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Effect of herbal feed additives fenugreek (*Trigonella foenum-graecum*) seed powder and onion (*Allium cepa*) powder on metabolizability of nutrients and gut health of broilers

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Abstract

The positive effect of Fenugreek and Onion and their active components on the digestion process has been reported in several studies. The present experiment was conducted to study the effect of supplementation of Fenugreek seeds powder and Onion powder on metabolizability of nutrients and gut health of broilers. A total of 210, day-old, broiler chicks (Vencobb-400) were randomly allotted to seven treatment groups. The T1 i.e., control group was fed on basal diet, while, group T2 and T3 were supplied with 1% and 2% fenugreek seed powder, respectively. Whereas group T4 and T5 were supplied with 1% and 2% onion powder, respectively and group T6 and T7 were supplied with 0.5% fenugreek seed powder and 0.5% onion powder and 1% fenugreek seed powder and 1% onion powder, respectively in the basal broiler pre-starter, starter and finisher ration. Metabolizability of organic matter, crude fiber and ash were higher ($P < 0.01$) in T6 group while dry matter and ether extract metabolizability were higher ($P < 0.05$) in T6 group. Non-significant effect was observed on crude protein and nitrogen free extract (NFE) metabolizability but numerically highest in T6 group. Whereas non-significant difference in intestine pH was observed in duodenum, jejunum and ileum parts of intestine. But numerically duodenum and jejunum pH were highest in T6 group and highest ileum pH was observed in T7 group.

Keywords: Broiler, fenugreek, onion, metabolizability, pH

Introduction

The poultry industry is one of the most profitable industries, offering the shortest possible time for nutritious meat and eggs for human consumption. The splendid expansion of industry is also due to the fact that it provides the main source of animal protein through meat and eggs at economical rate as compared to other sources of animal protein. In India, the poultry population has increased from 729.21 million to 851.81 million, according to this, the growth rate in poultry production was 16.81% as per 20th Livestock Census (DAHD, 2019). India is the 3rd largest egg producer in the world and the 5th largest broiler producer.

The economics of the poultry industry relies on feed. Feed additives used to reduce production cost by improve feed conversion ratio, growth rate and disease resistance. For over fifty years, the tradition of feeding livestock with sub-therapeutic antibiotic levels has been in use. Use of antibiotics has negative effects on animal health and its production. Recently, the focus is on searching for herbal formulations that could be useful for stress relief and contribute to an increase in bird production. Use of herbal plant is considered to be safe without having side effects for enhancing the performance of birds. Herbs could be expected to serve as feed additives due to their suitability and preference, lower cost of production, reduced risk of toxicity, minimum health hazards and environment friendliness (Devegowda, 1996) [7].

The effect of fenugreek as a natural feed additive on broiler chick performance has also been widely observed. Fenugreek leaves and seeds have been used extensively to prepare extracts and powders for medicinal uses (Basch *et al.*, 2003) [5]. Several researchers have showed that the fenugreek have hypoglycemic, anthelmintic, antibacterial, anti-inflammatory and antipyretic properties (Ahmadiani *et al.*, 2001; Basch *et al.*, 2003) [2, 5]. It is rich in protein, fat, total carbohydrates and minerals such as calcium, phosphorus, iron, zinc, magnesium (Gupta *et al.*, 1996) [9], fatty acids predominantly linoleic, linolenic, oleic and palmitic (Schryver, 2002) [11].

Onion bulbs possess numerous organic sulphur compounds including Trans-S-(1-propenyl) cysteine sulfoxide, S-methylcysteine sulfoxide, S-propylcysteine sulfoxides and cycloalliin,

flavonoids, phenolic acids, sterols including cholesterol, stigma sterol, b-sitosterol, saponins, sugars and a trace of volatile oil compounds mainly of sulphur compounds. Most of the plant components contain compounds with proven antibacterial, antiviral, antiparasitic, antifungal, antihypertensive, hypoglycemic, anti-thrombotic, anti-hyperlipidemic, anti-inflammatory and antioxidant properties. Therefore, the present study was carried out to investigate the effect of herbal feed additives such as Fenugreek (*Trigonella foenum-graecum*) and Onion (*Allium cepa*) in different dietary levels in broiler chicks to improve the performance of broilers.

