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THE EFFECTS OF HYDROLYSED SORGHUM ON GROWTH PERFORMANCE AND MEAT QUALITY OF RABBITS

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Abstract: The effect of sorghum hydrolysed by *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2 was evaluated on growth performance traits and rabbit meat quality. A total of 24 unsexed New Zealand rabbits, weaned at 20 d of age, were allocated to 2 treatments: T1 (diet including 300 g/kg of non-hydrolysed sorghum) and T2 (diet including 300 g/kg of hydrolysed sorghum by *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2). Rabbits of group T2 did not have significantly different ($P>0.05$) feed intake compared to those in T1. Carcass traits were also not significantly different ($P>0.05$) between the 2 groups. The pH, water-holding capacity, colour and cooking loss of the *longissimus lumborum* were not different ($P>0.05$) between treatments, whereas the pH of the rabbits *biceps femoris* was higher in T2 (6.21; $P<0.05$) than in T1 (6.14). Meat hardness and gumminess in T2 were lower ($P<0.05$) in comparison to meat from T1. Thus, sorghum hydrolysed by *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2 contributed to a better rabbit meat texture.

Key Words: feed intake, muscle, *Pycnoporus sanguineus* CS2, texture, *Trametes maxima* CU1, rabbits.

INTRODUCTION

White-rot basidiomycetes fungi (WRF) are recognised by their extracellular enzymatic systems that degrade components of plant cell walls (Sánchez, 2009). Oxidase enzymes that degrade lignin include lignin peroxidase (LiP), manganese peroxidase (MnP) and laccase. Enzyme production levels depend on the strain, genetics and metabolic plasticity, as well as the culture medium composition and inductors present (Elisashvilli and Kachlissvilli, 2009; Arora and Sharma, 2010). Furthermore, these enzymes have been used in bioremediation and biopulping processes in the food and pharmaceutical industries, and in the production of biofuels. The hydrolytic activity can be performed by endo/exo-cellulases, xylanases, cellobiose and glucose oxidase (Sánchez, 2009), and their presence and production of these enzymes are similarly affected by strain and culture medium composition (Baldrian and Valášková, 2008; Elisashvili *et al.,* 2008). These enzymes have gained increased interest for the degradation of agroindustrial wastes for bioethanol production (Maciel and Ribeiro, 2010).

Alternatively, some of the by-products from the agriculture sector are used for animal nutrition and are rich in lignocellulose. These by-products contain insoluble fibres (lignin and hemicellulose), phytates and phenolic compounds with non-nutritional effects that restrict the bioavailability of other components such as non-proteic amino acids, polyphenols and glycosides (Aganga and Tshwenyane, 2003). Lignocellulose-rich substrates are important resources

in animal nutrition, as they can be fermented by WRF and increase nutrient availability (Sánchez, 2009). However, the use of these lignocellulose-rich substrates, which can be made available by WRF metabolism, is limited in ruminant nutrition (Sarnklong *et al.,* 2010; Millati *et al.,* 2011). As a result, limited research has been conducted concerning the use of lignocellulose-rich substrates in monogastric animal diets (Shrivastava *et al.,* 2011; Sharma *et al.,* 2013; Shrivastava *et al.,* 2014). Although some studies have evaluated lignocellulose-rich substrate use in order to increase the nutritional value of different agroindustrial wastes, few have examined the effects of WRF-hydrolysed ingredients on production traits and rabbit meat quality (Brozzoli *et al.,* 2010; Shrivastava *et al.,* 2011; Isikhuemhen *et al.,* 2012; Tanemura *et al.,* 2016).

Trametes maxima CU1 and *Pycnoporus sanguineus* CS2 are 2 basidiomycetes from North-eastern Mexico with great lignocellulose potential (Hernández-Luna *et al.,* 2008; Gutiérrez-Soto *et al.,* 2015a), and are recognised for their production of laccases with high redox potential, as well as for the production of thermostable cellulases, xylanases and pectinases (Gutiérrez-Soto *et al.,*2015b). The aim of the current study was to evaluate the potential use of sorghum hydrolysed by *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2 strains as a feed supplement to enhance rabbit performance and meat quality.

