

*Original Research***Effect of Different Dietary Levels of Untreated and Copper Sulphate Treated Mustard Oil Cake (*Brassica campestris*) on Growth Performance and Nutrient Utilization of Broiler Chickens**Mridushmita Sonowal<sup>1\*</sup>, Hassan Farooque Ahmed<sup>2</sup> and Pranjal Borah<sup>3</sup><sup>1</sup>Livestock Research Station, AAU, Hekra, Mondira, Kamrup (R) - 781127, Assam, INDIA<sup>2</sup>Department of Animal Nutrition, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-781022, Assam, INDIA<sup>3</sup>Goat Research Station, AAU, Burnihat-793101, Kamrup (M), Assam, INDIA\*Corresponding author: [mridusassam@gmail.com](mailto:mridusassam@gmail.com)

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**Abstract**

An experiment was conducted to study the growth performance and nutrient utilization of 280 numbers of day old broiler chicks for 42 days, which were randomly divided into equal seven groups with two replicates and offered ad lib diets containing no MOC ( $T_1$ ) or untreated MOC and  $CuSO_4$  treated MOC (@ 8g/kg) at 10 ( $T_2$  and  $T_3$ ), 15 ( $T_4$  and  $T_5$ ) and 20 % ( $T_6$  and  $T_7$ ) levels respectively. Body weight gain (g) were significantly ( $P<0.01$ ) higher in  $T_3$  and  $T_5$  group while significantly lower ( $P<0.01$ ) gain was found in  $T_4$ ,  $T_6$  and  $T_7$  group than control. Highly significant ( $P<0.01$ ) differences was observed in FCR among the different treatment groups and no significant difference was observed in digestibility of organic nutrients. The study conclude that MOC treated with  $CuSO_4$  @ 8g/kg meal can be incorporated in the diet of broiler chicken upto 15 % level with a distinct economic advantage.

**Key words:** Broiler Chickens, Glucosinolates, Mustard Oil Cake

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**Introduction**

Mustard oil cake (MOC) is a good protein source for livestock which possess comparable metabolisable energy content to groundnut cake with better availability of lysine, nitrogen and better gross protein value. Despite its high nutritive value and availability, mustard oil cake is not being incorporated in the diet of poultry at a desired level or as a total replacement of protein in the diet due to presence of anti-nutritional factors like glucosinolates (50-120 $\mu$ mol/g oil extracted seed meal). Various information are available on detoxification of these anti-nutritional factors present in *Brassica* spp (Banday and Verma 2003a; Tyagi

2002). Treatment of MOC with copper sulfate solution to reduce antinutritional factor (Banday and Verma, 2003a) was found to be a cheaper and simpler method, but data on its level of incorporation was sparse. Hence, it was aimed to study the growth performance and nutrient utilization of broiler chickens at different dietary levels of untreated and copper sulfate treated mustard oil cake.

### Materials and Methods

The experiment was conducted on 280 day old broiler chicks for 42 days of age. The birds were randomly divided into equal seven groups based on body weight with two replicates of 20 birds each. MOC procured from local market was pretreated with copper sulphate following the procedure described by Banday and Verma (2003a) in order to reduce the glucosinolates content.

**Table1:** Chemical composition of experimental diets (on % DM basis) for starter and finisher

Nutrients	Treatments						
	T1 (0% MOC)	T2 (10% MOC)	T3 (10% TMOC)	T4 (15% MOC)	T5 (15% TMOC)	T6 (20% MOC)	T7 (20% TMOC)
<b>Dry Matter (DM)</b>							
Starter	89.5	89.25	89.8	89	89	89.25	89.5
Finisher	89.5	89	90	89.65	89.25	89.05	89.25
<b>Crude Protein</b>							
Starter	22.5	22.05	22.75	22.75	22	22	22.05
Finisher	19.5	19.55	19.65	19.05	19	19.85	19.45
<b>Crude Fibre</b>							
Starter	6.1	6.25	6.12	6.25	6.28	6.55	6.53
Finisher	6.05	6.25	6.23	6.35	6.3	6.55	6.5
<b>Ether Extract</b>							
Starter	6.5	6.25	6.25	6.75	6.6	6.75	6.75
Finisher	6.75	6.85	6.85	6.45	6.75	6.5	6.6
<b>NFE</b>							
Starter	51.9	51.7	50.9	51.1	51.87	51.35	51.35
Finisher	54.7	54.27	54.12	54.15	54.6	53.85	54.45
<b>Total Ash</b>							
Starter	13	13.75	13.88	13.15	13.25	13.35	13.32
Finisher	13	13.08	13.15	13	13.35	13.25	13
<b>Calcium</b>							
Starter	1.31	1.3	1.31	1.33	1.32	1.3	1.31
Finisher	1.12	1.12	1.1	1.15	1.11	1.07	1.13
<b>Phosphorus</b>							
Starter	0.71	0.72	0.71	0.7	0.73	0.72	0.74
Finisher	0.7	0.71	0.73	0.72	0.77	0.72	0.71
<b>Total Glucosinolate</b>							
Starter	-	1.13	0.26	1.7	0.39	2.26	0.52
Finisher	-	1.15	0.26	1.7	0.39	2.26	0.52
<b>Gross Energy(Kcal/kg)</b>							
Starter	4081	4043	4010	4088	4095	4077	4078
Finisher	4155	4165	4150	4136	4148	4110	4119