Materials and Methods

The present experiment was conducted during 2021 at Poultry unit of College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur (Rajasthan) on two hundred ten (210) unsexed, apparently healthy, day-old ('VENCOBB-400') broiler chicks of same hatch purchased from Kewal Ramani Hatcheries Pvt. Ltd. Ajmer. The experimental broiler chicks were wing banded for identification and weighed individually before starting the experiment. The broiler chicks were divided randomly into 7 treatment groups (T₁-T₇) with three replicates under each treatment. The ISO certified basal feed in the form of broiler pre- starter, broiler starter and broiler finisher was procured from feed distributor "Udaipur Kukkut Utpadak Sahkari Samiti Ltd.", Udaipur (Rajasthan) in sufficient quantity. Fenugreek Seeds and Onion Bulbs were procured from local market of Sikar (Rajasthan) in sufficient quantity than processed and stored in air tight plastic containers for further use. The T₁ i.e., control group was fed on basal diet, while, group T₂ and T₃ were supplied with 1%

and 2% fenugreek seed powder, respectively. Whereas group T₄ and T₅ were supplied with 1% and 2% onion powder, respectively and group T₆ and T₇ were supplied with 0.5% fenugreek seed powder and 0.5% onion powder and 1% fenugreek seed powder and 1% onion powder, respectively in the basal broiler pre-starter, starter and finisher ration. Fenugreek seed powder and onion powder were mixed with basal feed and used for feeding of experimental broiler chicks. Feed and water were supplied ad libitum.

The metabolism trial was conducted in last week of feeding trial. Two birds per replicate under each treatment were randomly selected and shifted to metabolic cages. The adaptation period was about two days followed by five days collection period. During the collection period the data for quantity of feed offered, left over and excreta voided were recorded in order to determine the utilization of nutrients. Dropping trays covered with aluminium foil paper were used for total excreta collection on daily basis for five days. The representative samples of droppings from each replicate were oven dried at temperature of about 80 °C for 24 hours to remove the moisture content and to bring the faeces to a constant weight. The five-day collection of such oven dried excreta of each group was mixed and ground to pass through 1mm sieve and was stored separately in air tight plastic containers for further analysis. Representative samples of treatment mixtures used for feeding were also collected and oven dried to obtain dry matter content of feed consumed. Samples of feed provided under various treatments and voided excreta were analysed for proximate principles as per AOAC (2016) [4] and the metabolizability of nutrients were calculated using the following formula:

$$\text{Metabolizability Coefficient of nutrients (\%)} = \frac{\text{Unit nutrient intake (g)} - \text{Unit nutrient outgo (g)}}{\text{Unit nutrient intake (g)}} \times 100$$

For estimation of pH samples from the intestine of the broilers were collected after slaughter and stored in the laboratory at refrigerated temperature of 4°C till further analysis. The pH of the intestinal contents was measured with the help of digital pH meter equipped with a combined glass electrode. The data obtained to all the parameters were subjected to ANOVA as per Snedecor and Cochran (1994) [12]. The significance of mean difference was tested by Duncan's New Multiple Range Test (DNMRT) as modified by Kramer (1957) [10].

Result and Discussion

Metabolizability of nutrients

There was highly significant difference in the mean values of metabolizability of nutrients viz. Organic matter, Crude fiber and Ash, significant difference in the mean values of Dry matter and Ether extract and non-significant difference in the mean values of Crude protein and NFE (Table 1). The highest ($P < 0.01$) values of Organic matter, Crude fiber and Ash were 82.48, 43.98 and 52.05, respectively and found in T₆ group and lowest values were found to be 75.82, 40.05 and 45.52,