MATERIALS AND METHODS

The study was performed at the Facultad de Agronomía of the Universidad Autónoma de Nuevo León (UANL), in Marín, Nuevo León, Mexico, located at latitude 23° 53', longitude −100° 2' O and altitude 400 m (INEGI, 2017). Rabbit management and care protocols were performed according to the national policies laid down by the Mexican Animal Welfare Standard NOM-062-ZOO(1999).

Rabbits

A completely randomised design was used where 24 unsexed New Zealand rabbits (*Oryctolagus cuniculus*) (532±65 g), weaned at 20 d of age, were distributed between 2 treatments: T1 (Control diet+non-hydrolysed sorghum) and T2 (Control diet+sorghum hydrolysed by *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2). The rabbits were bred individually in metallic-net cages (45×60×50 cm), fitted with a drinker and a feeder. The diets were formulated according to NRC (1994), however, the sorghum was hydrolysed (T2) before its use as an ingredient. Sorghum in the control diet (T1) was replaced by hydrolysed sorghum in T2 diet (Table 1).

Fungal Strains

Trametes maxima CU1 and *Pycnoporus sanguineus* CS2 were obtained from carpophores collected in oak forests and scrubland around Monterrey, N. L., Mexico. All strains belong to the Vegetative Mycelium Strain Collection of the Enzymology Laboratory of the Facultad de Ciencias Biológicas, UANL. The strains used for hydrolysation of the sorghum were cultivated for 7 d at 30°C in individual flasks containing potato dextrose broth (Becton, Dickinson and Company, Franklin Lakes, New Jersey, USA). Prior to culturing, each sorghum strain was washed with tap water and placed in a polyethylene container for sterilisation at 121°C for 1 h. Ten millilitres of each culture medium were used to inoculate 500 g of washed and sterilised sorghum contained in polyethylene bags. The inoculated sorghum was well mixed and incubated for 30 d at 30°C. Finally, the hydrolysed sorghum was milled and included in the preparation for the T2 experimental diet.

Table 1: Composition of the basal and hydrolysed diets.

Ingredients (g kg⁻¹)	Treatments	
	T1	T2
Alfalfa	496.7	496.7
Sorghum	300.0	0.0
Hydrolysed sorghum	0.0	300.0
Soya meal	146.0	146.0
Soya oil	12.5	12.5
Methionine	1.3	1.3
Molasses	30.0	30.0
Phosphate	6.5	6.5
Salt	4.5	4.5
Vitamin and mineral premix	2.5	2.5

T1=Control diet; T2=Control diet where sorghum has been replaced by hydrolysed sorghum with *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2.

Performance Traits

The initial weight (IW) of each rabbit (n=12 rabbits/treatment) was measured at the beginning of the experiment. The examined traits were: rabbit weight (RW; kg), feed intake (FI; kg) and water intake (WI; kg) at 7, 14, 21, 35 and 49 d of fattening. Mean daily weight gain per week (DWG=(RW$_{current}$–RW$_{previous}$)/days) and the daily feed intake per week (DFI=FI/days) were used to estimate the feed conversion ratio (FCR=DFI/DWG).

Rabbit Slaughter and Carcass Traits

Rabbit slaughter was performed according to the method used by Dal Bosco *et al.* (2014) and the Mexican Animal Slaughter Standard NOM-033-SAG/ZOO (2014). Carcasses were kept at 4±1.0°C for 12 h. Final body weight (FBW/SW), hot carcass weight and cold carcass weight were used to estimated hot (HCY=(HCW/SW)×100) and cold (CCY=(CCW/SW)×100) carcass yield.

Meat Quality

The principal characteristics evaluated for meat quality were pH, colour and water-holding capacity (WHC), and cooking losses (CL) of the *longissimus lumborum* (LL) and *biceps femoris* (BF) muscles were measured at 24 h post-mortem. The LL and BF were collected from eight randomly selected rabbit carcasses per treatment and bones and fatty and connective tissues were removed. Meat quality characteristics were measured in triplicate.

