

## Feeding of Azolla (*A. microphylla*) to Kadaknath Birds for their Growth and Survivability

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**ABSTRACT:** Kadaknath is an uncommon black meat chicken (BMC) breed of India which is famous for its quality of meat and their health benefits. The main problems with this species in farmer's fields and intensive care facilities are high mortality, illness rates, and low development rates. The main aim of this study was to see the effect of supplementary feeding as well as the feed replacement effect of azolla (*A. microphylla*) on kadaknath birds for their growth and survivability. Azolla is a free floating water fern that floats in water and fixes atmospheric nitrogen in association with the nitrogen fixing blue green alga, *Anabaena azollae*. *Azolla pinnata* is most commonly used as a feed substitute for livestock as well as on poultry, piggery and fish. The main aim of this study is to find out the impact of feeding of improved variety of *Azolla* i.e *A. microphylla* feeding to kadaknath birds (1 month old). Fresh *Azolla microphylla* ponds (3'× 6') size was used for experimental purpose. 600 kadaknath chicks (4 weeks old) of same age, weight was selected and distributed randomly into 3 groups of 200 birds each, In T<sub>1</sub> (control) kadaknath birds were fed normal feed, in T<sub>2</sub> group normal diets along with @ 5% extra supplementary feed) on DM basis were fed, and in T<sub>3</sub> group 5 % replacement of normal feeds with fresh *Azolla microphylla* (DM basis) were given. The growth rate, mortality rate was recorded periodically for all the three groups of the experiments. The data on growth rate, mortality rate showed significant changes in *Azolla* fed kadaknath birds (T<sub>2</sub>) as compared to control groups (T<sub>1</sub>). The main challenge of this study was availability of the birds as per requirement of the study and their maintenance during experimental periods. This study not only save the money of the kadaknath growers but also helps them to maintain their Kadaknath stock healthy which will add increase the quality of meat and eggs.

**Keywords:** Kadaknath birds, black meat chicken, *Azolla microphylla*, Growth, Rate, Mortality.

### INTRODUCTION

Kadaknath is an uncommon black meat chicken (BMC) breed of India. They have a dominant gene (EDN3 gene) that causes hyper-pigmentation (fibro-melanosis), making the chicken mostly black in color e.g feathers, beak, tongue, and other their internal organs. Kadaknath bird is a small-sized bird with small shanks whose body weight in adult cock and hen is 1.5 kg and 1.2 kg, respectively (Jena *et al.*, 2018). The average age at first egg is 6 months and the egg production potential of this breed is somewhat less, which goes up to 80 to 120 eggs (Thakur *et al.*, 2006). Their fertility and hatchability percentage are (80 to 85%) and (83 to 90%) respectively. Consumers prefer Kadaknath meat due to its desirable flavor and lean meat (0.11 to 0.52% abdominal fats) as compared to broiler meat (1.74 to 1.85% abdominal fats). Increased demand for healthier meat among consumers has led to the rearing of Kadaknath birds in intensive and semi-intensive systems around the major cities in India. The main

problem with this kadaknath bird is slow growth rate, high mortality rate and low egg production in intensive as well as in extensive system. To address these challenges this research work was planned with *A. microphylla* as a feed supplement and as a feed replacement. *Azolla pinnata* is used as a feed for broiler chicken (Basak *et al.*, 2002; Alalade and Iyayi 2006), duck (Becerra *et al.*, 1990), rabbit (Sadek *et al.*, 2010), Small ruminant (Tamang *et al.*, 1993) and ruminants. The use of *Azolla* as a supplementary fodder for different animals suggested and advocated by different researcher due to its simple cultivation process, high nutritive value, and fast-growing feed. Prabha and Kumar (2010); Rai *et al.* (2012) reported the body weight gain in the broiler poultry birds when supplemented with *Azolla* feed along with normal diet. Parthasarathy *et al.* (2002) reported that the cost of input in broiler production system cost more than 70% of the total cost. *A. microphylla* is an improved variety of *Azolla* which grows naturally in water with the temperature range of 10-37°C (Becerra *et al.*, 1995).

