Studies on the Effects of Mustard Seed Meal and Oil on the Growth Performance of Broiler Chicks

1.**Muhammad Tahir**, Department wildlife, fisheries and zoology, university of agriculture Faisalabad
2.**Ayesha Muhammad Ali,** Department wildlife, fisheries and zoology, university of agriculture Faisalabad
3.**Faryal Gohar**, Institute of Zoology Bahauddin Zakariya university Multan
4.**Sania Bashir**, Department of physiology, University of veterinary and animal sciences Lahore
5.**Muhammad Bilal**, Department of Chemistry, University of Agriculture Faisalabad
6.**Muhammad Kamal**, Department of Zoology, government college university Faisalabad
7.**Muhammad Mahmood**, Department of Zoology, Government College University Faisalabad
8.**Sajid Abbas Khan**, Department of Zoology, government college university Faisalabad
9.**Amara Akhtar**, Department Of Wildlife, Fisheries And Zoology, University Of Agriculture Faisalabad
Corresponding Author : Amara Akhtar , Amara.akhtar47@gmail.com

Abstract
Mustard (*Brassica juncea L.*) is one of the most extensively grown and versatile plants. It is also known as Indian mustard which belongs to the family Brassicaceae. Poultry is one of the largest agricultural sectors and poultry meat is an essential source of animal proteins for people all around the world. The present research work was designed to check the effect of mustard seed meal and oil as a food additive with 3%, 6% and 9%. The growth performance was calculated by the weight gain percentage and absolute weight gain on the weekly basis and specific growth rate, survival rate and Feed conversion ratio.Maximum weight was observed in 3% mustard meal (151) and minimum was observed in 9% mustard meal (126).maximum absolute weight was observed in 3% mustard meal (256) and minimum was 6% oil (164.75). Mortality was observed in 3% meal through all the treatments one chick died in 3% mustard meal. Maximum specific growth rate was observed in 9% meal(19.69) and minimum in the 6% oil (18.16) and maximum feed conversion ratio was observed in the 9% meal (1.73) and minimum was observed in 6% oil (1.05). All data was statistically analyzed using a one-way ANOVA followed by Newman-Keuls test.

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Introduction

The fast-growing global population has increased the demand for animal protein in human diets. The current world population of 7.3 billion is estimated to attain 8.5 billion by 2030, 9.7 billion in 2050 and 11.2 billion in 2100 . Soon this population growth will necessitate more than 70% increase in food production to be able to meet human needs (Popp et al 2013). As one of the driving forces for food security and sustainable development, animal production is very crucial to any nation. The poultry production sector in many countries has been playing a crucial role in the provision of animal protein in the form of eggs and lean meat (Ola Rotimi *et al.* , 2017).

Feed is a basic component for every living organism for their survival and metabolic process. In the poultry industry feed is always a key factor for meat production. Feed cost accounts for about 70% of poultry production and hence, the success of the business venture is dependent on the quality of feed that is produced (Banson *et al.* 2015). Herbs are used in the chicken production sector as growth stimulants instead of antibiotics that enhance the nutrient intake and immune system stimulation. By using strain selection and growth boosters poultry producers have been successful in achieving the highest weight increase at the lowest possible production cost. To increase feed utilization, increase meat quality and growth and reduce production costs some growth-promoting chemicals are used. Their antioxidant antifungal and antibacterial qualities medicinal herbs are regarded as secure growth-promoting substances. *(*Abdulameer *et al., 2015.*

Mustard increases the growth performance and weight gain of broiler chicks. This increases the feed intake or feed metabolism that is due to thyroxine hormones. Mustards contribute to the metabolism in the body such as the maximum release of thyroxine hormones stimulates more absorption of nutrients. Thyroid hormones are essential for body metabolism that causing an increase in metabolic rate and higher protein use in the body for broiler chick growth (Abd El-Hack *et al.* 2018)

Mustard seeds (Brassica) are a very good source of organo-Sulphur compound known as glucosinolates, phosphorus, manganese, dietary fiber and omega-3 fatty acids (Kumar., 2011).Mustard seed meal is an important source of protein for animals since it has a higher metabolisable energy content than groundnut meal. That improved lysine and nitrogen availability and a higher gross protein value. Because anti-nutritional components such as glucosinolates are present. mustard meal is not being used at the appropriate amount or as a complete protein substitute in poultry diets (Banday and Verma., 2003.