The muscle meat pH value was determined with a puncture electrode (Orion 3 Star Thermo Fisher Scientific, Pittsburgh, PA, U.S.A.). Meat colour values of lightness (L*), redness (a*), yellowness (b*), Chroma (Saturation index) and Hue angle were measured with a colorimeter (CR-400 Konica Minolta®, Tokyo, Japan; CIE Standard Illuminant/Observer: D65/10), set on the CIE Lab System (CIE, 1976). These measurements were taken at approximately 30 min after cutting of the carcasses into pieces of sample portions. WHC was measured by application of the compression method according to Tsai and Ockerman (1981) and Simitzis *et al.* (2014) by weighing a meat sample of 300±0.5 mg, placing it between 2 pieces of filter paper, between 2 acrylic-plastic plates, applying a force of 4.0 kg for 20 min, and obtaining the final weight: WHC=100–([initial weight–final weight]/initial weight)×100). CL was determined according to the method used by Alagón *et al.* (2015). The LL and BF were vacuum-packed (Koch 800, Koch Equipment LLC, Kansas City, MO, USA) individually in shrink vacuum bags (Zubex Industrial SA de CV, Monterrey, Nuevo León, Mexico) and cooked at 75.0±0.1°C for 1 h by immersion in hot water. After the samples were cooled by immersion in water bath at 4°C for 20 min, the pieces were removed from the bags, carefully drained and weighed. The raw and cooked weights of each muscle were recorded to evaluate the percentage CL (% CL=([raw weight piece–cooked weight piece]/raw weight piece)×100). The chemical composition of LL and BF was determined according to the Association of Official Analytical Chemists (AOAC 1998) for humidity (method 950.46), protein (method 981.10), fat (method 985.15) and ash (method 920.153).

Meat Mechanical Properties

Shear force (SF) and texture profile analyses (TPA) of LL were carried out with a TA.XT2i texturometer (Stable Micro Systems, Surrey, England). SF was measured using a Warner-Bratzler shear blade with a triangular slot cutting edge (Alagón *et al.,* 2015). Eight rectangular slices per treatment (2.0 cm long×1.0 cm wide×1.0 cm high for each rabbit) were used to evaluate SF; sample cuts were made parallel to the direction of the muscle fibres. The test conditions used in the instrument were velocity of 2 mms^{-1} pre-test, 2 mms^{-1} during the test, 10 mms^{-1} post-test, and distance of 30 mm. SF was calculated from the maximum point of the curve obtained from the test. TPA was determined in 12 standardised cylinders (1.5 cm high and 1.5 cm in diameter), oriented perpendicular to the direction of the muscle fibres (Gil *et al.,* 2006). A cylindrical piston was used to compress the sample during 2 test cycles, compressing the sample up to 60% from the original height within a time span of 5 s between cycles. Force-time curves of deformation were obtained from the conditions established in the texturometer. The velocities used were pre-test 1.0 mms^{-1}, during the test 5.0 mms^{-1}, and post-test 5.0 mms^{-1}. The following traits were recorded according to Bourne (1978): hardness (g), fracturability (g), adhesiveness (g s^{-1}), springiness (mm), cohesiveness (dimensionless), gumminess (g), chewiness (g mm), and resilience (dimensionless).

Statistical Analysis

Performance variables were analysed by PROC MIXED of SAS (2006), using the statistical model (Wang and Goonewardene, 2004): $y_{ijk}=\mu+T_i+\delta_j+(T\delta)_{ij}+\Phi_{k(ij)}+\lambda IW+\varepsilon_{ijk}$; where y_{ijk}=RW, FI, WI, DWG and FCR measured over time; μ=general media; T_i=fixed effects of *i*-th treatment (T1 and T2); δ_j=effect of *j*-th fattening day (7, 14, 21, 35 and 49 d); $(T\delta)_{ij}$=effect of the interaction between the *i*-th treatment and the *j*-th day; $\Phi_{k(ij)}$=nested effect, where every *i*-th treatment was nested in the cage in the *j*-th day; λ=co-variable initial weight (IW); ε_{ijk}=random error independently normally distributed with mean of zero and variance σ^2. When the effect of interaction between treatments and days was significant ($P\leq0.05$), means were compared using Adjust=Tukey (SAS, 2006). Meat quality variables were analysed by least squares, using the GLM method (SAS, 2006) and the following statistical model: $y_{ij}=\mu+T_i+\varepsilon_{ij}$, where y_{ij}=response variables; μ=general average; T_i=effect of *i*-th treatment (T1 and T2); ε_{ij}=error independently normally distributed with mean of zero and variance σ^2. When the treatments had a significant effect ($P\leq0.05$), further comparisons were made with the Tukey test.

