Effects of Feed Supplemented with Mealworm Meal Premix on Production Performance, Fertility Hatchability and Survival of Newly Hatched Chicks in Indian Peafowl (Pavo Cristatus)

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ABSTRACT

This study was conducted to investigate the effect of mealworm meal (MWM) premix supplementation on the production performance, fertility, hatchability, and survival of newly hatched chicks in breeding peafowl kept in captivity. Production performance was significantly enhanced by the supplementation with MWM premix. Hatchability and fertility were also significantly increased with increase in MWM premix supplementation. Survival and performance of newly hatched chicks were improved with Supplementation. From the results of the present study, it was concluded that MWM premix supplementation enhanced the productive performance, fertility, hatchability, and performance of newly hatched chicks in peafowl kept in captivity.

Keywords: Fertility, Hatchability, Peafowl, Production performance, Worm Meal

INTRODUCTION

In poultry production productivity and profitability is greatly influenced by breeding fertility, hatchability, and survival of newly hatched chicks. There are many factors which effect fertility and hatchability like egg weight (Caglayan *et al.,* 2009), storage period (Oral Toplu *et al.,* 2007), age of flock (Seker, Bayraktar, 2004), breeding type (Ozbey and Esen, 2007), sex ratio (Narinc *et al.,* 2013) and composition of hen diet (Praes *et al.,* 2014) in poultry species. The diet composition is an effective factor that influenced egg production, weight, and hatching characters in poultry. Protein level in the diet is one of the important factor that influence egg production and weight. Increase in quantity and quality of supplied protein enhanced egg production and improved egg weight (Shim *et al.,* 2013). The protein level of breeder hen diet is one of the factors that influenced the hatching characters and embryonic mortality.

Peafowl are omnivorous which fed on green crops, grains, and insects in their natural environment (Naseer *et al.,* 2017). In their natural habitat they forage in agricultural field and fed on a variety of available feed stuffs they find (Johansgard, 1986). In captivity they are deprived from their natural habits of feeding and raised on commercial feed available for broiler breeders and broiler. To maximize the production performance of peafowl kept in captivity a balanced diet with optimum protein level is required (Leeson and Caston (1996). The protein levels of breeder diet is also important for hatching characters and embryonic mortality. Survival of newly hatch chicks, fertility and hatchability was higher in birds fed with diet high containing high protein as compared to those having low protein diet (Mohiti-Asli *et al.,* 2012). Due to natural habitat destruction and other factors posed a severe threat to the survival of peafowl. Obliteration of natural habitats enforced an urgent need of ecological and feeding behavior related studies to understand the requirements so that wild population

may be conserved. Therefore, it is important to optimize the protein level in diet of breeding peafowl for better performance and breeding practices.

Objectives:

1: To investigate the effects of diet supplemented with MWM premix on production performance, fertility, and hatchability of breeding Peafowl hen.

2: To study the effect of MWM premix supplementation on the performance and survival of newly hatched chicks.

METHODOLOGY

Preparation of Mealworm meal premix:

MWM premix was developed from the Meal worms produced in the Meal worm lab established under PSF funded project PSF/NSLP/KP-UAP (709) in the University of Agriculture were collected and oven dried for 02-04 hours at 60-80 ^{0}Ċ. The dried worms were crushed to make powder and was analyzed for proximate composition. Meal worm powders were supplemented with fish waste powders at the rate 150 g per kg. The fish waste was collected from local fish hotels, sun dried and powdered in the department of Poultry Science.

Birds housing and grouping

The preset study was carried out at a private pheasantry near Peshawar, Khyber Pakhtunkhwa, province, Pakistan during March through July 2021 for a period of twelve weeks. A total of 12 adult peafowl (8 ♀ + 4 ♂ ratio) of almost similar body weight and age were used for this study. All the birds were kept in open cages 10x10x12 ft dimension provided with a 5x5x4 ft covered area. Peafowls were divided in to four experimental groups (A, B, C, D) having a Sex ratios (1♂: 2♀) for each experimental group. All the birds in experimental groups A were provided with 150g of commercial broiler breeder ration per bird as per prevailing practice, while birds in groups B, C, and D were provided with same amount of commercial broiler breeder ration supplemented with MWM premix at the rate of 20, 40 and 60g per kg of ration. Unconsumed feed was weighed and removed from each feeding pot to record feed intake by each replicate (Khan *et al.*, 2006). Total and average feed intake per peafowl was calculated on weekly basis. Egg production and weight were recorded daily from the onset of egg laying. (Zou and Wu, 2005). The egg weight mass was used to calculate feed conversion ratio (FCR) = Feed consumed/Kg egg mass production (Khan, 2001). To calculate the fertility ratio the eggs were transfer to incubator for incubation at 37.7°C and 65% moisture for 29 days in the development section, and at 37.5°C and 90% moisture for the last 3 days (Cetin and Kirikci, 2000). The fertility and hatchability rate were calculate as described by (Ugurlu *et al.*, 2017). Fertility = Number of fertile eggs / total number of eggs set.