Azolla contains relatively high levels of nitrogen and an attractive protein source for animal feed, not only for the livestock and poultry (Buckingham *et al.*, 1978). Azolla is also rich in iron (1000–8600 ppm dry weight), copper (3–210 ppm dry weight) manganese (120–2700 ppm dry weight), vitamin A (300–600 ppm dry weight), vitamin A (300–600 ppm dry weight), chlorophyll and carotenes. It contains 4.8–6.7% dry weight crude fat, with 6.1–7.7% and 12.8–26.4% total fat for the polyunsaturated acids omega 3 and omega 6 fatty acid (Paoletti *et al.*, 1987). Lumpkin and Plucknett (1982); Van Hove and Lopez (1983) all concluded that azolla is the most promising aquatic plant for livestock feed due to its ease of cultivation, productivity and nutritive value. Azolla's use as a feed for fish, swine and poultry was also tested and recommended by Alcantara and Querubin (1985) and Tran and Dao (1979) reported that one hectare of azolla can produce 540-720 kg of protein per month. The basic idea of selection of *A. microphylla* against *A. Pinnata* is their high temperature tolerance and fast growth (Kamalasanana *et al.*, 2002). *Azolla microphylla* has the advantage of being a feed ingredient for poultry, namely its high protein content of 20-35% (Biplob *et al.*, 2002). It contains vitamins A and B12 and amino acids (lysine 0.46%, methionine 0.05%, and amino acid glutamate 1.54% (Nuraini and Mirzah 2021). Kadaknath is a native of Jhabua which is wild in nature prefer leafy vegetable, leaves, earthworm to fulfill their nutritional needs mostly and like to roam freely in Jungles. The population of this bird is decrease day by day so people started rearing these birds in intensive system under deep litter system which is not all suited and their performance decreases day by day. So, to fulfill their nutritional needs and to satisfy their behavioral needs *Azolla mircophylla* tried for this experiment.

## MATERIALS AND METHODS

The experiment was done at kadaknath Unit of KVK Jhabua and in the farmer fields under On Farm Trail. For production of Azolla at established pits of azolla used and, in the farmers, field azolla pits were prepared (6 × 3) feet size with help of bricks and cement. In each pit 20 kg of soil poured and make a soil bed 1-2 cm. thick evenly. Each pit filled with water up to the height of 15-20 cm. Around 2.5 kg. Old cow dung/vermicompost and 15-20 gm. of SSP mixed in 10 liters of water to make slurry and poured into water bed. Then added about 100-150 g fresh *A. microphylla* culture. The mother culture of *A. microphylla* was collected from Kanyakumari (Tamilnadu) and prepared mother culture at KVK Jhabua under the guidance of Dr K. Pillai and distributed to the farmer's field also for their propagation and for experimental purposes. Harvesting was done after 5 to 7 days and offered to Kadaknath birds after harvesting washing was done with clean water. For experimental purpose kadaknath chicks were selected and reared under same diet and same condition and from same lot of parent birds after attaining their age of 1 month, 600 grower kadaknath

birds were selected which have equal shape and size and weight randomly and grouped into 3 groups using Randomized Block Design which is further divided in 2 sub-groups or replicates with 200 chicks in each. Fresh Azolla culture were used (3'×6' size) for experiments. In T<sub>1</sub> (control) Group (200) two hundred kadaknath birds were fed normal diet (Table 2) only which contains nutrients (Table 1), T<sub>2</sub> group were fed basal commercial diets along with @ 5% extra supplementary feed (fresh azolla on DM basis), and in T<sub>3</sub> group 5 % replacement of basal diets with fresh azolla (DM basis) were fed. All the diets (starter and finisher) were prepared as per BIS (1992). The growth rate, mortality rate was recorded periodically for all the three groups of the experiments and data recorded.

Sufficient management conditions like floor space, light, temperature, ventilation and relative humidity were provided to each of the groups. During the experimental period, they were fed *ad libitum* on replicate basis and provided with clean and wholesome water. Data on Initial and final body weight gain was recorded. The data obtained were statistically assessed by the Analysis of Variance through SPSS (17.0) Software considering replicates as experimental units. Duncan's multiple range tests was used to test the significance difference between the differences of significant at 0.01 and 0.05 %.

## RESULTS AND DISCUSSION

The growth performance of the grower kadaknath birds fed different levels of Azolla meals is presented in the Table 3. Average final weight of the birds at 140 days show were significantly different in T<sub>2</sub> group (p<0.05) in which they attain body weight of 1680±3.9g. The average value for the gain in live weight in control group T<sub>1</sub> was 1423.0±3.5 whereas corresponding gain in the live weight in T<sub>2</sub> and T<sub>3</sub> was 1680.0±3.9 and 1583.0±4.50 respectively. Increased fiber contents owing to increasing levels of Azolla meal in the broiler diets could be the reason for this decreased gain. Highest value for gain in live weight was exhibited in T<sub>2</sub> group whereas lowest value was recorded in the T<sub>1</sub> group. The feed consumption in T<sub>2</sub> group is more which may be due to improved digestibility (7.35 kg) as compared to T<sub>1</sub> (5.60 kg) and T<sub>2</sub> (6.95 kg) as described in Table 4.