RESULTS

Rabbit performance traits are presented in Table 2. The treatment interaction effects over time $[(T\delta)_{ij}]$ were significant ($P<0.05$) for RW and FI. Throughout the performance period from 1-49 d, RW was different ($P=0.049$) between

Table 2: Treatment effects over time for rabbit growth performance.

Treatments (T_i)/Days (δ_j)	Traits[§]				
	RW (g)	FI (g)	WI (ml)	DWG (g)	FCR
T1					
7	635[a;A]	423[a;A]	664[A]	14[A]	4[B]
14	847[b;B]	501[a;B]	821[A]	22[B]	3[A]
21	1068[c;C]	696[bc;C]	892[A]	25[B]	4[B]
35	1395[d;D]	788[c;D]	1424[B]	24[B]	4[B]
49	1713[d;E]	667[b;C]	1995[C]	24[B]	4[B]
1-49*	1716[1]	667	1991	24	4
T2					
7	635[a;A]	455[a;A]	518[A]	14[A]	4[B]
14	838[b;C]	491[a;A]	688[AB]	21[B]	3[A]
21	1042[bc;C]	688[bc;C]	863[B]	24[B]	4[B]
35	1317[cd;D]	752[c;C]	1338[C]	22[B]	4[B]
49	1555[d;E]	607[b;B]	1880[D]	20[B]	4[B]
1-49	1583[2]	622	1919	21	4
SEM	37	18	76	1	1
SEM (1-49)	61	22	121	1	0
P-value					
T_i	0.212	0.386	0.191	0.399	0.482
δ_j	<0.001	<0.001	<0.001	<0.001	0.018
$(T\delta)_{ij}$	0.015	0.029	0.883	0.362	0.286
T_i(1-49)	0.049	0.197	0.157	0.272	0.642

T1=Control diet; T2=Control diet where sorghum has been replaced by hydrolysed sorghum with *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2; T_i=fixed effects of *i*-th treatment (T1 and T2); δ_j=effect of *j*-th fattening day (7, 14, 21, 35 and 49 d); $(T\delta)_{ij}$=effect of the interaction between the *i*-th treatment and the *j*-th day; SEM=standard error of the mean. RW=rabbit weight (g); FI=feed intake (g); WI=water intake (ml); DWG=daily weight gain (g); FCR=feed conversion ratio. *Only statistical analysis of 49 d, without consider the fattening days.
[a-d]Means (n=12/treatment) within the same column with different superscripts differ significantly between treatments when *P*-value of $(T\delta)_{ij}$<0.05.
[A-E]Means (n=12/treatment) within the same column and treatment with different superscripts differ significantly ($P<0.05$) (through time).
[1-2]Means within the same column with different superscript differ significantly ($P<0.05$) (49 d*).

Table 3: Carcass traits and meat composition of rabbits supplemented with hydrolysed sorghum.

Traits	Treatments		SEM	*P*-value
	T1	T2		
Rabbit slaughter				
FBW (g)	1827	1679	65	0.133
HCY (%)	54.49	54.35	0.83	0.909
CCY (%)	54.50	53.97	0.66	0.587
Meat composition (%)				
LL				
Moisture	74.54	75.55	0.43	0.170
Protein	21.11	20.38	0.26	0.072
Fat	0.62	0.55	0.06	0.420
Ashes	1.02	0.93	0.05	0.252
BF				
Moisture	79.02	78.94	1.06	0.963
Protein	16.50	16.74	0.52	0.753
Fat	1.24	2.2	0.55	0.284
Ashes	1.01	0.91	0.02	0.062

T1=Control diet; T2=Control diet where sorghum has been replaced by hydrolysed sorghum with *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2; SEM=standard error of the mean. FBW=final body weight; HCY=hot carcass yield; CCY=cold carcass yield; LL=*longissimus lumborum*; BF=*biceps femoris*.

treatments with RW for T1 being higher than for T2. However, WI values over time for T2 rabbits tended to be lower than in T1 rabbits. Although T1 rabbits gained more weight at 49 d, their FI and WI values over time were greater than those for T2 rabbits, highlighting that there was no difference ($P>0.05$) in FRC over time.