Mustard meal contained Glucosinolates, dietary fiber, magnesium, selenium, iron calcium, protein, niacin, zinc and omega-3 fatty acids. These are utilized as growth stimulants to prevent and treat intestinal disorders in chicken diets (Kumar *et al.* 2011). Mustard meal has a lower protein content, higher crude fiber content and lower metabolizable energy than SBM. Research Council of the United States. Mustard meal protein has the highest protein efficiency ratio of all the plant-based proteins utilized in feed materials. which is a result of its well balanced essential amino acid content. Mustard meal is a good supplier of selenium and phosphorus in particular as well as other important minerals including potassium sulfur calcium and iron (Bell *et al.* 1999).

Mustard oils are typically utilized as energy sources in broiler chick diets (Jalali *et al.*, 2015). The color of mustard oil ranges from yellow to brown. The aroma and flavor of mustard oil are distinct. Mustard oil contains 20 to 28 percent oleic acid 9 to 9.5 percent linolenic acid 10 to 12 percent linoleic acid and 30 to 40 percent erucic acid among other fatty acids (Abul-Fadl *et al.* 2011).

Among various fatty acids, omega-6 (ω-6) and omega-3 (ω-3) fatty acids are proving indispensable in a properly maintained ratio for numerous biological, physiological, developmental, reproductive and beneficial health functions. Adequate supplementation of poultry diets with novel and beneficial feed additives or supplements is gaining importance as it significantly improves overall poultry production and performance as well as safeguards the health of birds (Lee *et al* 2019).

The advantages of using oils in poultry diets involves a reduction of feed dust and improvement in hydrolysis and absorption of the lipoproteins that supply fatty acids (Nobakh et al 2013). In addition, oils are the main source of energy for the birds and have the highest caloric value among all dietary nutrients. They can also enhance the absorption of fat-soluble vitamins, increase diet palatability and improve the utilization of the consumed energy. Moreover the rate of food passage through the gastrointestinal tract can be reduced with subsequent better absorption of all dietary nutrients (Pourghasemi 2013).

The effect of the herbal plant such as mustard seeds as an alternative to antibiotics in poultry production. MS-treated diet resulted in an increase in BW, FI and BWG during the grower and finisher stages compared with the control group. This increase can be attributed to improved gastrointestinal function and enhanced enzymatic excretion of broilers. Improvement in body weight gains can be attributed to the bio-agent components of herbal plants that improve metabolic activities and absorption of macro and micronutrients. Moreover these bioactive components boost birds' appetite which results in the improvement of overall growth performance. Although their possible impression on the health and productivity of the bird. High doses of some herbs, spices and essential oil may lower growth performance, physiological function and immune response.

Mustard Meal had higher metabolizable energy (ME) and apparent ideal crude protein (CP) digestibility that gave slightly better performance of broilers although its glucosinolate content was higher (34.3 vs 21.8-25.5 µmole/g) . Mustard Meal which contains 45.7% CP, 1.69% ether extract (EE) and 6.5% crude fiber (CF) can be incorporated in broiler diet at 10% without any adverse effect on growth . Mustard can be incorporated in a broiler diet at 10% during 1-2 weeks of age or at 20% only in week 3-4. Carcass quality was not affected by MM with the exception of the enlarged thyroid glands.

Objectives

In this study the effects of feeding broiler chicks diets containing solid state fermented mustard meal and mustard oil on their growth performance were examined.