Hatchability = Number of chick hatched / total eggs of eggs set

Rearing of newly hatched chicks

The newly hatch chicks were assigned to four groups on basis of their origin and broiler starter ration as per prevailing practice was provided and supplemented with MWM premix at the rate of 20, 40 and 60g per kg of ration. The newly hatched chicks were studied for weight gain, feed intake and survivability rate for a period of four weeks.

Statistical analysis

Data on production performance of breeding Peafowl and survival of newly hatched chicks was collected within in specific duration for each supplemented group. Completely Randomized Design (CRD) was set to

analyze the collected data using statistical software (Statistix 8.1) and LSD test was used to link the differences among all selected parameters.

RESULTS

Effect of MWM premix supplementation on Production performance of breeding peafowl (Table 1)

Feed consumption and conversion ratio (FCR): Feed consumption were non significantly (P>0.05) affected by supplementation of MWM premix in breeding peafowl. All the treatments groups (A, B, C, D) consumed almost similar feed. The MWM premix supplementation significantly (P<0.05) improved the FCR. Improved and better FCR was recorded for Groups D, C and B which were supplemented with worm meal premix as compared to control group.

Table 1. Effect of MWM premix supplementation on Production performance of breeding peafowl.

Parameters	Groups	Weeks											
		1	2	3	4	5	6	7	8	9	10	11	12
Feed intake	A	345^{a}	346^{a}	345^{ab}	344^{a}	344^{a}	345^{a}	344^{a}	344^{a}	344^{a}	344^{a}	345^{a}	344^{a}
	B	342^{a}	342^{a}	341^{ab}	342^{a}	343^{a}	342^{a}	342^{a}	342^{a}	341^{ab}	341^{a}	341^{a}	341^{a}
	C	341^{a}	342^{a}	341^{ab}	340^{a}	340^{a}	340^{a}	341^{ab}	341^{a}	341^{ab}	341^{a}	341^{a}	341^{a}
	D	340^{a}	339^{a}	341^{ab}	339^{a}	340^{a}	339^{a}	339^{a}	339^{a}	339^{a}	339^{a}	339^{a}	339^{a}
	P.Value	0.11	0.18	0.13	0.17	0.16	0.15	0.19	0.16	0.11	0.12	0.16	0.17
FCR	A	0.00	4.15^{a}	2.07^{a}	2.06^{a}	1.38^{a}	1.38^{a}	2.06^{a}	1.38^{a}	2.06^{a}	2.06^{a}	4.14^{a}	0.00
	B	0.00	0.00	2.04^{a}	1.36^{b}	1.37^{a}	1.36^{a}	1.36^{b}	1.36^{a}	1.36^{b}	2.04^{a}	0.00	0.00
	C	0.00	0.00	2.04^{a}	1.02^{c}	1.36^{a}	1.02^{b}	0.81^{c}	1.02^{b}	1.02^{c}	1.36^{b}	0.00	0.00
	D	0.00	2.03^{b}	1.02^{b}	0.81^{d}	0.81^{b}	0.67^{c}	0.67^{c}	0.81^{c}	1.01^{c}	1.01^{c}	1.35^{b}	0.00
	P.Value	0.00	0.05	0.03	0.04	0.05	0.02	0.01	0.02	0.02	0.04	0.01	0.00
Egg weight	A	00	62^{ab}	64^{bc}	65^{b}	65^{b}	65^{b}	66^{b}	67^{b}	66^{c}	66^{c}	67^{b}	0.00
	B	00	66^{ab}	67^{ab}	66^{b}	67^{b}	67^{b}	68^{b}	70^{b}	70^{b}	70^{b}	0.00	0.00
	C	00	66^{ab}	68^{a}	70^{a}	72^{a}	73^{ab}	70^{b}	70^{b}	72^{b}	75^{ab}	0.00	0.00
	D	00	71^{a}	73^{a}	76^{a}	78^{a}	80^{a}	80^{a}	82^{a}	85^{a}	85^{a}	84^{a}	0.00
	P.Value	0.00	0.14	0.11	0.15	0.04	0.05	0.02	0.01	0.05	0.03	0.01	0.00
Egg production	A	00	01^{b}	02^{c}	02^{c}	03^{b}	03^{ab}	02^{b}	03^{b}	02^{ab}	02^{ab}	01^{b}	0.00
	B	00	00	02^{ab}	03^{b}	03^{b}	03^{ab}	03^{b}	03^{b}	03^{ab}	02^{ab}	00	00
	C	00	00	02 ^{ab}	04^{a}	03^{b}	04^{b}	05^{a}	04^{a}	04^{a}	03^{ab}	00	00
	D	00	02^{a}	04^{a}	05^{a}	05^{a}	06^{a}	06^{a}	05^{a}	04^{a}	04^{a}	03^{a}	00
	P.Value	0.00	0.05	0.04	0.05	0.05	0.03	0.05	0.04	0.06	0.06	0.01	0.00
Fertility	A	00	00	82^{ab}	82^{a}	85^{a}	84^{ab}	84^{ab}	84^{ab}	84^{ab}	84^{ab}	00	00
	B	00	00	85^{a}	83^{a}	85^{a}	85^{a}	85^{a}	85^{a}	85^{a}	85^{a}	00	00
	C	00	00	86^{a}	83^{a}	86^{a}	86^{a}	86^{a}	86^{a}	86^{a}	86^{a}	00	00
	D	00	00	85^{a}	84^{a}	85^{a}	85^{a}	85^{a}	85^{a}	85^{a}	85^{a}	00	00
	P.Value	0.00	0.00	0.07	0.06	0.10	0.15	0.17	0.21	0.19	0.12	0.00	0.00
Hatchability	A	00	00	63^{ab}	65^{ab}	65^{ab}	65^{ab}	65^{ab}	65^{ab}	65^{ab}	65^{ab}	65^{ab}	00
	B	00	00	66^{a}	65^{ab}	65^{ab}	65^{ab}	65^{ab}	65^{ab}	65^{ab}	65^{ab}	00	00
	C	00	00	65a^{b}	66^{a}	66^{a}	65^{ab}	65^{ab}	66^{a}	66^{a}	66^{a}	00	00
	D	00	00	66^{a}	67^{a}	67^{a}	69^{a}	67^{a}	68^{a}	68^{a}	67^{a}	67^{a}	00
	P.Value	0.00	0.00	0.10	0.14	0.11	0.18	0.10	0.14	0.12	0.11	0.00	0.00
Hatching chick weight	A	00	00	38^{ab}	40^{ab}	40^{c}	40^{c}	42^{c}	42^{c}	40^{c}	40^{c}	00	00
	B	00	00	41^{a}	42^{a}	45^{ab}	43^{b}	43^{bc}	43^{bc}	43^{bc}	43^{bc}	00	00
	C	00	00	41^{a}	42^{a}	46^{a}	45^{a}	45^{b}	45^{b}	45^{b}	45^{b}	00	00
	D	00	00	42^{a}	43^{a}	47^{a}	49^{a}	49^{a}	49^{a}	49^{a}	49^{a}	00	00
	P.Value	0.00	0.00	0.11	0.06	0.05	0.01	0.01	0.02	0.00	0.01	0.00	0.00

