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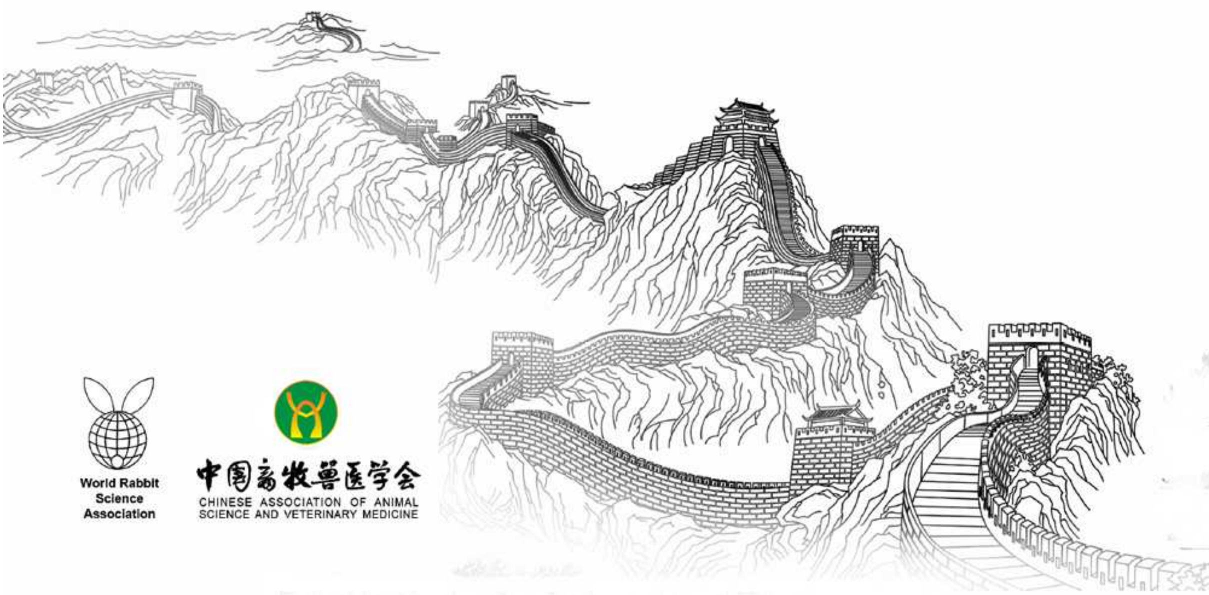

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EFFECT OF CHICKPEA SCREENINGS BY-PRODUCTS AS UNTRADITIONAL ENERGY SOURCE ON PERFORMANCE OF GROWING RABBITS

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ABSTRACT

This work aimed to study the effects of partial and complete substitution of barley by chickpea screenings by-products (CSB) at levels 25, 50, 75 and 100% in rabbit diets on growth performance and nutrients digestibility of New Zealand White rabbits. Seventy five rabbits, five weeks old with similar an average body weight 786.73g ±14.00 were randomly divided into five groups. Each group included three replicates (three rabbits each). Results of growth trail revealed that rabbit fed 25% and 50% CSB achieved significantly (P<0.05) better average daily gain (ADG) by 10.56%; 12.52% compared with the control group. Besides, feed conversion ratio (FCR) values were significantly (P<0.05) better with rabbits group fed 25 and 50% CSB than the control group (3.76 and 3.74 vs. 4.04 g feed/g gain). Nutrients digestibility increased (P<0.05) with the rabbit groups fed 25 or 50% CSB diets in comparison to the control group. The recorded values were 69.20 and 69.44% vs. 63.88% for DM; 71.51 and 71.56% vs.66.12% for OM.; 70.55 and 72.30% vs. 63.77% for CP.; 52.40 and 51.80% vs. 42.75% for CF.; 75.61 and 75.31% vs.71.60% for NFE, respectively. Accordingly, rabbit group fed 25 or 50% CSB recorded higher (P<0.05) values of DCP, TDN and DE in comparison with other experimental groups. It could be concluded that substitution of chickpea screenings by-products in rabbit diets at 25, 50, 75 and 100% has no negative effect on growth performance and the digestibility

Key words: chickpea screenings by-products, growth performance, rabbit, digestibility.