- To demonstrate the effects of mustard seed meal and oil on the growth and development of broiler chicks.
- To investigate the impact of Mustard seed meal and oil on the proximate composition of broiler chicks
- to investigate the role of mustard oil in enhancing broiler chick cellular metabolism as growth simulator

Materials And Methods

Poultry succeeded in obtaining maximum weight gain at low production cost using some selective growth promoters. Some growth promoting agents are applied to enhance feed efficiency, growth meat quality and minimize production costs. The objective of study to assess the impact of mustard seed meal and oil on the proximate composition and growth performance of broiler chicks. The experiment was carried out in the zoology lab of the Department of Zoology, Wildlife and Fisheries at the University of Agriculture (pars) Faisalabad.

Experimental Conditions:

Broiler chicks were taken from Jadeed GP Hatchery, Sargodha. Broiler chicks were put in cages where they were acclimatized to new experimental conditions for one week. chicks were fed once a day on basal diets.The pH and temperature of the water were measured by an AMPROBE pH meter before the trial began. Wire mesh cages were used to provide aeration for chicks.

Experimental Diets and Ingredients:

Ingredients of experimental diets were taken from the local market. Before making experimental fat-based diets, ingredients were ground and strained for getting specific particle size. The diets were created using mustard seed meal and oil as a base. Each experimental diet formulated was made by supplementing different levels of mustard seed meal and oil viz. 0%, 3%, 6% and 9% .

Feeding Protocol:

The chicks were fed according to 2% of their wet body weight. 4 chicks were stocked in each experimental cages. The feeding once a day in every morning. After that, unconsumed diets were collected from the cages and the cages were cleaned and refilled in pots every day. That un-consumed diet was collected and was used in FCR determination

Table 3.1: Composition of experimental diets with Mustard seed meal levels:

Ingredients	Control	%Mustard seed meal in diet			% of Mustard oil in diet		
		3%	6%	9%	3%	6%	9%
Corn	45.0g	45.0g	45.0g	45.0g	30.0g	30.0g	30.0g
Soya bean	40.0g	1.5g	3.0g	4.5g	55.0g	55.0g	55.0g
Wheat muffle	15.0g	1.5g	3.0g	4.5g	15.0g	15.0g	15.0g
Total	100g	100g	100g	100g	100g	100g	100g

Growth performance and Feed utilization:

Weekly gross weight measurements of the chicks from each treatment were used to assess growth performance. By removing uneaten feed from the chicks' cage, feed utilization was measured. Growth performance and feed utilization can be evaluated in terms of Feed conversion ratio specific growth rate (SGR) specific weight gain (WG) and absolute weight gain (WG) (FCR).

Weight gain (%):

The formula below was used to calculate weight gain:

$$Weight\ gain\ \% = \frac{Final\ weight - Initial\ weight}{Initial\ weight} X100$$

Absolute weight gain (AWG):

The absolute weight gain was measured by subtracting the final weight from the starting weight of the chicks.

Absolute weight gain (g) = Final weight (g) – Initial weight (g)

Specific growth rate (SGR):

SGR for chicks was determined as follows:

$$SGR = \frac{In[Initial\ weight\ -Final\ weight\ ]}{Experimental\ duration\ in\ days}\ X100$$

Survival rate (%):

Survival rate of chicks was determined as:

$$Survival\ rate\ (\%) = \frac{Final\ number\ of\ chicks}{Initial\ number\ of\ chicks} X100$$

Feed conversion ratio (FCR):

Feed use was determined using FCR.

$$FCR = \frac{Total\ dry\ feed\ intake\ (g)}{Net\ weight\ gain\ (g)}$$

Statistical analysis:

ANOVA was used to statistically analyze the data (One-way analysis of variance). When comparing data means the student Newman-Keuls test was employed and a probability of p 0.05 was applied (Snedecor and Cochran, 1991).

Results and Discussion

Effect of different levels of (3%, 6% and 9%) mustard seed meal and mustard seed oil an on growth and feed utilization of Broiler chicks

Growth performance of broiler chicks fed with mustard seed meal and mustard seed oil with basal die (soybean wheat muffle and corn) was observed during the trial. Weight gain absolute weight gain specific growth rate survival rate and FCR were determined in terms of growth performance. The density of chicks in each cage is 4.