MOC : Untreated Mustard Oil Cake; TMOC : Treated Mustard Oil Cake

Seven iso-caloric and iso-nitrogenous mesh diets were prepared for starter (0-3 weeks) and finisher (4-6 weeks) broilers as per BIS (1992) specifications using conventional feed ingredients. The control (T1)

group was offered a diet which contained no MOC. Experimental birds of group (T<sub>2</sub>), (T<sub>4</sub>) and (T<sub>6</sub>) were offered untreated MOC @ 10, 15 and 20 % level and group (T<sub>3</sub>), (T<sub>5</sub>) and (T<sub>7</sub>) were offered copper sulphate treated MOC @ 10, 15 and 20 % level. The birds were fed *ad lib* throughout the experiment in intensive system of rearing as per standard practices.

Body weights of the individual birds were recorded at weekly interval in the early morning before feeding. The average feed intake of different experimental groups were calculated out daily from the difference of quantity of feed offered and the residual feed collected from the feeder in the next day morning. A metabolism trial was conducted for 3 days with 5 representative birds from each group at the end of feeding trial. The cost of production was also calculated. Proximate principles of feed, residue left and excreta were analyzed according to AOAC (2016); calcium and phosphorus were estimated as per the modified methods of Talapatra *et al.* (1940). The glucosinolate in raw and treated MOC was analyzed as per the methods of McGhee *et al.* (1965). Statistical analysis was done as per the method of Snedecor and Cochran (1994).

### Results and Discussion

The mean total feed intake, body weight gain, feed conversion ratio, nutrient digestibility and cost of production of the experimental birds under different treatment groups has been presented in Table 2. Mean total feed intake (g) of experimental birds under different copper sulphate treated groups (T<sub>3</sub>, T<sub>5</sub> and T<sub>7</sub>) were found to be significantly higher ( $P < 0.01$ ) than the corresponding untreated groups. Copper sulphate treatment of MOC improves palatability and reduces glucosinolates content, which might be due to the interaction of copper ions and glucosinolates, hence limiting its hydrolysis to form the toxic moieties and thus reducing its harmful effect on palatability and feed intake (Pailan and Singhal, 2003). The lower feed intake along with higher levels of inclusion of raw MOC (T<sub>2</sub>, T<sub>4</sub> and T<sub>6</sub>) might be due to reduced appetite, as erucic acid content in mustard oil cake causes pathological change in the intestine (Sonowal *et al.*, 2017). However, Fenwick *et al.* (1982) reported that, presence of glucosinolates like sinigrin and progoitrin impart bitter taste to the diet and thereby reduces the feed intake. The lowest feed intake among all the experimental groups was found with the diet where 20 % untreated MOC (T<sub>6</sub>) was incorporated. The glucosinolate content of this group was found to be many fold higher (2.26 % *i.e.* 52.8  $\mu$  mol per g) than the tolerance level of birds which is reported as 11.6  $\mu$  mol per g for broiler birds (Lesson *et al.* 1987). The pungent smell and biting taste of hydrolysis products of glucosinolates reduce the palatability of feed resulting reduced total feed intake (Bell, 1984 and Hill, 1991).