*Azolla pinnata* meal successfully introduced in the ration of broiler and layer chickens and their result is very much appreciating (Querubin *et al.*, 1986; Bhuyan *et al.*, 1988; Dhumal *et al.*, 2009; Pannerker, 1988) which is reflecting in this experiment also in case of *A. Microphylla*. Pillai *et al.* (2002) reported that it is not only the nutrients, but also other components, like carotenoids, bio-polymers, probiotics are present which contribute to increase their body weight gain and to maintain the health of the birds. *Azolla microphylla* has advantages as feed ingredients for poultry because it proliferates and has high protein but contains high fiber. Therefore, fermentation with lignocellulolytic fungi was carried out to improve the nutritional quality of *Azolla microphylla*. Senthil *et al.* (2020) reported

Azolla can be easily digested by the livestock and poultry as it contains high quality protein and low lignin content which is reflected in the birds body weight gain. The average bodyweight gain was observed to azolla fed kadaknath birds in supplemented as well as in replaced group as compared to control group which is similar to report presented by Rai *et al.* (2012). Lakshmanan *et al.* (2017) reported the use of azolla as a potential feed and their nutritional facts in broiler chicken likewise kadaknath birds also Subudhi and Singh (1978) concluded that about 20% of commercial feed can be replaced by fresh Azolla in the diet of young chickens but in the current experiments we have replace only 5% which is quite effective beyond this digestion of kadaknath birds disturbed, significant reduction in growth rate was observed when azolla was included in the diet at a level of 16 % (Singh and Subudhi 1978). Basak *et al.* (2002) reported improvement in live weight, feed conversion ratio, protein and energy efficiency, dressing percentage and profitability was reported in broilers (7-42 days) fed diet with 5 % azolla which is in line with the current experiments. Basak *et al.* (2002) done experiments on broilers which shows use of Azolla meal up to 5% in the broiler ration found to be effective and the performance of broiler improved as in the case kadaknath also.

The mortality rate of kadaknath birds in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> group were 6 %, 2% and 3% respectively, (Table 5) which is reflects the promising effect of feeding of *A. microphylla* in Kadaknath birds as in these birds 10% mortality in intensive condition is considered normal. Table 6 shows the cost of rearing of T<sub>1</sub> group was found to be of Rs. 96200 whereas in T<sub>2</sub> group despite of feeding azolla (Rs. 5/birds) the cost comes around Rs. 97600 and in T<sub>3</sub> due to replacement of feed cost comes around Rs. 93100 only. The profit in the T<sub>3</sub> group of bird was found to be of Rs. 104430 followed by T<sub>2</sub>, Rs. 101960 and lowest in T<sub>1</sub> group Rs. 95360, which is quite impressive and justify the rearing of kadaknath birds with feeding of azolla. Azolla covers the surface of water in full grown situations which prevents mosquitoes to prolife rate their population and restrict their breeding (Rajendaran and Reuben 1998), but none of the literature supports their study. In the present study the reduction in the fly population was observed which can be due their fast-growing nature and symbiotic property which need to be explored further.

**Table 3: Overall growth performance of Kadaknath birds from 4<sup>th</sup> to 24<sup>nd</sup> week of age (gm/birds).**

Age of the Birds	T <sub>1</sub> weight in(gm)	T <sub>2</sub> weight in(gm)	T <sub>3</sub> weight in(gm)
Initial body weight	169.0±0.5	183.0 ±0.5	180.0±1.5
1 -2 Month	501.0 ± 3.6	512.0±1.4	507.0±3.4
2 - 3 Month	1081.0±2.4	1201±3.8	1107.0±0.71
3 - 4 Month	1102.0±3.4	1311.0±4.4	1205.0±2.6
4 – 5 Month	1508.0±3.1	1618±4.7	1403.0±4.2
Final body weight	1423.0±3.5	1680±3.9*	1583.0±4.5