Table 4.1: Effect of Mustard seed meal and mustard seed oil diets on weight gain of Broiler Chicks

Table 4.4: Effect of Mustard seed meal and mustard seed oil diets on percentage average weight gain of Broiler Chicks

week	T0	T1	T2	T3	T4	T5	T6
	Control	(3% MEAL)	(6% MEAL)	(9% MEAL)	(3% OIL)	6% OIL)	9% OIL)
Initial	45	46	43	42.74	43.5	44.9	42.76
final	305.25	265	207.75	243.25	299.66	285.5	292.75
eve wt. gain	205.25	165	107.75	43.25 1	199.66	185.5	192.75

It is observed that in comparison of Mustard seed meal and mustard seed oil , the maximum average weight gain was shown in T0 treatment (205.25) fed with basal feed and minimum average weight gain was observed in T6 with 9% mustard seed oil (143.25). Total average weight gain of chick fed with mustard seed meal and oil is shown in Table 4.4

Table 4.5: Effect of Mustard seed meal and mustard seed oil diets on absolute weight gain of Broiler Chicks

week	T0 Control	T1 (3% MEAL)	T2 (6% MEAL)	T3 (9% MEAL)	T4 (3% OIL)	T5 6% OIL)	T6 9% OIL)
Initial	45	46	43	42.74	43.5	44.9	42.76
final	305.25	265	207.75	243.25	299.66	285.5	292.75
A wg	260.25	219	164.75	200.51	256.16	240.6	249.99

It is observed that in comparison of Mustard seed meal and mustard seed oil , the maximum absolute weight gain was shown in T1 treatment (225) fed with 3% mustard seed meal and minimum absolute weight gain was observed in T6 with 9% mustard seed oil is 129.49. Total average weight gain of chick fed with mustard seed meal and oil is shown in Table 4.5.

Table 4.8: Effect of Mustard seed meal and mustard seed oil diets on survival of Broiler Chicks

	control	3% oil	6% oil	9% oil	3%meal	6%meal	9%meal
	T0	T1	T2	T3	T4	T5	T6
initial	4	4	4	4	4	4	4
final	4	4	4	4	3	4	4

survival rate	100	100	100	100	75	100	100

It is observed that in comparison of Mustard seed meal and mustard seed oil , the maximum absolute weight gain was shown in T0,T2,T3,T4,T5 and T6 treatment was observed 100% survival and T1 and had 75% survival rate. Total survival rate of chick fed with mustard seed meal and oil is shown in Table 4.8

Table 4.11: Effect of Mustard seed meal and mustard seed oil diets on specific growth rate of Broiler Chick

	control	3%meal	6%meal	9%meal	3%oil	6%oil	9%oil
	Av. Wt	**Av. Wt**	**Av. Wt**	**Av. Wt**	**Av. Wt**	**Av. Wt**	**Av. Wt**
initial	45	46	43	42.74	43.5	44.9	42.76
Final weight	305.25	265	207.75	243.25	299.66	285.5	292.75
SGR	19.86	19.17	18.16	18.94	19.71	19.49	19.69

It is observed that in comparison of Mustard seed meal and mustard seed oil the maximum Specific growth rate was shown in T0 treatment (19.86) fed with basal feed and minimum Specific growth rate was observed in T2 with 6% mustard seed oil (18.16). Total Specific growth rate of chick fed with mustard seed meal and oil is shown in table 4.11.

Table: 4.15: Effect of Mustard seed meal and oil on feed conversion rate of Broiler

	T0	T1	T2	T3	T4	T5	T6
	Control	3% oil	6%oil	9% oil	3%meal	6%meal	9%meal
Total feed intake	2987	3295	2115	2668	3262	3101	3976
Twg	2259	2291	2004	1934	2353	2368	2297
FCR	1.322	1.438	1.055	1.379	1.386	1.309	1.730

It is observed that in comparison of Mustard seed meal and mustard seed oil the maximum feed conversion rate was shown in T0 treatment (1.63) fed with basal feed and minimum Specific growth rate was observed in T3 with 9% mustard seed oil (1.05). Total Specific growth rate of chick fed with mustard seed meal and oil is shown in table 4.15.

