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Economic impact of supplementing mannan-oligosaccharide and pomegranate peel powder in diet of broiler chickens

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Abstract
A research study was conducted in two hundred forty day-old commercial Ven Cobb strain 400 broiler chickens during the month of September and October to estimate the economics upon mannan-oligosaccharide (MOS) and pomegranate peel powder (PPP) supplementation. Chicks were randomly distributed into 4 groups of 3 replicates of 20 chicks in each by following Randomised Block Design. The dietary treatment groups were as follows: T0 (Control; basal diet), T1 (basal diet + 0.1% MOS), T2 (basal diet + 0.6% PPP) and T3 (basal diet + 0.9% PPP). It was observed that T3 followed by T1 group showed better net profit value per bird. Hence, supplementation of MOS @ 0.1% and PPP @ 0.9% in broiler rations increased the profit for broiler production and thus, is inevitable for production of cost effective high quality broiler ration.

Keywords: MOS, pomegranate peel powder**,** broiler chickens, economics

Introduction
In the last five decades, poultry production in India has evolved from a wholly unstructured and unscientific farming practice to a commercial production system with cutting-edge technological innovations [1]. The major limiting variables in poultry rearing have been recognized as nutrition and diseases. Feed is a crucial input for the poultry industry, accounting for 60 to 70% of production expenses [2]. As a result of the ban on the sub-therapeutic use of antibiotics as growth promoters in poultry feeds due to their detrimental effects such as residues in meat products and the development of antibiotic resistant bacteria populations [3, 4], research efforts in supplementation of feed additives like prebiotics and phytogenic compounds have received a lot of focus in order to improve meat and egg production [5, 6].
There is a need to acquire a scientific understanding on using low-cost locally available agro-industrial by-products in poultry feed to lower the feed costs. Considering the expected rise in meat consumption over the next years, low-cost poultry rearing is a bonanza for small-scale farmers. The demand for traditional feed ingredients for poultry feeding is always escalating. The use of these feed components in poultry feed has accelerated production costs [7]. Strategies to use locally available cheap by-products may benefit end users by lowering feed costs, which in turn can minimize the total cost of meat production and make it more affordable in rural India [2]. Traditional sources of protein, vitamin, mineral utilized in poultry diets, such as fish meal, meat and bone meal, soybean meal, groundnut cake, and so on, are becoming more expensive day by day in the developing countries. The availability of such feed ingredients is insufficient due to the booming cost of raw resources and the intensifying competition with humans for the same food products. As a result, the hunt for alternate feed sources has become unavoidable in order to lower the feed costs without compromising with health of poultry [8].
The public's inclination towards natural products has resulted in the usage of natural feed additives such as prebiotics and natural antioxidants in poultry nutrition. Prebiotics are good examples of food supplements that enhance animal growth and health by altering gastrointestinal tract microbiota, such as providing energy for beneficial endogenous bacteria and limiting the proliferation of harmful intestinal bacteria [9]. One such prebiotics is mannan oligosaccharides (MOS), which are structural cell wall components of *Saccharomyces cerevisiae* [10]. In monogastric animals, dietary MOS supplementation improved growth performance and nutrient digestion, promoted health status, improved gastrointestinal tract

morphological integrity, increased antioxidant capacity, facilitated immunological status, and upregulated immune related gene expression [11, 12].

Secondary metabolites from plants also have a variety of health benefits, including antioxidant properties. Polyphenols are the most abundant phytochemicals possessing antioxidant [13, 14], antihyperlipidemic [15, 16], bactericidal [17] and hypotensive properties [18]. Pomegranate peel contains numerous prebiotic components such as polyphenols, flavonoids, anthocyanins, minerals and complex polysaccharides. Thus, it encompasses multiple health-promoting qualities like antibacterial, antioxidant, cytotoxic, hypoglycemic, hypolipidemic, hepatoprotective, anti-inflammatory and wound healing properties [19, 20].

Therefore, the present study was conducted to investigate the economic impact of a prebiotic (MOS) and a phytogenic compound (pomegranate peel powder) supplementation on broiler chickens.

Materials and Methods

The experiment was conducted in the Experimental Poultry Shed, Department of Animal Nutrition, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam -781022, India. The feeding trial was conducted during the month of September and October, 2018 with an average temperature ranging from 21 to 33ºC and relative humidity from 58 to 98 percent. Two hundred forty (N=240) day old commercial Ven Cobb strain 400 broiler chicks with 45.50±0.67 g/bird were procured from local market. The chicks were kept in brooder by maintaining optimum brooder temperature for three days. The chicks were offered *ad libitum* pre-starter diet (crumbles) containing 22% crude protein and 3050 kcal ME per kg [21] for the first 7 days of age. On 7th day, chicks were weighed individually in chick weighing balance and wing banded for identification.