Table 3 shows results from rabbit carcass traits and meat chemical composition. There were no treatment effects ($P>0.05$) on carcass yield at slaughter, where the mean values for FBW, HCY and CCY were 1753.32±64.44 g, 54.42±0.86% and 54.24±0.66%, respectively. Differences were not observed ($P>0.05$) between meat chemical composition. Combined means for both treatments in moisture, protein, fat and ashes: LL, 75.05±0.43, 20.75±0.26, 0.59±0.06 and 0.98±0.05%; BF, 78.98±1.06, 16.62±0.52, 1.72±0.55 and 0.96±0.02%, respectively.

Meat quality traits for rabbit LL and BF are shown in Table 4. The LL pH values were not different ($P>0.05$) between treatments. However, the BF pH value was higher ($P<0.05$) in T2 than in the T1 group. There were no treatment effects ($P>0.05$) in the LL and BF for WHC, L*, a*, b*, Chroma, Hue angle and CL.

Shear force and texture profile analyses of the LL muscle at 49 d are presented in Table 5. Only hardness and gumminess were different ($P<0.05$) between treatments, with greater values in T1 compared to the T2 group. However, the other TPA variables were not different ($P>0.05$) between treatments, even though SF and chewiness values tended to be lower in T2 rabbits compared to corresponding values for T1 rabbits. These results suggest that hydrolysed sorghum contributes to softer (more tender) rabbit meat.

DISCUSSION

The objectives of this study included the evaluation of growth performance traits and meat quality in rabbits fed sorghum hydrolysed by the fungi *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2. Few studies have evaluated performance traits in rabbits fed enzyme-degraded diet ingredients such as sorghum. Feed ingredients enzyme-degraded with a commercial complex containing α-amylase (source *Aspergillus oryzae*), β-glucanase (source *A. niger*) and β-xylanase (source *A. niger*) promoted daily weight gain and reduced feed intake in New Zealand rabbits (Cachaldora *et al.,* 2004). In contrast, similar results were not obtained in the current study with New Zealand rabbits fed *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2 hydrolysed sorghum. Currently, there are no reports describing the effects of enzymes produced by white-rot basidiomycetes or of substrates fermented by these fungi

Table 4: Meat quality of the rabbit *longissimus lumborum* and *biceps femoris* at 49 d (n=8 rabbit carcasses/treatment).

| Piece / Traits | Treatments | | SEM | *P*-value |
	T1	T2		
LL				
pH	6.03	6.06	0.03	0.263
WHC (%)	68.36	70.97	1.90	0.342
L*	54.39	56.12	1.12	0.299
a*	19.16	18.26	0.68	0.371
b*	10.45	10.63	0.67	0.849
Chroma	21.89	21.16	0.75	0.505
Hue	28.56	30.19	1.61	0.489
%CL	31.09	30.33	1.40	0.705
BF				
pH	6.14	6.21	0.02	0.015
WHC (%)	68.96	65.4	2.06	0.233
L*	59.65	58.56	0.62	0.243
a*	14.68	13.75	0.86	0.464
b*	5.19	4.83	0.59	0.676
Chroma	15.58	14.6	0.99	0.494
Hue	19.11	19.09	1.32	0.992
%CL	20.27	19.14	0.92	0.392

T1=Control diet; T2=Control diet where sorghum has been replaced by hydrolysed sorghum with *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2; SEM=standard error of the mean. LL=*longissimus lumborum*; BF =*biceps femoris*; WHC=water-holding capacity; L*=lightness; a*=redness; b*=yellowness; Hue=Hue angle; Chroma=saturation index; %CL=percentage cooking loss.

on rabbit performance traits and meat quality. However, results similar to those presented in the current study were obtained by Abdel-Aziz *et al.* (2015) for slaughter weight and hot and cold carcass yield in rabbits fed sugarcane bagasse treated with ZAD®, a commercial product containing anaerobic bacteria exogenous enzymes. In the present study there were no significant effects of hydrolysed sorghum on rabbit body weight, feed intake, water intake, daily weight gain, feed conversion ratio and carcass yield. Similar effects were obtained in other studies using enzymatic supplements in New Zealand rabbit diets (Cachaldora *et al.,* 2004; Abdel-Aziz *et al.,* 2015). However, over the entire experimental period (1-49 d) in the current study, weight was lower in rabbits fed hydrolysed sorghum (T2), which could indicate a possible restriction in growth and weight gain due to the general unavailability of diet ingredients. In