It has been found that when comparing mustard seed meal and mustard seed oil the treatment T1 treated with 3% mustard seed meal exhibited the highest average weight (151±105.62) and the treatment T3 (126±80.22) showed the lowest absolute weight gain. The difference between the diets was not significant (P>0.05).However broiler chicken weight increase was shown to be decreased with

greater mustard concentrations (30 to 40%) due to the effects of glucosinolates (>30 mol/g) , a growth inhibitor. This was observed by Franzon et al. (1998) results are not supporting the present research results as In comparison to the control group the MS treated diet increased during the grower and finisher stages BW FI and BWG. This rise can be linked to broilers' improved digestive health and increased enzymatic excretion. The bio-agent components of herbal plants which enhance metabolic processes and nutrient absorption are responsible for improvements in body weight growth. These bio active elements increase the appetite of birds, which enhances their general growth performance

It was found when comparing Mustard seed meal and seed oil. The T0 treatment exhibited the highest feed conversion rate (1.63). While the T3 treatment showed the lowest specific growth rate, 9 % mustard seed oil (1.05). The outcomes are consistent with those of Gawecki et al. (1986) Trappett (2001) who found that layers of chicken given mustard containing diets had better FCR values as mustard levels in diets increased (20 to 40%). The findings of the current study supported those of Rojas et al. (1985) and Leeson et al. (1987) who discovered that no feed intake reduction was noticed when mustard was used up to 15%. However From 0 to 21 days and from 36 to 40 days when larger quantities (up to 40%) of mustard were used in the diets broilers chicken were fed a lower diet. According to Nassar and Arscott (1986) and Franzon et al. (1998) the precise cause of the decrease in feed intake was unknown; its flavor and high fiber content were likely to blame. The findings of this study imply that the improved Growth performance and a decreased FCR in MS patients may be related to bioagents' effects on the enhancement of antioxidants and general health factors. In 2019 Ripon Rashid also proposed the idea that the inclusion of natural herbs had no effect on the broiler's ability to thrive. In this study low blood cholesterol levels and a reduction in the effects of stress were caused by alpha-linolenic acid in MS

Average mortality rates for birds fed diets T0 T1 T2 T3 T4 T5 and T6 were tracked throughout the trial was 0% with the exception of the 3% meal that had a 25% mortality rate. This was in line with what Campbell and Slominski had noted (1999) supporting the present study as the quick growth, excellent feed efficiency and massive pectoral muscle mass Ascites was the primary cause of fatalities. The volume of modern chicken's lungs is little. body weight ratio prevents the respiratory system from being able to keep up with the broilers increased oxygen demands which can cause hypoxia and respiratory acidosis (Kiiskinen (1985) support the present study as Ascites arises as a result of acidosis impact on cellular membrane integrity reduction in free radical clearance transude blood vessel leakage and accumulation in the abdomen cavity. According to Rajasekhara Reddy and No mortality was seen in broiler chicks given sesame cake and soybean meal in place of fish meal at levels of 25 and 50 percent so their results showed dissimilarities with present study. In broiler diets Veena show dissimilarities in our results as the different dietary treatments comprising the oil cakes had no appreciable impact on mortality because the total mortality rate was only 2.32 percent.

Summary

The outcome of present research reflected that broiler chicken weight gain was to be decreased with greater mustard concentrations due to the effects of glucosinolates (>30 mol/g) , a growth inhibitor. In the comparative study of mustard oil and meal maximum weight was observed in 3 % meal (because it

contains a minimum amount of Glucosinolates by comparing other treatments. Control treatment has maximum weight gain throughout the treatment. Feed intake was observed maximum in the control (1.63) and minimum in the 9 % Mustard oil (1.05) because it contains maximum Glucosinolates. Mortality was observed in treatment with 3% meal due to high consumption of feed. Body weight ratio prevents the respiratory system from being able to keep up with the broiler's increased oxygen demands which can cause hypoxia and respiratory acidosis.

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