). Unlike other authors, significant differences were found among treatments (Franco *et al.*, 2012a), with values that were higher than those obtained for other animals fed with cereals (Díaz *et al.*, 2013b).

Regarding chemical composition, the most interesting finding to emerge from the data is the high protein percentage obtained in the breast. Meat from cockerels showed higher protein percentages (1.5-3%) compared to previous studies with Mos roosters and hens (Franco *et al.*, 2012a, 2013, 2016; Pateiro *et al.*, 2018), and other breeds (Black-Boned, Thai, Polverara, Bresse, Rhode) (Wattanachant *et al.*, 2004; Jaturasitha *et al.*, 2008; Díaz *et al.*, 2013b; Dalle Zotte *et al.*, 2020). Similar breast protein percentages were observed working with Castellana Negra (cocks and capons) and Taiwan native chicken (Miguel *et al.*, 2008; Chumngoen & Tan, 2015).

The IMF content found in Mos drumstick varied between 0.85 and 1.27%, which is lower than those previously reported to Mos hens, roosters, and capons (Franco *et al.*, 2016; Pateiro *et al.*, 2018). Comparing to hybrids,

Table 6. Effect of finishing diet on amino acid profile (% respect to protein) of drumstick and breast of the cockerels slaughtered at 18 weeks

Amino acids ^[1]	Drumstick					Breast				
	Treatments ^[2]			SEM ^[3] (n=25)	p-value	Treatments ^[2]			SEM ^[3] (n=25)	p-value
	CF	WH	CR			CF	WH	CR		
Aspartic	9.60 ^a	9.38 ^b	9.70 ^a	0.039	0.002	9.71 ^a	9.39 ^b	9.31 ^b	0.043	<0.001
Serine	4.26	4.31	4.26	0.017	0.360	3.68 ^c	4.17 ^b	4.36 ^a	0.045	<0.001
Glutamic	16.74 ^a	16.25 ^b	16.82 ^a	0.057	<0.001	14.99 ^c	15.62 ^b	15.94 ^a	0.078	<0.001
Glycine	4.59	4.61	4.75	0.040	0.224	4.02 ^c	4.60 ^b	4.93 ^a	0.064	<0.001
Arginine	8.49	8.55	8.33	0.050	0.203	8.26	8.28	8.25	0.050	0.983
Alanine	6.28 ^b	6.27 ^b	6.40 ^a	0.017	0.002	6.11 ^a	5.97 ^a	5.75 ^b	0.035	<0.001
Proline	3.78	3.72	3.86	0.040	0.386	4.80 ^a	3.85 ^b	4.02 ^b	0.098	<0.001
Cysteine	0.81	0.94	0.82	0.027	0.053	1.12 ^a	0.78 ^b	0.82 ^b	0.027	<0.001
Tyrosine	3.52 ^b	3.72 ^a	3.45 ^b	0.042	0.018	3.81	3.80	3.58	0.048	0.098
ΣNE	58.07 ^{ab}	57.75 ^b	58.39 ^a	0.070	0.003	56.50 ^b	56.46 ^b	56.96 ^a	0.086	0.001
Histidine	2.99 ^a	3.00 ^a	2.90 ^b	0.016	0.016	3.67	3.62	3.53	0.036	0.297
Threonine	4.85 ^a	4.81 ^{ab}	4.75 ^b	0.018	0.065	4.77 ^a	4.86 ^b	4.70 ^b	0.024	0.019
Valine	4.87 ^b	4.96 ^a	4.84 ^b	0.013	<0.001	5.32 ^a	5.24 ^b	5.28 ^{ab}	0.013	0.029
Methionine	1.53	1.55	1.50	0.042	0.891	1.91	1.87	1.92	0.014	0.384
Lysine	10.36 ^a	10.03 ^b	10.54 ^a	0.063	0.003	9.64	9.73	9.67	0.058	0.796
Isoleucine	5.00 ^b	5.17 ^a	4.95 ^b	0.019	<0.001	5.50 ^a	5.23 ^b	5.17 ^b	0.024	<0.001
Leucine	8.20 ^b	8.31 ^a	8.15 ^b	0.021	0.003	8.73 ^a	8.46 ^b	8.47 ^b	0.031	<0.001
Phenylalanine	4.12 ^b	4.35 ^a	3.97 ^c	0.031	<0.001	4.24	4.32	4.20	0.026	0.211
ΣE	41.92 ^{ab}	42.19 ^a	41.62 ^b	0.070	0.003	43.77 ^a	43.52 ^a	43.00 ^b	0.086	0.001
E/NE	0.72 ^{ab}	0.73 ^a	0.71 ^b	0.002	0.003	0.78 ^a	0.77 ^a	0.75 ^b	0.003	0.001