**Cost of Production.** The economics was worked out by comparing the expenditure taught on total amount of feed consumed by kadaknath birds from 4<sup>th</sup> to 24<sup>nd</sup> week of age, and selling after 24<sup>nd</sup> week, to obtained income. The average weight produced was 1423.0±3.5g, 1680±3.9 and 1583.0±4.5g in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> group, respectively. The respective output at the end of experiment was Rs. 188, 000.00 in control groups (T<sub>1</sub>) and, Rs.1,96,000 and Rs. 1,96,000 live birds produced in treatment T<sub>2</sub> and T<sub>3</sub> groups, respectively. Thus, the net profit was Rs. 95,360 in control and Rs. 1,01,960 and 1,04,430 in treatment T<sub>2</sub> and T<sub>3</sub> groups, respectively, yielding a cost benefit ratio of 1.95 in control and 2.01and inT<sub>2</sub> and T<sub>3</sub> groups, respectively (Table 6). Similarly, the percentage of *Azolla i.e.,*5% of basal feed could be replaced by supplementing fresh *Azolla* meal in the diet (Shukla *et al.*, 2018) will increases weight gain and bird mortality was reduced by 3% (Badariprasad *et al.*, 2018). The cost of growing kadaknath birds up to the age of 8 month is exceed more than 75% due to their long rearing periods which can be reduced by supplementing Azolla in their feeds in contrary to the report of Parthasarathy *et al.* (2002).

**Table 1: Proximate Analysis of *Azolla microphylla*.**

Sr. No.	Nutrients	<i>Azolla microphylla</i> (Dry Matter)
1.	Crude protein	26.75%
2.	Ether Extract	4.02%
3.	Crude Fiber	12.72%
4.	Nitrogen Free Extract	36.13%
5.	Total Ash	18.08%
6.	Ca	2.05%
7.	Phosphorus	0.75%

**Table 2: Normal basal feed composition of kadaknath birds (Handbook of Animal Husbandry, 2008).**

Sr. No.	Ingredients (Grower layer feed)	Basal diet (%)
1.	Maize (Yellow)	27.10
2.	Wheat bran	15
3.	Rice police DOC	40
4.	Soybean cake	10
5.	Fish meal	6
6.	Lime stone	0.8
7.	bone meal	0.6
8.	Mineral mixture	0.1
9.	Toxin binder	500gm/ton
10.	Salt	0.4

**Table 4: Average feed intake of Kadaknath birds during 4<sup>th</sup> to 24<sup>nd</sup> week of age (5 month of old).**

Particulars	Feed intake By Kadaknath birds up to end of the experimental period (140 days )
T <sub>1</sub>	5.60 kg
T <sub>2</sub>	7.35 kg
T <sub>3</sub>	6.95 kg

**Table 5: Mortality in kadaknath birds during the trial.**

Groups	No. of birds started with (n=200)	Mortality(No.)
T1	200	12
T2	200	04
T3	200	06

**Table 6: Cost of production and economics of kadaknath birds during trial (4<sup>th</sup> to 24<sup>nd</sup> week).**

Parameters	Control (T <sub>1</sub> )	Treatment T <sub>2</sub>	Treatment T <sub>3</sub>
Quantity of basal feed per kadaknath birds /day (grams)	100 gm	100 gm	95 gm
Quantity of basal feed fed from 4 <sup>th</sup> to 24 weeks/ 200 kadaknath birds (kgs)	2800 kg	2800 kg	2650 kg
Quantity of Azolla fed / kadaknath birds /day (grams)	0 gm	5 gm	5 gm
Quantity of Azolla fed /200 kadaknath birds / from 4 <sup>th</sup> to 24 weeks (kgs)	0 kg	140 kg	140 kg
Expenditure	84000	84700	80200
Cost of kadaknath birds at 4 weeks of age (Rs. 60/ chick)	12000	12000	12000
Cost of basal feed	30/kg	30 /kg	30 /kg
Cost of production of Azolla /kg (Rs. 5/ kg)	0	700	700
Electricity and miscellaneous (Rs. 1 / chick)	200	200	200
Total expenditure	96200	97600	93100
Income			
No. of birds Selling	188	196	194
Selling of birds (Rs. 1000/ live per birds)	188000	196000	194000
Selling of litter	3000	3000	3000
Selling of gunny bags @ 10/bag	560	560	530
Net income	191560	199560	197530
Net profit (b-d)	95360	101960	104430
Cost-benefit ratio	1.95	2.01	2.08

## CONCLUSIONS

The unorganised poultry sector which contributes around 20% of total poultry population, Kadaknath is one of them reared by tribal as well as selected poultry growers. The growth of poultry industry was limited during the last two fiscal years because of the pandemic especially organised sector but unorganised sector shown less impact of lockdown. However, due to high price of maize and soy meal the cost of production is more, hence kadaknath growers started searching alternate source of feed in which *Azolla microphylla* solve their problems. The palatability, digestibility and their potential to prevent birds from disease further improved their demand.

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**Conflicts of Interest.** None.

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