



## The Effect of Diet type (Mash, Pellets, Extruded and Crumble) on some Immune Responses Broiler Chicken

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**ABSTRACT:** New processing methods of feed in poultry feed industry with changing the feed physical and chemical structures can increase the availability and digestibility of nutrients and influence some immune responses. The aim of this study is evaluating the effect of diet type (mash, pellets, extruded and crumble) on some immune responses. For this purpose 240 one day ROSS 308 chickens were used. Chickens were grouped as a CRD design with 4 treatments and 5 replications. During the experiment chickens freely access to food and water. The treatments consisted of mash diet, pelleted diet, crumbles diet and extruded diet. All diets were identical in terms of all the nutrients and energy and protein levels. All diets were same in terms of all the nutrients and energy and protein levels. In this research, data were analyzed using SAS (2008) based on CRD design as a GLM method. Two chickens at the age of 25 days from each replication were selected and washed sheep red blood cells were injected into chickens. On day 30 of the experiment, blood was sampled from chickens by hemagglutination method to determine the level of antibody production against sheep washed red blood cells. Then with using prepared plasma specific antibodies production content against influenza and Newcastle diseases in chicken's blood serum were measured by hemagglutination inhibition method. In this study, the impact of diet types on the amount of antibody produced against the flu virus was not significant. However, the amount of antibody production against Newcastle virus in the mash treatment significantly was higher than in extruded treatment. Using crumble in comparison with extruded treatment caused to significant increase in antibody production against washed sheep red blood cells. However, between mash and pelleted treatments there were no statistical difference. Diet types had no significant effects on heterophile / lenfosit and lymphoid organ weights. Results showed that extruded diet type had no significant effect on heterophile / lenfosit, lymphoid organ weights and antibody content against flu virus.

**Keywords:** hemagglutination method, lymphoid organ.

### INTRODUCTION

World population growth and increasing demand for protein sources are greater than protein supply. To enhance the quality of food, a variety of processing methods on feed intake by animals, especially poultry rearing is to be placed at the highest level of quality. Nowadays, various commercial feed mills are producing different forms of feed for different age group of bird. Pelleting is a processing method that is employed by the feed manufacturers to improve farm animal performance. The physical form of feed (mash, pellet and crumble) is a crucial factor in meat yield of broiler. Various feed forms pellet, mash or crumble that to be supplied to chickens are the most important factor which directly influence the cost of mixed feed and production performance of broiler. The major objective of poultry feeding is the conversion of feedstuff into human food.

Mash is a form of a complete feed that is finely ground and mixed so that birds cannot easily separate out

ingredients; each mouthful provides a well-balanced diet. Mendes *et al.*, (1995) showed that birds fed mash diets had a better feed conversion efficiency than those given the pellet. Proudfoot and Hulan (1982) observed that the incidence of sudden death syndrome (SDS) was significantly higher for broilers fed on crumble-pellet or ground crumble-pellet form diet than for birds fed on mash.

Pellet system of feeding is really a modification of the mash system. It consists of mechanically pressing the mash into hard dry pellets or "artificial grains". Pellet is a form of complete feed that is compacted and extruded to about 1.8 inch in diameter and 1.4 inch in long (Banerjee, 1988). Asha Rajini *et al.*, (1998) reported that pellets had better-feed efficiency up to six-week age of birds. On the other hand Moran (1990) observed that pelleting of feed improves the body weight of poultry. Bolton and Blair (1977) reported that feed intake of broilers could be up to 10 per cent greater with crumble or pellets compared with mash.

It is generally accepted that the feeding of pellets improves broiler growth rate compared to mash (Nir *et al.*, 1994). Reasons for the enhanced performance may be due to decreased ingredient segregation, increased digestibility, reduction of energy during prehension, less time and energy expended for prehension, destruction of pathogenic organisms, thermal modification of starch and protein and increased palatability (Behnke, 1994). However, feeding pelleted rations is not enough to ensure enhanced performance of poultry (Jafarnejad *et al.*, 2010). The quality of pellets must be taken into account also. Crumble also is a type of feed prepared at the feed mill by pelleting of the mixed ingredients and then crushing the pellet to a consistency coarser than mash. Recently this form of feed has become popular in broiler production due to its convenience of feeding (Briggs *et al.*, 1999). The objective of the present study was to investigate the effect of pellet and mash diets on the broiler chicks' performance and carcass characteristics.

