Effect of dietary replacement of crushed sorghum grains by bakery by-products on laying hen performance

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Summary:
This study was conducted to investigate the nutritive value of bakery byproducts inclusion and its effects on layer hen performance.
A total number of 36 Hisex white hens (32 weeks age) were weighed and distributed over 12 cages with almost the same egg production (EP) level among the cages. The experiment was conducted as a 3×4 complete randomized of treatments including three replacement levels (0, 20, and 40%) of sorghum grains with dried bakery byproducts (BP). The data collected included hen day egg production% (EP), egg weight (EW) and egg mass (EM g/hen/day). Also egg characteristics were recorded. The results revealed that dietary inclusion of BP in layer hen diets exerted no negative effect on production performance namely EM, EP and EW (45.54, 45.33and 44.72; 85.48, 81.67 and 84.52; 53.26, 55.57 and 52.88 respectively) or egg characteristics.
The conclusion drawn from this study, was that BP could effectively replace up to 40% sorghum grains in layer hen diets without adverse effects on production performance or egg quality.
key words : bakery, By-products, laying hen

Introduction:

In poultry production enterprises feeds resembles more than 70% of the total production cost. Sorghum (Sorghum vulgare) is well adapted to arid and semi-arid regions and could be used as corn substitute, in poultry feeding, due to its high energy content. Sorghum ranks the fifth most produced crop worldwide after wheat, corn, rice, and barley (NRC, 1996). It has been used consistently as a major ingredient (normally 55-60%) in poultry rations in Sudan. The nutrient contents of sorghum (Feterita), are crude protein 14% and metabolizable energy as 15.22 (MJ/kg);(Sulieman and Mabrouk,1999).

However the grain price is increasing because of the competition between humans and livestock. Therefore the need appears for other cheap energy sources for poultry production. Recently bakery byproducts were used as an alternative energy source to substitute cereals in poultry diets(Al Sagan et al., 2021). Bakery byproducts are cheap source of energy ,and its inclusion in poultry rations minimize environmental pollution resulting from their dumping as garbage, that forms insects and rodents breeding habitat.. Recently Ayanrinde *et al.* (2014) stated that increasing levels of bread waste in replacement for maize in broiler diets (up to 100% replacement) can be practiced, as it gives similar performance and carcass yield to the control diet. Torki and Kimiaee (2011) stated that partial or even complete replacement of corn with bakery by-products in laying hens diet, had no adverse effect on performance or egg quality.

The objective of this study was to evaluate the nutritional value of bakery waste as replacement for sorghum grains in laying hen diets in Sudan.

Materials and methods:

Experimental location and duration:

The experiments were carried in the experimental farm of Poultry Research Department of Animal Production research Centre (APRC), Hillat Kuku-Sudan. The study continued for five months starting from February, 2018.

Experimental diets:

Bakery byproduct (BP) used in this study was in a form of pastry byproducts obtained from pastry factory in Khartoum, Sudan. Three iso-caloric and iso-nitrogenous diets were formulated (ME=2700 kcal/kg and crude protein= 18 g/100 g diet). Proximate analysis was conducted for the formulated diets according to AOAC (1990).

Experimental birds and design:

A total number of 36 Hisex white hens (32 weeks age) were weighed and distributed between 12 cages with almost the same egg production (EP) level among the cages. The experiment was conducted as a 3×4 complete randomized of treatments including three replacement levels (0, 20, and 40%) of sorghum grains with dried pastry byproducts. Each experimental diet was replicated 4 times with 3 birds per replicate.

Data collection and analysis:

The hens' performance including egg mass (EM g/hen/day), hen day egg production% (EP) and egg weight (EW) were calculated. The experiment lasted for eight weeks. Egg characteristics including shell weight (g), shell % of egg weight and shell thickness (mm) were recorded for the last two weeks.

The data collected were analyzed based on completely randomized design using Stat soft (2001) computer program. Significant means were separated using least significant **difference at p <0.05.**

Results and discussion

Ingredient proportions and composition of the experimental diets are presented in table (1). The main poultry feed ingredients in Sudan used are sorghum (Feterita), groundnut cake and wheat bran (Babiker *et al.,* 2009)..

Replacing dietary sorghum with bakery byproducts (up to 40% level) had no significant effect on feed intake (table 2), hen-day egg Production (%), egg mass, and egg weight (table 3). In addition to that feed utilization (table 3) of layer hens in term of crude protein intake and energy intake were not influenced by substitution of sorghum grains by bakery byproducts. The same was true for egg quality characteristics (table 4 and 5). Records investigating effects of dietary inclusion of bakery byproducts in layer hen performance are scarce. However, it has been reported (Torki and Kimiaee ,2011) that bakery byproducts could be successfully used in layer's diets. In line with our results Torki and Kimiaee (2011) incorporating bakery byproducts up to 56.99 % in laying hens diets as untraditional ingredients exerted no negative effect on their performance compared with the control treatment of corn based diets. Moreover similar conclusion was drawn by Shafey *et al.*(2011) raising laying hen.

