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Bakery Waste as a Potential Unconventional Feed Ingredient in Broiler Ration- A Review

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ABSTRACT

With the increasing demand for poultry products, feed prices as well as shortage is increasing. Hence, there is a need for exploring suitable unconventional feed ingredients for successfully replacing conventional feed ingredients. Maize being one of the major constituents of poultry ration, if replaced with suitable unconventional ingredient can reduce the cost of ration while at least maintaining the performance of broiler chicken. Bakery waste is abundantly available and can be successfully utilized to counter these feed shortages. Bakery waste can improve or atleast maintain the performance of broiler chicken at lower costs. This review discusses the findings of various studies where researchers analyzed as well as incorporated bakery waste in ration of broiler chicken.

KEYWORDS: Bakery waste, Economics, Performance, Poultry

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INTRODUCTION

The 34th report on standing committee on agriculture has estimated that India is deficit of 23 % dry fodder, 32 % green fodder and 36 % concentrate on dry matter basis. Hence, a lot of stress is being laid on search of feeds as replacer of maize because there is reliance on maize as a feed source for many meat and milk producing animals as well as for human consumption. In this context, there is urgency for poultry raisers, animal nutrition researchers and feed industry to look for alternative feed ingredients to keep down costs. Due to higher availability of bakery waste as well as high proportion of non-fibrous carbohydrates, bakery trash appears to be one of the more attractive alternative feeds (Arosemena et al., 1995). Bakery waste is available in commercial quantities at many places in India for animal feeding. Use of wastes from bakery manufacturing units might bring about significant reduction of feed costs.Bakery wastes are products obtained during different stages of bakery product processing. It consists of unsold breads, expired bakery products, wasted dough, low quality products etc. and can be used as components of livestock rations after dehydration, which can reduce their disposal issues and can alleviate environmental problems. Bread waste is, thus, a byproduct of the bakery industry that is made from flour, which is a product obtained from dehulled wheat (*Triticum aestivum*). As the bread waste is not consumed by human beings, it is always been disposed as waste. As per the estimates, the total volume of cakes, pastries and muffins production in India in 2017 was 16.6 thousand metric tons, whereas the total volume of production of breads, buns and croissant during the same time in India was 262.7 thousand metric tonnes (Statista, 2019). According to Mishra (2017), the threshold for waste in the Indian baking business is reportedly between 10 and 20 percent. In view of this, largeamount of bakery waste is available for potential use in animal feeding; however, its use is limited due to the variationsin their nutritive profile.

Bakery products are suitable ingredients for animal and poultry feeds, according to the research

findings of feeding trials with livestock as well as poultry (Afzalzadeh et al., 2007; Santos et al., 2014; Mahmud, 2017; Al-Ruqaie et al., 2011; Torki et al., 2011; Yadav et al., 2014). With the creation of nutritionally adequate and cost-effective animal diets, bakery waste has been successfully explored as a viable maize replacement.

Nutritional composition of bakery waste

While choosing an unconventional feed ingredient, it is necessary to evaluate its nutritional composition so as to decide its replacement level in ration without any negative impact in the animal's performance. Bakery wastes usually consist of different byproducts obtained from the processingin bakery industry, and thus, their composition is highly variable as presented in Table 1. But the energy content as calculated during various research studies indicates potential use of bakery waste for maize replacement in broiler ration.