Highest body weight gain of the birds for the experimental period was observed in the group which was fed with 10 % treated MOC (T<sub>3</sub>), whereas the lowest gain was observed in group fed with 20 % untreated MOC (T<sub>6</sub>). The highest body weight gain in the T<sub>3</sub> group may be due to the lowest glucosinolate content following copper sulphate treatment of the diet. The hydrolyzed products of glucosinolates after coming in contact

with enzyme myrosinase yields several toxic moieties (isothiocyanates, oxazoline-2-thione, nitrile and thiocyanates) due to molecular rearrangements. These substances inhibit the function of thyroid hormone and thyroxine formation (Tripathi and Mishra, 2007) which is an important hormone needed for maintaining basal metabolic rate and might be the reason for the lowest body weight gain in the group T<sub>6</sub> where 20 % untreated MOC were incorporated. Toghyani *et al.* (2009) reported that, rapeseed meal at higher level impairs the performance of broiler birds. The mean feed conversion efficiency was best in the group which were fed with 10 % treated MOC (T<sub>3</sub>) followed by 15 % (T<sub>5</sub>) and both the groups were showed significantly (P<0.01) higher efficiency of feed conversion than the control. The better efficiency of feed conversion found probably due to better nutrient utilization especially the dietary protein. This finding was in congruency with the findings of Banday and Verma (2003b) who reported significantly better feed conversion efficiency with 15 % copper sulphate treated rapeseed meal over the same level of untreated rapeseed meal. Higher feed conversion efficiency was also reported by Toghyani *et al.* (2009) while feeding high levels of rapeseed meal to the broilers.

**Table 2:** Feed intake, body weight gain, feed conversion efficiency, nutrient digestibility and cost of feeding of experimental birds under different treatment groups

Parameters	Treatment						
	T1 (0% MOC)	T2 (10% MOC)	T3 (10% TMOC)	T4 (15% MOC)	T5 (15% TMOC)	T6 (20% MOC)	T7 (20% TMOC)
Feed intake (g)	3877.89 <sup>e</sup> ±2.950	3829.59 <sup>d</sup> ±1.145	4005.90 <sup>e</sup> ±0.255	3801.55 <sup>c</sup> ±1.250	3953.10 <sup>f</sup> ±9.600	3718.49 <sup>a</sup> ±3.390	3718.49 <sup>a</sup> ±3.390
Body weight gain (g)	1816.85 <sup>c</sup> ± 18.05	1794.35 <sup>c</sup> ± 19.99	1927.87 <sup>d</sup> ± 20.01	1648.75 <sup>b</sup> ± 15.26	1882.12 <sup>d</sup> ± 17.49	1517.50 <sup>a</sup> ± 20.14	1652.37 <sup>b</sup> ± 20.72
Feed conversion efficiency	2.132 <sup>c</sup> ± 0.002	2.133 <sup>c</sup> ± 0.000	2.077 <sup>a</sup> ± 0.005	2.305 <sup>e</sup> ± 0.000	2.100 <sup>b</sup> ± 0.000	2.450 <sup>f</sup> ± 0.002	2.270 <sup>d</sup> ± 0.005
<b>Nutrient digestibility</b>							
Dry matter	60.52 ± 0.09	60.77 ± 0.22	60.78 ± 0.23	60.37 ± 0.14	60.59 ± 0.19	60.39 ± 0.18	60.54 ± 0.22
Crude protein	53.25 ± 0.44	53.16 ± 0.37	54.02 ± 0.44	52.77 ± 0.34	53.34 ± 0.40	52.67 ± 0.72	52.91 ± 0.57
Ether extract	81.00 ± 0.12	80.94 ± 0.47	81.34 ± 0.34	80.98 ± 0.31	81.19 ± 0.30	80.94 ± 0.47	80.88 ± 0.36
Crude fiber	22.26 ± 0.12	21.89 ± 0.30	22.27 ± 0.17	22.08 ± 0.06	21.83 ± 0.21	22.02 ± 0.36	22.18 ± 0.19
Cost of feeding/kg weight gain (Rs)	25.38	24.74	24.15	26.26	23.91	27.64	25.6

Means bearing different superscripts within a parameter differ significantly (P<0.01); MOC : Untreated Mustard Oil Cake; TMOC : Treated Mustard Oil Cake

No significant difference (P>0.05) was observed in digestibility of dry matter, crude protein, ether extract and crude fibre in different groups fed different dietary levels of treated and untreated MOC indicating no effect of levels or treatments of MOC on dietary organic matter digestibility. The cost of feeding per kg body weight was lowest (Rs 23.91) in the group (T<sub>5</sub>) where 15 % treated MOC was incorporated in the diet. Deng (1993) also reported similar findings when incorporated detoxified rapeseed meal in broiler diet.

## Conclusion

Based on different parameters studied and cost of per kg live weight gain, it may be concluded that, mustard oil cake treated with copper sulfate at the rate of 8g per kg meal can be incorporated in the diet of broiler chicken upto 15 % level with a distinct economic advantage.

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