^[1] E = essential amino acid; and NE = nonessential amino acid. ^[2] CF: commercial fodder; WH: 50% wheat and 50% corn and CR: 33% wheat and 66% corn. ^[3] SEM is the standard error of the mean. ^{a-c} Means of the same row with different letters differ significantly by the Duncan's test ($p < 0.05$).

IMF of Mos drumstick was far lower, at least twice, than capons of Sasso T-44 slow-growing line and Sasso X-44 (Díaz *et al.*, 2013a,b; Franco *et al.*, 2016; Pateiro *et al.*, 2018), and analogous comparing to CP707 broiler (Wattanachant *et al.*, 2004). In contrast, higher values were observed in Sasso T-44 rooster (Franco *et al.* 2012, 2013). Considering breast samples, our results are in accordance with previous studies of Mos hens, roosters, and capons (Franco *et al.*, 2016; Pateiro *et al.*, 2018). However, cockerel values were lower than those (0.07-0.19% vs. 0.45-0.7%, respectively) reported in Black-Boned, Thai, Polverara, Bresse, and Rhode Island Red breeds (Jaturasitha *et al.*, 2008; Dalle Zotte *et al.*, 2020). Higher values (average value of 1.3%) were also found in Castellana Negra and commercial hybrids (Miguel *et al.*, 2008; Dalle Zotte *et al.*, 2020). On the other hand, our IMF values were higher than Mos roosters (Franco *et al.*, 2012a, 2013).

The average cholesterol value of 62.44 mg/100g in drumstick cut was slightly higher than those previously reported in Mos roosters (58 mg/100 g), other native breeds such as Thai and Black-boned (53.9 mg/100 g and 58.70 mg/100 g), and hybrid lines like Sasso T-44

(55.00 mg/100 g) or Sasso X-44 (60.00 mg/100 g) (Jaturasitha *et al.*, 2008; 2012; Franco *et al.*, 2016). On the contrary, our values were lower than those shown in other studies with Mos roosters (65.00 mg/100 g), Bresse (67.20 mg/100 g) or Rhode Island genotype (83.3 mg/100 g) (Jaturasitha *et al.*, 2008; Franco *et al.*, 2012a, 2016).

In terms of human health and considering the reference value of 300 mg (USDA, 2015), one hundred-gram of drumstick from cockerel will represent approximately 21% of daily cholesterol intake. Our results indicate that dietary treatment modified the cholesterol contents of cockerels, observing the lowest values of 57.58 mg/100 g in the CF group. Our findings might be due to metabolic processes, as the genes that control endogenous cholesterol synthesis, which even with high levels of fat in the diet can generate low levels of cholesterol in meat or vice versa.

The dietary treatment affected meat colour in agreement with previous studies (Franco *et al.*, 2012a; Díaz *et al.*, 2013b; Pateiro *et al.*, 2018). In general, poultry meat from indigenous breeds has greater a^* values (Díaz *et al.*, 2013b), but redder meat can be explained for several

factors like pH (higher muscle pH is associated with darker meat), muscle location and age (Wattanachant *et al.*, 2004; Chumngoen & Tan, 2015; Kim *et al.*, 2020).

Overall, it can be observed that the inclusion of corn in the diet decreased L* values and increased a*; however, these data must be interpreted with caution because the effect of cereals in meat colour is not clear since meat myoglobin content is the main factor that contributes to meat colour (Chumngoen & Tan, 2015; Kim *et al.*, 2020). For breast cut, it should be noted the important and significance differences in breast a* among feeding groups (1.16, 3.33 and 4.61 for CF, CR and WH groups, respectively). Our findings are in agreement with Franco *et al.* (2012b) and Chumngoen & Tan (2015), who found differences in a* index caused by feeding treatment. Within drumstick, our results are in disagreement with those found by other authors, who did not find significant differences among feeding treatments (Díaz *et al.*, 2013b). Except for L*, a* and b* values were higher than those obtained for the aforementioned authors. On the contrary, Lyon *et al.* (2004) reported that b* index was the value more influenced by diets with corn, observing that corn-based diets displayed significantly higher b* values than those obtained in wheat-based diets.