Table 1.Nutritional composition of bakery waste

Location	TMEn (kcal/kg)	Moisture %	CP %	EE %	CF %	Ash %	Other parameters	Reference
Mumbai, India	-	-	10.2	10.2	1.14	6.32	72.0% NFE	Epao et al., 2017
Nigeria	2798.81	-	19.2	7.06	4.16	-	-	Shittu et al., 2016
USA	-	-	12.4	2.14	1.04	0.64	-	Ayanrinde et al., 2014
Nigeria	-	-	12.4	2.14	1.04	0.64	73.9 % NFE	Oke, 2013
Saudi Arabia	3895.4	8.43	12.2	1.32	0.18	1.83	0.18 % calcium, 0.15% phosphorus, 3.2% sodium, 0.12% chloride	Tulaihan et al., 2004
South Africa	3680.75	8.11	12.5	11.0	2.25	4.80	0.28% Calcium and 0.52% phosphorus	Madiya et al., 2003

Effect of bakery waste based ration on performance and feed utilization of broiler chicken

DBP (dried bakery waste) can be used instead of a part of the grain usually fed to poultry. Research studies (Table 2) pertaining to growth performance of broiler fed bakery waste tends to atleast maintain, even if not, improve the performance of the birds. This has been attributed to the energy and protein content being similar to the maize grain.

Table 2. Variation in growth performance of broiler chicken fed on broiler ration

Bakery waste	Bird and duration of feeding	Dietary treatment (% replacement of maize with bakery waste)	Effects		Reference
			Body weight gain	FCR	
Bakery waste	240-day-old broiler chicks	0, 20, 40, and 60 %	Similar among all treatment groups	Similar in all the treatment groups	Epao et al., 2017
Biscuit dough	144 broiler chicken (Arbor acre strains) for 56 days	0, 5, 10 and 15 %	Higher in treatment groups	Similar in all the treatment groups	Shittu et al., 2016
Dry bakery waste	240 broiler chicken	0, 10, 20, 30, 40, and 50%	Treatment groups (30%, 40%, and 50%) had higher final weight compared	Similar in all the treatment groups	Fagbemi,2015
Bakery waste	240 broiler chicks (8-week)	0%, 33%, 67%, and 100%	No significant variations	T1 had higher FCR while T3 had lowest value	Ayanrinde et al., 2014
Bakery trash	180 broiler chicks (42-day feeding trial)	0, 20% ,40% and 60%	Higher in control group during fourth to the sixth week	20% and 40% bakery waste fed groups significantly better FCR than the birds fed 60% bakery waste	Yadav et al., 2014
Bakery waste	120 broiler chicks (56-day feeding trial)	0%, 10%, 20%, and 30%	Control group had highest value and 30% bread waste fed group had lowest value	Better FCR in control group	Oke, 2013
Bakery waste	(35 day)	0, 60 and 100%	T1 and T2 had a higher weight gain than control	Broilers fed 20% BW had a lower FCR when compared with those fed rations containing 0%, 60% and 100% BW	Al-Ruqaie et al., 2011
Dried bakery waste	49-day feeding trial	0%, 5%, 10%, 20% and 30%	No significant differences	No significant differences	Al-Tulaihan et al., 2004
Dried bakery product	570 day-old male broiler chicken	0 and 100 %	TA group were heavier	-	Madiya et al., 2003

Effect of bakery waste based ration on nutrient utilization in broiler chicken

Any change in the nutrient digestibility is indicative of the effects of the dietary interventions on the activity of digestive enzyme and intestinal integrity.Incorporation of bakery waste in broiler diet doesn't have any negative effect on the nutrient digestibility among the various treatment groups (Shittu et al., 2016; Al- Ruqaie et al., 2011). This indicates that bakery waste incorporation can atleast maintain, if not improve, the performance of chicken. However, Gregori et al. (2009) reported that nutrient digestibility for 21 to 42 days study showed no significant differences between different bakery waste diets for ileal digestibility of both DM and CP. However, faecal digestibility of dry matter in diets with dried bakery waste was lower than in control diets.

Effect of bakery waste based ration on blood biochemical parameters of broiler chicken

Bakery waste has been reported to be devoid of any major anti-nutritional compounds. Also, high-energy content of bakery waste makes it a good replacer for maize (Olayemi et al., 2007). However, being a waste product, there are chances of presence of various microbes (spoilage and pathogenic) or even chemical compounds which can harm the birds and hence the final product i.e., meat or eggs. Since blood biochemistry is an indicator of the normal functioning of the body, it is helpful to study the presence of harmful compounds in the feed.