From the result of this experiment it can be concluded that dietary sorghum could be replaced by bakery byproducts up to 40% replacement level with no adverse effect on laying hen performance or egg quality. In addition to that higher inclusion levels of BP in layer hen's diets should be tried.

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Table 1.Composition and ingredients of the experimental diets

Ingredients	Level of sorghum replacement with bakery byproducts BP (%)			Bakery byproducts (BP)
	0	20	40	
Sorghum	64.0	51.8	38.3	
Bakery byproducts	0	13	26	
Groundnut cake	21.0	19	19	
Wheat bran	2.3	3.5	4.0	
Layer concentrate	2.5	2.5	2.5	
Limestone	9.0	9.0	9.0	
Dicalcium phosphate	0.4	0.4	0.4	
Common salt	0.1	0.1	0.1	
Vit. & Min. premix	0.1	0.1	0.1	
Lys-HCl	0.18	0.2	0.2	
DL-Meth	0.1	0.1	0.1	
Choline	0.1	0.1	0.1	
Anti-fungal	0.1	0.1	0.1	
Probiotics	0.1	0.1	0.1	
Total	100	100	100	
Chemical analysis				
ME (kcal/kg DM)*	2992	3019	3063	3936
Crude protein (%)	18.2	18.1	17.9	13
Organic matter (%)	85.57	84.72	83.71	97.4
Ether extract (%)	3.4	4.9	6.2	15
Crude fibre (%)	3.9	3.5	3.3	Nil

*ME (kcal/kg DM) was calculated according to Lodhi*et al.* (1976).

Table 2. Effects of dietary replacement of sorghum grains with BP on daily feed dry matter intake (DMI), crude protein intake (CPI) and metabolizable energy intake (MEI) during 5-week experimental period.

Parameter (Mean 1-5 week)	Dietary BP replacement (%)			SEM	L. S.
	0	20	40		
DMI (g/hen/d)	95.39	97.67	89.65	3.778	NS
CPI (g/hen/d)	17.36	17.68	16.05	0.684	NS
MEI (Kcal/hen/d)	285.40	294.86	274.59	11.402	NS
Energy-protein ratio	16.44	16.68	17.11	-	-

Table 3. Effects of dietary replacement of sorghum grains with BP on layer hens; egg production, feed and energy utilization during 5-week experimental period.

Parameter (Mean 1-5 week)	Dietary BP replacement (%) 0	20	40	SEM	L. S.
	i. Egg production				
Egg Mass (g/hen/d)	45.54	45.33	44.72	1.804	NS
Egg Production (hen-d %)	85.48	81.67	84.52	3.013	NS
Egg weight (g)	53.26	55.57	52.88	1.24	NS
	ii. Feed and Energy utilization				
FCR (g feed/g egg mass)	2.10	2.167	2.01	0.088	NS
ME use(Kcal/ g egg mass)	6.28	6.53	6.16	0.267	NS
CP use (g/ g egg mass)	0.382	0.391	0.360	0.0159	NS
Feed required (kg) to produce dozen egg	1.34	1.43	1.27	0.052	NS
MEI required to produce dozen eggs (kcal).	4010.58	4327.30	3901.83	157.848	NS
CPI required to produce dozen eggs (g).	243.96	259.44	228.02	9.458	NS
Feed required (kg) to produce kg egg	2.10	2.16	2.01	0.088	NS
Feed required (kg) to produce kg egg	2.10	2.16	2.01	0.088	NS
MEI required to produce kg eggs (KCal).	6275.48	6529.18	6162.47	267.31	NS
CPI required to produce kg eggs (g).	381.73	391.45	360.13	15.910	NS

Table 4. Effects of dietary replacement of sorghum grains with BP on Egg quality characteristics at week 7-8 of experiment.

Treatments	**Egg characteristics**			
Sorghum replacement by BP	**Yolk weight (g)**	**Egg index**	**Yolk height (mm)**	**Haugh unit**
0% replacement	13.97	77.01	1.57	80.06
20% replacement	15.16	74.26	1.61	74.98
40% replacement	13.97	76.83	1.57	76.79
SEM	0.355	0.797	0.046	2.481
L. S.	NS	NS	NS	NS

Table 5. Effects of dietary replacement of sorghum grains with BP on Egg quality characteristics at week 7-8 of experiment-continue.

Treatments	**Egg characteristics**		
Sorghum replacement by bakery byproducts	**Shell %**	**Shell weight (g)**	**Shell thickness (mm)**
0% replacement	13.41	6.81	0.270
20% replacement	13.72	7.56	0.305
40% replacement	14.05	7.22	0.258
SEM	0.307	0.259	0.0239
L. S.	NS	NS	NS

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