The water loss that occurs during cooking has a substantial influence on the purchase decisions of consumers since affects important parameters as appearance, color tenderness and juiciness. CL results were higher than those reported previously by other authors (Franco *et al.*, 2012a, 2013; Pateiro *et al.*, 2018), who obtained average values of 9% in Mos roosters and hens. However, in other studies with Mos roosters higher mean values have been observed (Sánchez *et al.*, 2005; Franco *et al.*, 2013), indicating that slaughter age and rearing conditions have a strong influence on CL. Sasso capons, Padovana Camosciata, Berlanda-Gaina, Taiwan Native Chicken and CP707 broiler have also displayed higher values (16-19%) (Wattanachant *et al.*, 2004; Díaz *et al.*, 2013a,b; Chumngoen & Tan, 2015; Cassandro *et al.*, 2015). Even higher CL (22-23%) were registered for Thai, Black-Boned, Bresse, and Rhode Island Red (Wattanachant *et al.*, 2004; Jaturasitha *et al.*, 2008). The literature reported a wide range of temperatures (70-80 °C) and times (until 60 minutes) in the cooking procedure, which could explain these differences among studies. Therefore, CL depends on time and temperature during the cooking process, because protein denaturation led to the loss of CL reducing juiciness and changing the consistency of the meat (Wang *et al.*, 2009; Chumngoen & Tan, 2015).

Some textural parameters were significantly affected by finishing feeding, in agreement with the findings found in other studies with Mos young hens (Pateiro *et al.*, 2018). In this study changes in hardness, gumminess, and chewiness were detected. The same behavior was also found by Lyon *et al.* (2004), who noticed that meat

from broilers fed corn required significantly less shear force than animals fed wheat. The values found by the aforementioned authors were slightly higher than those found in the present study (17.83 vs. 13.79 N/cm² and 21.46 vs. 15.50 N/cm² for corn and wheat feedings, respectively). On the contrary, studies conducted with capons fed cereals (mixtures of corn and wheat, or corn and barley) did not show changes in textural parameters (Díaz *et al.*, 2013b).

Our values for shear force were slightly lower than those reported by Franco *et al.* (2016) in capons and roosters slaughtered at 8 months, while TPA parameters were similar. The mean values obtained for shear force agrees with those values reported by Cassandro *et al.* (2015) in Padovana Camosciata and Berlanda-Gaina breeds but they were lower than those (7.64 vs. 14.12 N/cm² for broilers and Mos cockerels, respectively) found by Wattanachant *et al.* (2004). In addition, higher values than those presented in our study have been reported in Taiwan & Thai breeds (23.52 and 40.08 N, respectively) (Wattanachant *et al.*, 2004; Chumngoen & Tan, 2015). These differences found for texture could be related to fed, slaughter age, genotype and collagen composition. In this sense, several authors have suggested an interaction effect between genotype and slaughter age to explain differences in meat texture. Indeed, Wattanachant *et al.* (2004) and Chumngoen & Tan (2015) reported that older indigenous chickens had more total and cross-linked collagen and consequently less-soluble collagen than younger broilers, suggesting that differences in meat texture could be attributed to these variations in collagen composition.

Effect of diet type on fatty acid (FA) profile

The results obtained confirmed that one of the main factors influencing the FA composition of poultry meat is the diet of the animals (Geldenhuis *et al.*, 2015). In the present study, correlating to previous works with Mos, cockerels showed SFA contents (35.51-36.73) less abundant than roosters (Franco *et al.*, 2013), while SFA contents were very similar in roosters and hens (Franco *et al.*, 2012a; Pateiro *et al.*, 2018). Comparing these values with those found in other breeds, Mos cockerels reached SFA less abundant than Thai, Black-Boned, Bresse and Rhode Island Red, Padovana Camosciata, and Berlanda-Gaina (Wattanachant *et al.*, 2004; Jaturasitha *et al.*, 2008; Cassandro *et al.*, 2015).