INTRODUCTION

Rabbit is an herbivorous but also a monogastric animal. Thus it is able to valorize raw forages and concentrates. (Lebas, 2013). Using of unconventional by-product play an important role in decreasing the diet cost and also improving productive traits as chickpea screenings by-products. Chickpea *(Cicer arietinum* L.) is a legume seed. The wastes of chickpeas were ranged from 15-20% of the total production, there are 2200 Ha cultivated with chick peas in Egypt (FAOSTAT, 2013). Chickpea seeds contain 29% protein, 59% carbohydrate, 3% fiber, 5% oil and 4% ash. Chickpea is also a good source of absorbable Ca, P, Mg, Fe and K (Christodoulou, 2005). It is known that the proteins of legumes are richer in essential amino acids especially lysine and arginine and more digestible than those of cereals but most deficient in sulphur-containing amino acids methionine and cystine (Lebas, 2013). chickpeas have a digestible energy that exceeds rabbit energy requirements, making them a suitable source of energy for rabbit feeding (Lebas, 1988 and Nizza et al., 1993). However, the value of these seeds is limited by the presence of various anti-nutritive factors such as trypsin inhibitors, saponins, lectins or tannins. These metabolites, in some concentrations reduced nutrient digestibility (Jezierny, 2010). The main objective of this work was to study the possibility of replacing chickpea by-products for barley in rabbit diets at 0, 25, 50, 75 and 100% levels and their effects on growth performance and digestibility of New Zealand White rabbit.

MATERIALS AND METHODS

Chickpea (*Cicer arietinum* L.) by-products (broken seeds and hulls) were obtained from chickpea sorting factories. The moisture content was 10%, ground by hammer mill and kept for mixing. Five experimental diets were formulated; the first used as control diet (Zero CSB) while other four diets, formulated to replace chickpea screenings by-products for barley at levels of 25, 50, 75, 100%. Seventy five rabbits, six weeks old with an average live body weight 786.73 g±32.02 were randomly divided into five groups. Each group consisted of three replicates (five rabbits each) representing the five experimental diets. Feed and water were offered *ad libtium*. Animals were individually weighed every week. Feed consumption was recorded while feed conversion was calculated as a ratio of gram of feed per gram of gain. All the experimental diets were formulated to be iso-nitrogenous, iso-caloric, and to meet all the essential nutrient requirements of growing rabbits according to Lebas 2013 as shown in Table 1. A digestibility trial was conducted to determine the digestibility and the nutritive values of the experimental diets according to (Perez *et al.* 1995). Fifteen male New Zealand White rabbits were used and allotted randomly to five groups of three rabbits. Rabbits were housed in individual metabolism cages and fed the experimental diets for a period of 7 days for adaptation, and then faeces were collected every 24 hours for 5 consecutive days. Total digestible nutrients (TDN) were calculated according to Cheeke *et al*., (1982). Digestible energy (DE, Kcal/Kg diet) was calculated as described by to (Schneider and Flatt, 1975). Chemical analysis was performed as recommended by A.O.A.C (2007) for determining moisture, crude protein (CP), crude fiber (CF), ether extract (EE), ash and minerals for the raw materials, diets and feces. Calcium, phosphorous and phytic acid were determined by atomic absorption DU 7400 spectrophotometer. Neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) were determined sequentially according to Van Soest *et al*. (1991). Gross energy determined by Isoperibol bomb calorimeter. Tannins were determined using vanillin hydrochloric acid method as described by Burn (1971) and saponin was determined by using the method of Shany *et al.,* (1970). The results of experimentation were statistically analyzed using GLM (general linear models) procedure of SAS (2000) by one-way ANOVA. Using Duncan's multiple range of test (Duncan, 1955).

Table 1: Feed ingredients and chemical composition of experimental diets (% DM basis).