respectively in control group. The higher ($P < 0.05$) values of Dry matter and Ether extract were found to be 75.85 and 80.08, respectively and found in T₆ group and lowest values were found to be 70.02 and 72.12, respectively in control group. Numerically highest values of Crude protein and NFE were found 83.78 and 80.11, respectively in T₆ group and numerically lowest values were found to be 78.12 and 77.78, respectively in control group. Similarly, Abdel-Azeem (2006) [1]; Toson and Latif (2021) [13] observed significant increase in total serum protein level in broilers fed fenugreek seed powder supplemented diet. The present finding accordance with that increased level of fenugreek seed powder to 2% in diet of turkey chicks cause significant increase in digestibility of NFE% and this may be due to saponin content in fenugreek seed powder that stimulate insulin activity (EL-Mallah *et al.*, 2005) [8]. The effect of fenugreek seed on digestion and absorption of nutrients may be due to long contact between the digesta and mucosal epithelium so that positive impact on intestinal morphology (Boguslawska-Tryk *et al.*, 2012) [6].

Table 1: Effect of fenugreek seed powder and onion powder on metabolizability of nutrients

Metabolizability (%)	Treatment Groups							SEM
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	
	C	1% FSP	2% FSP	1% OP	2% OP	0.5% FSP +0.5% OP	1% FSP + 1% OP	
Dry matter*	70.02 ^b	72.74 ^a	70.13 ^b	72.44 ^{ab}	73.14 ^a	75.85 ^a	74.84 ^a	1.240
Organic matter**	75.82 ^c	76.09 ^c	77.26 ^{bc}	78.11 ^b	80.27 ^{ab}	82.48 ^a	81.65 ^a	1.340
Crude protein	78.12	79.18	80.05	79.53	81.72	83.78	81.89	1.614
Ether extract*	72.12 ^b	75.13 ^b	75.82 ^{ab}	76.23 ^a	77.85 ^a	80.08 ^a	78.72 ^a	1.496
NFE	77.78	77.93	78.14	78.82	79.05	80.11	79.78	0.973
Crude fiber**	40.05 ^e	40.98 ^{de}	41.13 ^d	41.80 ^{cd}	42.78 ^{bc}	43.98 ^a	43.02 ^{ab}	0.349
Ash**	45.52 ^d	46.62 ^{cd}	48.88 ^{bc}	47.09 ^c	50.33 ^{ab}	52.05 ^a	51.69 ^a	0.840

C: Control FSP: Fenugreek Seed Powder OP: Onion Powder
Means with different superscripts in a row differ significantly

Evaluation of Gut Health Intestinal pH

The pH was recorded from the parts of intestine viz., duodenum, jejunum and ileum. There was non-significant effect of supplementation of fenugreek seed powder and onion powder on intestinal pH. Numerically highest values of

duodenum and jejunum pH were found to be 6.42 and 6.58 in T₆ group and numerically highest ileum pH was recorded 7.11 in T₇ group. The lowest value of duodenum pH was found to be 6.17 in T₂ group and lowest jejunum pH was found 6.28 in T₇ group while lowest ileum pH was found to be 6.79 in T₃ group.

Table 2: Effect of fenugreek seed powder and onion powder on Intestinal pH in broiler chicks

Intestine pH	Treatment Groups							SEM
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	
	C	1% FSP	2% FSP	1% OP	2% OP	0.5% FSP +0.5% OP	1% FSP + 1% OP	
Duodenum pH	6.28	6.17	6.23	6.35	6.32	6.42	6.19	0.107
Jejunum pH	6.35	6.30	6.42	6.47	6.52	6.58	6.28	0.153
Ileum pH	6.83	6.91	6.79	6.98	7.01	7.05	7.11	0.138

C: Control FSP: Fenugreek Seed Powder OP: Onion Powder
Means with different superscripts in a row differ significantly

Conclusion

The present feeding trial on herbal feed additive Fenugreek (*Trigonella foenum-graecum*) seed powder and Onion (*Allium cepa*) powder alone and in combination indicated their potential in the ration of broiler chicks as far as metabolizability of nutrients and evaluation of gut health are concerned. Present study concluded that inclusion of 0.5% fenugreek seed powder and 0.5% onion powder with basal diet is very effective and could be a viable suggestion for worth, while raising of broilers for meat production.

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