Regarding unsaturated FA (UFA), Mos cockerels presented lower levels of MUFAs (30.55-31.18) than Mos hens and roosters (Franco *et al.*, 2012a, 2013; Pateiro *et al.*, 2018). Moreover, the values were similar to those found in Mos roosters (Franco *et al.*, 2016). On the contrary, PUFAs contents (32.08-33.64) were higher than those obtained in Mos roosters and hens (Franco *et al.*,

2012a, 2013, 2016; Pateiro *et al.*, 2018). In addition, the aforementioned local breeds presented similar values for UFA than Mos cockerels (Wattanachant *et al.*, 2004; Jaturasitha *et al.*, 2008; Cassandro *et al.*, 2015). With respect to nutritional ratios, the values obtained for n6/n3 (9.52-10.21) were lower than those obtained in Mos roosters (Franco *et al.*, 2012a, 2013, 2016), but similar to Mos hens (Pateiro *et al.*, 2018).

These healthful patterns in meat composition of indigenous chickens could be observed even if broilers and native breeds were fed with the same diet because their feeding behavior more selectively than industrial lines (Wattanachant *et al.*, 2004). Although PUFA incorporation into muscle and their meat content depends on a mechanism attributed to elongation/denaturation, this it is more efficient in native breeds (Pateiro *et al.*, 2018). Further, considering groups of FA, the amount of PUFA in the chicken tissues is more influenced by the diet, whereas SFA and MUFA depend on the tissue evaluated (Díaz *et al.*, 2013b). In this way, in the present study, the higher levels of PUFA in Mos compared to hybrid breeds may be related to a combined effect of breed and fed system.

Fat intake through the diet is related to diseases associated with modern life. Therefore, it is necessary to consider the dietary recommendations of health departments to reduce total energy intake, especially SFA. According to European Food Safety Authority, there are not enough data to define a precise fat intake to SFA, MUFA, PUFA, or n-6/n3 ratio (EFSA, 2017). Total fat intakes >35E% (expressed as percentage of total dietary energy) may be compatible with both good health and normal body weight depending on dietary patterns and the level of physical activity. However, SFA intake should be as low as is possible and should be replaced by some PUFA (especially n-3 at the expense of n-6), which decreases cardiovascular diseases by reducing plasma triacylglycerol concentrations, platelet aggregation and blood pressure. However, the high proportion of PUFA *per se* is not necessarily healthy if the n6/n3 ratio is not balanced, which should not exceed 4 (Simopoulos, 2004; FAO, 2010b).

Overall, our findings for IMF composition were satisfactory, since cockerels presented lower SFA than other Mos category (Franco *et al.*, 2012a, 2013), indigenous breeds (Wattanachant *et al.*, 2004; Jaturasitha *et al.*, 2008; Cassandro *et al.*, 2015), and broilers (Wattanachant *et al.*, 2004). In addition, PUFA content was higher than Mos roosters and hens (Franco *et al.*, 2012a, 2013, 2016; Pateiro *et al.*, 2018), and hybrids lines (Wattanachant *et al.*, 2004; Franco *et al.*, 2013, 2016; Pateiro *et al.*, 2018), and similar to other indigenous breeds (Wattanachant *et al.*, 2004; Jaturasitha *et al.*, 2008; Cassandro *et al.*, 2015). Our results for FA (high PUFA and low SFA) could be considered attractive to poultry meat consumers since FA profile obtained have positive health benefits for humans (Ashayerizadeh *et al.*, 2018).

Regarding the individual FAs and drumstick cut, oleic acid followed by palmitic and linoleic acids were the main FA. This is in agreement with previous studies with roosters, capons and hens in Mos breed (Díaz *et al.*, 2012, 2013b; Franco *et al.*, 2012a; Pateiro *et al.*, 2018). A change in the pattern was reported by Franco *et al.* (2016) when roosters were castrated (capons), since linoleic acid becomes the second most important FA (oleic>linoleic>palmitic acids). In breast, oleic acid was the predominant FA except for CR group, where oleic was replaced by palmitic acid. These findings are consistent with those found by Nkukwana *et al.* (2014), Cassandro *et al.* (2015) and Kim *et al.* (2020), who reported that the three most abundant FAs in chicken breast were oleic, palmitic and linoleic acids. On the contrary, these results have not been previously described in other studies with autochthonous breeds such as Thai breed, where palmitic acid was the major FA, followed by oleic, stearic and linoleic acids in both cuts (Wattanachant *et al.*, 2004). In other studies with Black-Boned and Castellana Negra genotypes, linolenic was the main FA, followed by palmitic and oleic acids (Miguel *et al.*, 2008; Jaturasitha *et al.*, 2008).