Feed Ingredients (%)	Substitution level of barley by chickpea screenings by-products				
	Control (0%CSB)	25%CSB	50%CSB	75%CSB	100%CSB
Soybean meal (44%CP)	16	16	15	14	14
chickpea by-products	--	5	10	15	20
Barley	20	15	10	5	--
Clover hay	34	34	34	36	35
Wheat bran	24	24	25	24	25
Molasses	3.0	3.0	3.0	3.0	3.0
Di- Ca- phosphate	2.0	2.0	2.0	2.0	2.0
Dl-Methionine	0.4	0.4	0.4	0.4	0.4
Salt	0.3	0.3	0.3	0.3	0.3
Vit.-Min. premix*	0.3	0.3	0.3	0.3	0.3
Chemical composition(%DM basis)					
DM	88.38	88.30	88.49	88.87	88.24
OM	90.55	91.46	92.07	91.69	91.40
CP	17.37	17.50	17.03	17.73	17.43
CF	13.16	13.09	12.90	12.71	12.51
EE	2.08	2.44	2.77	2.16	2.77
NFE	58.04	58.43	59.29	57.31	58.88
Ash	9.35	8.54	8.01	7.93	8.41
NDF	29.93	30.33	30.42	30.49	30.57
ADF	16.67	16.94	17.11	17.27	17.44
ADL	3.64	3.71	3.74	3.78	3.82
Methionine	0.64	0.64	0.64	0.64	0.64
Lysine	0.80	0.80	0.80	0.80	0.80
Calcium	1.01	1.01	1.01	1.01	1.01
Phosphors	0.66	0.66	0.65	0.65	0.65
Digestible energy(Kcal/Kg DM)	2783.70	2773.03	2774.17	2775.31	2776.40

(1) *Each kg vitamins and minerals premix contains:Vit. A. 2.00000IU,10.000mg, $B_1$400mg, $B_2$1200mg, B_6,400mg, B_{12}.2mg, K_3 400 mg, D_3 200000IU, Choline chloride 240mg pantothenic acid 400mg, Niacin 1000mg, Folic acid 1000 mg, Biotin 40 mg, Manganese 1700 mg, Zinc 14000 mg, Iron 1500mg, copper 500 mg, selenium 20 mg, Iodine 40 mg and Magnesium 8000 mg.

RESULTS AND DISCUSSION

Results of chemical composition in Table 2 indicated that, Chickpea screenings by-products had higher CP, EE contents and lower CF, NDF, ADF and ADL contents, compared with barley. These results are agreement with those obtained in the literature (Lardy and Anderson, (2009); Bampidis and Christodoulou (2011). While Ghezeljeh and Mesgaran (2010) reported that chickpea pre-screening by-products has high CP, EE, CF and low NDF, ADF

(279, 78, 72, 351 and 96 g/kg DM, respectively) compared the present study. Concerning to Ca and P content were higher in CSB than in barley and comparable to those values reported by Lardy and Anderson, (2009) who found that CSB contained 0.17% and 0.37% for Ca, P, respectively. Chickpea by-products contained 4.57g/100g DM phytic acid. As reviewed by Sebastian *et al*., (1998), phytic acid form complex with proteins and consequently reduce their availability besides it reduces the activity of pepsin, trypsin and αamylase. Chickpea screenings by-products also contain 0.90 saponin and 1.44 g/kg tannins which impair nutrient absorption from the gastrointestinal tract (Perez et al., 1999). On the other hand, the content of GE in Chickpea screenings by-products was higher than that of barley.

Table 2: Chemical analysis of chickpea screenings by-products and Barley (on dry matter basis).

Item %	*DM*	*OM*	*CP*	*CF*	*EE*	*NFE*	*Ash*	*NDF*	*ADF*	*ADL*	*Ca*	*P*	*GE (Kcal/kg DM)*
CSB	*90.19*	*95.69*	*22.43*	*3.04*	*3.18*	*67.04*	*4.31*	*13.60*	*5.64*	*1.43*	*0.18*	*0.36*	*4120*
Barley	*92.00*	*87.17*	*9.62*	*6.30*	*2.00*	*79.83*	*2.70*	*19.01*	*8.02*	*2.04*	*0.06*	*0.35*	*3770*

GE: Gross Energy, CSB: Chickpea screenings by-products

Results in Table 3 showed that rabbits fed 25% , 50% and 75% CSB diets recorded significantly (P<0.05) better final live body weight (LBW) and average daily gain (ADG) compared with the control group. Also, the FCR values were better (P<0.05) with rabbit groups fed CSB diets at different tested levels in comparison with the control group. In this connection, Lebas, (1988) found that the inclusion of chickpeas up to 20% replacing partially soybean meal had no negative effects on growth rates. Alicata et al., (1991) found that the inclusion rates of 10 and 20% chickpeas are more common in rabbit diets. However, Christodoulou et al. (2006) showed that broiler turkey diets containing higher inclusion levels of extruded chickpeas (400, 600, 800 g/kg of diet) did not affect daily feed, but negatively influenced final BW and FCR. This improvement in growth performance with 25, 50 or 75% CSB could be attributed to high nutritive value of CSB. Besides to that, Chickpea seeds can be used safely as a protein source for growing and breeding rabbits (Roy et al., 2002). Nevertheless, the values of DFI and ADG were lower with the highest inclusion of CSB at 100% compared with the other tested inclusion levels (25, 50 and 75%). This adverse effect may be due to the presence of various anti-nutrition factors such as trypsin inhibitors, saponins, lectins or tannins at high level led to reduce nutrient digestibility (Jezierny, 2010).