Table 3. Blood biochemical parameters of broiler chicken fed bakery waste based ration

Bakery waste	% replacement of maize with bakery waste	Effect on blood biochemistry	Reference
Biscuit waste meal	0, 50 and 100%	No detrimental effect on the total protein, albumin, globulin, uric acid; calcium and glucose content But total cholesterol higher in birds fed 100% biscuit waste meal ($p<0.01$)	Adewale et al., 2018
Bakery waste meal	0, 50 and 100%.	Phosphorus value significantly higher in birds fed the control diet while total cholesterol was higher in birds fed 100% bakery waste meal diet ($p<0.01$). But total protein, albumin, globulin, uric acid, calcium and glucose values were similar	Ahaotu et al., 2018
Bakery waste	0, 20, 40, and 60 %	Average serum albumin, globulin, cholesterol, triglycerides, LDL and VLDL values were similar Average serum HDL values were significantlyhigher in 20 and 40% bakery fed groups	Epao et al., 2017
Biscuit dough	0, 5, 10 and 15%	Serum parameters (AST, ALT, total protein, cholesterol, creatinine) were similar across dietary treatments	Shittu et al., 2016
Bakery waste	0, 10, 20, 30, 40, and 50 %	No significant ($P \geq 0.05$) effect of dried bakery wastes on all the hematological parameters	Fagbemi, 2015
Bakery waste	0 and 50%	Slight difference in total serum proteins, albumin and globulin but within the normal physiological range	Adekunle and Omoh, 2014

Effect of bakery waste base diet on carcass characteristics of broiler chicken

Broiler chicken is reared for meat purpose, hence the carcass characteristics should be noted at the end of a feeding trial so as to analyse the effect on the final product. The incorporation of bakery waste in broiler ration doesn't cause any adverse effects on the major carcass traits (Epao et al., 2017; Shittu et al., 2016; Al-Tulaihan et al., 2004). However, various studies have found significant differences among the bakery waste fed treatment groups and the control (Fagbemi et al., 2015; Ayanrinde et al.,

2014; Oke, 2013). This indicated that the bakery waste utilisation as maize replacer can improve the carcass quality.

Effect of bakery waste based diet on economics of broiler chicken rearing

The major reason behind the search for non-conventional ingredients is the urgent need to cut down costs of production so as to enhance the economics returns. Hence, studies have been conducted to analyse the effect of bakery waste on economics of broiler ration (Table 4). Bakery waste, being a discard, is usually sold at lower prices compared to grain or sometimes even for free. This may help the poultry rearers to utilize the bakery waste as a replacer to costly energy rich ingredients.

Table 4. Effect of bakery waste incorporation on economics of broiler chicken production

Bakery waste	Effect on cost economics of poultry production	Reference
Bakery waste	Net profits per kg body weight were higher for treatment groups.	Epao et al., 2017
Biscuit dough	Reduced the cost per unit weight gain for treatment groups compared to control	Shittu et al., 2016
Bakery waste	No adverse effect on economy upto 40 % inclusion	Yadav et al., 2014
Bakery waste	Reduced cost of production at 30% bakery waste inclusion	Oke, 2013
Bakery waste	reduced the total cost of feed	Al-Ruqaie et al., 2011
Dried bakery Product	Feed inputs reduced by approximately one-third while gross margin increased by around 15 %	Madiya et al., 2003

CONCLUSION

Bakery waste has a potential for use in the ration of poultry sector as an unconventional feed ingredient. Inclusion of bakery waste in broiler rations has not produced any adverse effects in the birds. However, due to the variations in the composition of bakery waste the results may vary. Its utilisation for poultry as well as livestock sector can be further interrogated so as to cut the costs of feeding while improving or atleast maintain the growth and production performance.

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