Finally, the nutritional indices calculated according to the values of FA allow evaluating the ratio between healthy and unhealthy FA, giving information about the health of the fat composition (Gálvez *et al.*, 2020). Birds fed predominantly with corn and wheat (WH and CR groups) showed significantly higher PUFA/SFA ($p<0.01$) ratio in drumstick and breast. These results may be explained considering chemical composition of finishing diets, because CF diet has higher percentages of palmitic acid (29.30), similar oleic acid (29.70), and lower PUFA/SFA ratio than the other two finishing-diet treatments. The values obtained in drumstick are close to nutritional recommendations for human diet (0.85; FAO, 2010b). The n6/n3 ratio of breast was affected by finishing diet, being the group fed with higher wheat percentage which displayed better results (n-6/n-3<4; FAO, 2010b). Like other authors, the values of AI and TI indices were higher in animals fed with fodder (Pateiro *et al.*, 2018). Moreover, the use of corn and wheat in the finishing diet significantly ($p<0.001$) increased h/H ratio in breast and drumstick samples. The values found in drumstick for WH group were considered favourable (h/H ≥ 2.5 ; Fernández *et al.*, 2007).

Effect of diet type on amino acid profile

As can be observed, the finishing feeding affected the content of most AA. Similar findings were found in Mos roosters slaughtered at 6 and 10 months (Franco *et al.*, 2012a). However, despite reaching statistical differences, the numerical differences among AA contents from the three dietary treatments were small, suggesting that the AA profile of muscle tissue being relatively conserved

(De Smet & Vossen 2016). However, the AA profile of autochthonous breeds was not similar to that of the commercial strains, since in local breeds finishing feeding had effect on the majority of AA (Franco *et al.*, 2012b).

In both cuts, the AA profile was dominated by lysine and leucine in the essential fraction, while glutamic, aspartic and arginine were the predominant AA in the non-essential. This finding agrees with data reported by Dalle Zotte *et al.* (2020), who found a similar pattern in samples of breast obtained from local breed Polverara and commercial hybrids. On the other hand, Wattanachant *et al.* (2004) reported higher levels for some essential aminoacids, especially for valine, lysine, isoleucine, and leucine in breast samples from Thai breed and broilers (CP707 and Sasso T-44), meanwhile the rest of the AA profile was similar with exception of methionine. The values of essential/non-essential ratio also showed significant ($p < 0.01$) differences among diets, ranging between 0.71 and 0.78. These values were similar to those observed in Mos roosters (Franco *et al.*, 2012a) and lower than those obtained in other types of poultry meat (Gálvez *et al.*, 2018, 2020).

The total protein requirement for a human adult is 0.66 g/kg per day, with intakes per day of around 0.18 and 0.48 g/kg of essential and non-essential AA, respectively (WHO, 2007); establishing the specific requirements (expressed in mg/100g) for adults of the essential AA histidine (1.0), isoleucine (2.0), leucine (3.9), lysine (3.0), methionine (1.0), phenylalanine + tyrosine (2.5), threonine (1.5), and valine (2.6), since these AA cannot be synthesized in the body and must be supplied by the diet. Our findings showed that meat from Mos cockerels has potential nutritive value as a source of essential AA, not only for these protein percentage but also for its quality highlighted by the AA contents.

To sum up, this study allows to characterize for first time Mos cockerels fed with different finishing diets (commercial fodder, corn and wheat). Carcass weight, dressing percentage, and commercial cuts percentage (drumstick, breast, thigh, and wing) obtained were higher than previous studies with other Mos categories (roosters, capons and hens), and some autochthonous and industrial breeds, especially considering fed treatment used (CF). Meat from these birds was characterized by a high protein percentage and lower IMF with a favourable cholesterol level for human health. Birds finished with CF showed the highest content in SFA, MUFA, palmitic acid, and linoleic acid among the three groups studied. Moreover, meat from Mos cockerels reared in extensive indoor (barn-reared) conditions and using alternative fed systems, presented meat with biological value to cover the daily requirements in terms of PUFA content as well as the main essential AA. The findings of this study can boost the commercialization of other types of meats from local breeds, besides to contribute to biodiversity conservation.

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