Table 3: Performance of rabbits fed diets containing chickpea screenings by-products.

Items	Substitution level of barley by chickpea screenings by-products						
	Control (0% CSB)	25% CSB	50% CSB	75% CSB	100% CSB	±SEM	Probability
No. of rabbits	18	18	18	18	18		
Initial L.B.W. g	789.66	787.88	780.83	784.16	791.11	32.02	<0.0001
Final L.B.W. g	1961 **c**	2083 **a**	2099 **a**	2047 **b**	2004**bc**	23.26	<0.0001
Average daily gain (ADG) / g	20.92 **c**	23.13 **a**	23.54 **a**	22.55 **b**	21.66**bc**	0.46	<0.0001
Av. daily Feed intake (ADFI) g/h/d	87.06**ab**	84.56**b**	88.01**a**	85.00**ab**	81.34**c**	1.05	<0.0001
FCR (g feed/g gain)	4.16 **a**	3.66 **b**	3.74 **b**	3.77 **b**	3.76 **b**	0.07	<0.0001

a,b,c Means values with the same letter within the same row did not differ significantly (P>0.05).

Results in Table 4 showed that rabbits group fed 25 or 50% CSB recorded significantly (P<0.05) higher digestibility of DM, OM, CP, CF, EE and NFE compared with the other tested levels (0, 75 and 100% CSB). Besides, the digestibility of DM and CP were higher (P<0.05) with rabbit groups fed 25, 50 and 75% CSB than the control group. Meantime, insignificant differences were observed among 100% CSB and control group in DM, OM, CP, CF and NFE. These results agreed with those reported by Brenes *et al*., (2008); Nalle, (2009) who reported that digestibility and biological value of chickpea nutrients for rabbit are high. Moreover, Data of nutritive values illustrated that rabbit group fed 25 or 50% CSB recorded the highest (P<0.05) values of DCP, TDN and DE in comparison with other experimental groups. Lebas, (1988) stated that the inclusion of chickpea at 10 or 20% in growing rabbit diets resulted in a high digestible energy concentration for chickpea 3100-3200 kcal DE/kg and a moderate to high digestibility of protein 70 to 80%.

Table 4: Effect of inclusion of chickpea screenings by-products on digestion coefficients.

	Substitution level of barley by chickpea screenings by-products						
Items	Control (0% CSB)	25% CSB	50% CSB	75% CSB	100% CSB	±SEM	Probability
DM	63.88[c]	69.20[a]	69.44[a]	66.07[b]	63.16[c]	0.67	<0.0001
OM	66.12[b]	71.51[a]	71.56[a]	67.43[b]	65.57[b]	0.63	<0.0001
CP	63.77[c]	70.55[a]	72.30[a]	67.06[b]	64.00[c]	0.64	<0.0001
CF	42.75[b]	52.40[a]	51.80[a]	44.11[b]	42.33[b]	1.28	<0.0001
EE	73.01[b]	75.49[a]	75.16[a]	71.84[bc]	70.40[c]	0.65	<0.0001
NFE	71.60[b]	75.61[a]	75.31[a]	71.94[b]	70.49[b]	0.71	<0.0001
DCP	10.66[cd]	11.44[b]	11.78[a]	10.98[c]	10.44[d]	0.11	<0.0001
TDN	63.87[b]	67.95[a]	67.90[a]	63.81[b]	62.05[b]	0.63	<0.0001
DE(kcal/kg)	2829[b]	3010[a]	3008[a]	2827[b]	2748[b]	28.13	<0.0001

a,b,c--- Means in the same row with different superscripts are significantly different (P<0.05).

CONCLUSIONS

The chickpea screening by-product seems to be satisfactory energy source for the weaned rabbit. The reasonable growth performance obtained in this study could encourage us to recommend the use of chickpea screenings by-products at 25, 50 and 75% in replacement of barley as a non-conventional cheap feedstuff in growing rabbit's diets without any detrimental effects on the growth performance.

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