Egg weight and production performance

Supplementation showed significant effect on egg weight and production. Mean egg weight in group D and C was significantly ($P<0.05$) higher (71-85 g) and (66-75g) respectively as compared to groups B (66-70) and A (62-67g). Similarly, significantly high number of eggs (2-6) per week was produced by the peahens of group D followed by group C as compared to group B and A.

Fertility and hatchability

Supplementation of MWM premix to the diet of breeding Peafowl hen positively influenced the egg fertility rate. The maximum number of fertile eggs (84-85%) were produced by birds in Group C, followed by group B and D as compared to group A. Similarly, percent hatchability was also enhanced with supplementation. Significantly high hatchability ratio (65-68%) was recorded for eggs obtained from group D, while minimum hatchability ratio was recorded for group A.

Hatching chick weight (g)

The MWM premix supplementation in the diet of breeding peafowl significantly improved ($P<0.05$) the weight of newly hatched chicks. The newly hatched chick weight was higher of the group D (42-49 g), C (41- 46 g) and (41-45 g) as compared to A (38-42 g).

Effect of MWM premix supplementation on hatching chick's performance

Feed intake (g) (Table 2)

The feed intake was significantly affected with supplementation of MWM premix. Group supplemented with high level had improved the feed intake as compared to groups supplemented with low level of the premix.

Table 2. Effect of MWM premix supplementation on hatching chick's performance Feed intake (g).

Parameters	Groups	Weeks			
		1	2	3	4
Feed intake	A	660^{b}	923^{c}	1360^{b}	2134^{ab}
	B	660^{b}	950^{b}	1567^{a}	2135^{ab}
	C	780^{a}	956^{b}	1556^{a}	2140^{a}
	D	785^{a}	1154^{a}	1560^{a}	2143^{a}
	P.Value	0.00	0.02	0.00	0.06
Weight gain	A	400^{c}	480^{d}	630^{d}	786^{c}
	B	455^{c}	546^{c}	711^{c}	790^{c}
	C	490^{b}	611^{b}	723^{b}	801^{b}
	D	510^{a}	623^{a}	745^{a}	812^{a}
	P.Value	0.02	0.03	0.01	0.05
Livability %	A	80^{c}	80^{c}	90^{b}	100^{a}
	B	90^{b}	90^{b}	100^{a}	100^{a}
	C	100^{a}	90^{b}	100^{a}	100^{a}
	D	100^{a}	100^{a}	100^{a}	100^{a}
	P.Value	0.00	0.00	0.05	0.99

Weight gain and Livability of Peafowl Chicks

The MWM supplementation in different levels significantly ($P<0.05$) improved the weight gain of chicks. Peafowl Chicks weight gain of group D and C had significantly high ($P<0.05$) mean weight gain (812 g), (801 g) respectively as compared to group B and A. Similarly, livability was also higher in group D (100 %) and C (100 %) as compared to Group B (90 %) and A (80 %).

CONCLUSION

Present study concluded that MWM premix supplementation enhanced the productive performance, fertility, hatchability, of breeding peafowls in captivity. Supplementation also improved the chicks weight, growth performance and survival of newly hatched peafowl chicks.

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