Table 5: Shear force and texture profile analyses of the *longissimus lumborum* at 49 d (n=8 rabbit carcasses/treatment).

| Traits | Treatments | | SEM | *P*-value |
	T1	T2		
Shear force (g)	1382	1140	87	0.071
Hardness (g)	3901	2992	247	0.018
Fracturability	ND	ND	-	-
Adhesiveness (g s^{-1})	−6.64	−9.37	1.71	0.274
Springiness (mm)	0.45	0.47	0.01	0.375
Cohesiveness	0.47	0.49	0.014	0.289
Gumminess (g)	1817	1462	99	0.021
Chewiness (g mm)	818	687	55	0.110
Resilience	0.17	0.19	0.0079	0.198

T1=Control diet; T2=Control diet where sorghum has been replaced by hydrolysed sorghum with *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2; SEM=standard error of the mean. ND=variable no detected.

another study, rabbits were fed diets supplemented with 3% Lisosan G® (ground wheat (*Triticum aestivum*) bran and germ fermented with lactobacilli and a yeast strain and then dried) (Casamassima *et al.,* 2016). Feed intake in that study was increased at 42 d (151 g/d), in comparison to the T2 group at 49 d (95.31 g/d) of the current study, and was not affected by the treatment. Previous results suggested that the addition of sorghum hydrolysed with WRF in the diet could improve performance traits compared to commercial enzymes, native plants or probiotics (Cachaldora *et al.,* 2004; Abdel-Aziz *et al.,* 2015; Kone *et al.,* 2016).

Among the meat quality traits measures, LL pH was not different between treatments. However, in rabbits supplemented with chia (Meineri *et al.,* 2010), the observed LL pH (5.65) was lower compared to that observed in T2 group (6.06) of the present study. The pH values obtained by Kone *et al.* (2016) for LL and BF meat from rabbits supplemented with plant extracts and essential oils were similar to those observed for the T2 group in the present study, but L* and a* values were lower. Finally, meat composition results in the current study were similar to those obtained by Rotolo *et al.* (2013), Dalle Zotte *et al.* (2015), Cardinali *et al.* (2015), and Méndez-Zamora *et al.* (2016) evaluating natural additives. These findings suggest that hydrolysed sorghum treatment does not affect carcass traits and meat composition. On the other hand, the CL of LL for the T2 treatment was higher than that for Pannon Large and Hungarian Giant rabbit genotypes fed commercial diets (Dalle Zotte *et al.,* 2015), but was similar to those obtained with Grimaud rabbits (Kone *et al.,* 2016). The WHC values obtained by Ariño *et al.* (2006) were similar to those observed in the T2 group. These results suggest that a hydrolysed sorghum diet could improve water-holding capacity and reduce loss from cooking. Finally, the meat texture analysis of the T2 treatment showed lower values than those reported by Ariño *et al.* (2006), Gil *et al.* (2006), and Pascual and Pla (2008) for rabbits fed commercial diets, with different size, weight and growth rate values. The hardness and gumminess traits obtained with sorghum hydrolysed with *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2 showed improved meat texture (softness). Results may suggest that the synthesis and assimilation of nutrients in muscles are more efficient when diet ingredients are hydrolysed before being consumed by the rabbits. Results show that FI and WI in T2 rabbits were reduced when feed ingredients were hydrolysed, without affecting DWG and FCR. These results could present an economic advantage for rearing rabbits as a meat source. Potential economic benefits presented by supplementing rabbits with fungi-hydrolysed sorghum will need further study.

CONCLUSIONS

Rabbits supplemented with hydrolysed sorghum using a co-culture of *Trametes maxima* CU1 and *Pycnoporus sanguineus* CS2 showed lower intake of feed and water without affecting carcass traits or chemical composition. Results suggest a potential advantage in production cost reduction, as well as contributing to the enhancement of meat softness.

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