The chicks were randomly distributed into 4 treatment groups i.e., T0, T1, T2 and T3 on the basis of their body weight having 60 chicks in each with 3 replicates of 20 chicks each by following Randomised Block Design (RBD). Experimental diets were formulated for starter and finisher phases to meet the nutrient requirement as per ICAR (2013) [21] using commonly available ingredients. The control group was fed with basal diet during starter and finisher phase and designated as T0. Whereas, the treatment groups were fed basal diet supplemented with Mannan-oligosaccharides (MOS) @ 100 mg/kg (T1), Pomegranate peel powder (PPP) @ 600 mg/kg (T2) and @ 900 mg/kg diet (T3), respectively during starter and finisher phases. Mannan-oligosaccharide and Pomegranate peel were procured from Anthem biosciences, Bengaluru, Karnataka – 560099 and Bhubaneswar city of Odisha – 751003, respectively. Net profit (Rs.) per bird was calculated for birds under each treatment group taking cost of chick, feed and miscellaneous into consideration.

Result and Discussion

Supplementation of 0.9% PPP (T3 group = Rs. 36.26) was found to be the most cost effective followed by 0.1% MOS fed group (T1 group = Rs. 34.24), 0.6% PPP (T2 group = Rs. 16.65) and basal diet fed groups (T0 group = Rs. 13.21). Result was in agreement with Bostami *et al.* (2015), who reported that the supplementation of fermented pomegranate by-products (FPB) @ 1.0 and 2.0% in basal diet of broilers reduced feed cost per unit weight gain (P<0.05) compared to basal diet fed group [22]. Pomegranate has nutritional as well as health benefit attributes due to its antioxidative, antimicrobial and disease prevention action [23, 24] which may be the reason of growth improvement in pomegranate supplemented groups. Therefore, feed cost per unit of weight gain improved over basal diet fed group in broilers. Kamran *et al.* (2013) studied the efficacy of mannan-oligosaccharides (MOS) as alternatives to antibiotic growth promoters (AGP) in broiler diets from 1 to 22 days of age. Economic evaluation revealed that cost per kg of live weight gain was lower with AGP fed groups as compared to control or MOS group [25]. On the contrary, Hooge *et al.* (2003) reported that there was no numerical difference in cost per kg live weight gain among various treatments which was found to be associated with better growth performance of MOS group as compared to control [26]. Eseceli *et al.* (2010) found better results with avilamycin as compared to MOS which indicated that the use of AGP in diet was more cost effective, resulting in greater economic returns [27].

Table 1: Economics of Feeding in Broilers in Different Experimental Groups

SL. No.	Attributes	Dietary Treatment*			
		T0	T1	T2	T3
1.	Cost of day-old chick (Rs.) = A	42	42	42	42
2.	Total feed consumed/ bird (kg) = B	3.024	3.087	3.020	3.009
3.	Basal Feed cost/kg (Rs.) = C	32	32	32	32
4.	Supplement Cost /kg (Rs.)	0	600	250	250
5.	Supplement Cost /bird (Rs.) = D	0	1.85	0.90	1.35
6.	Total Feed Cost/ bird (Rs.) = E, (B x C)	96.76	100.65	97.55	97.65
7.	Miscellaneous Cost (Rs.) = F, 12% of (A+E)	16.65	17.12	16.75	16.76
8.	Total cost/ bird (Rs.) = G, (A+E+F)	155.41	159.77	156.30	156.41
9.	Average BW/bird (Kg) = H	1.53	1.76	1.57	1.75
10.	Market price of bird/kg (Rs.) = I	110	110	110	110
11.	Total earning/ bird (Rs.) = J, (H x I)	168.62	194.00	172.95	192.67
12.	Net profit/ bird (Rs.) = K, (J-G)	13.21	34.24	16.65	36.26

* T0 = Control (basal diet), T1 = Basal diet + MOS (0.1%), T2 = Basal diet + PPP (0.6%) and T3 = Basal diet + PPP (0.9%)

Conclusion

The study suggested that a broiler farmer can have more profit by incorporating PPP @ 0.9% followed by MOS @ 0.1% in rations for broiler chickens. Hence, it can be concluded that the supplementation of 0.9% PPP and 0.1% MOS in the diets of broiler chickens may yield better economic benefit to a farmer.

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