Crumble also is a type of feed prepared at the mill by pelleting of the mixed ingredients and then crushing the pellet to a consistency coarser than mash. Recently this form of feed is becoming popular in broiler production due to its convenience of feeding. Reece *et al.* (1984) observed that best feed conversion was obtained with a feeding of high energy level with high protein profile in crumble form of feed. Choi *et al.* (1986) reported that chicks fed the crumbled starter diet consumed more feed.

Researchers evaluated the effect of physical type of diet and salon temperature on performance and deduction of ascites syndrome in broiler chickens. For this purpose, 360 one day ROSS broiler male chickens were selected and they were fed and grown with three types of diet (pellets, crumble and mash) under 14°C and 23°C. Mean growth rate, feed consumption, feed conversion factor and the number of deaths from ascites syndrome were recorded and at the end of six-week hematocrit content and blood serum samples were determined. Results showed that deaths caused by ascites syndrome for mash feeding was lower than that under crumble and pellets diets. Hematocrit percentage, total weight of the right ventricle of the heart under pellet +cold were significantly higher than those under other treatments. These changes indicated that chickens treated with pellet +cold influenced by metabolic disturbance as a result of cold. This research showed that with decreasing weather temperature, pellets can cause to increase in metabolic activity and consequently resulted in hypoxia and ascites. They concluded that mash diet with reduction in feed consumption and energy gain can cause to decrease in growth rate in broilers and consequently deduction of ascites syndrome (Zang *et al.*, 2009).

2009 Feeding chickens in the first few days of life with food which have coarse particles (as crumbles) can prevent the contamination of egg yolk. Also, chickens due to gaining complete nutrients can enhance immune

system and improve tolerance against disease and other negative environmental factors. Chickens due to gaining complete nutrients can enhance immune system and body tolerance against different types of disease and other negative environmental factors.

Using mash diet in due to dust during feeding impaired bird respiratory structure and resulted in disease such as CRD. However, feeding with pellets can reduce these negative effects. Pellet system of feeding is really a modification of the mash system. It consists of mechanically pressing the mash into hard dry pellets or "artificial grains". Pellet is a form of complete feed that is compacted and extruded to about 1.8 inch in diameter and 1.4 inch in long (Banerjee, 1988). The greatest advantage in using pellets is that there is little waste in feeding. The disadvantage is that pellets are expensive-about 10 percent more expensive than that of feeds not pelleted. Asha Rajini *et al.* (1998) reported that pellets had better-feed efficiency up to six-week age of birds. On the other hand Moran (1990) observed that pelleting of feed improves the body weight of poultry. Bolton and Blair (1977) reported that feed intake of broilers could be up to 10 per cent greater with crumble or pellets compared with mash. Crumble also is a type of feed prepared at the mill by pelleting of the mixed ingredients and then crushing the pellet to a consistency coarser than mash. Recently this form of feed is becoming popular in broiler production due to its convenience of feeding. Reece *et al.* (1984) observed that best feed conversion was obtained with a feeding of high energy level with high protein profile in crumble form of feed. Choi *et al.* (1986) reported that chicks fed the crumbled starter diet consumed more feed. Feeding of each form of feed has its advantages and disadvantages. The effectiveness, digestibility and conversion efficiency of different forms of feed are also different. But limited research work has been performed to investigate the effect of feeding different forms of feed (mash, pellet and crumble) on the productive performance of broiler in Bangladesh. Crumble and pellet mixture, using smaller pellet and improve management can control and decrease ascites, sudden death syndrome (SDS) and cannibalism. Pellet consumption because of linking materials in it such as sodium bentonite also prevent increasing moisture content of environment due to water absorption characteristic.

Birds repeatedly due to various combinations of microbes exposed to poultry outbreaks. Under this unfavorable condition we aim to plan a diet program that can decrease disease risks and resulted in increasing of productivity and economical profit. Physical type of diet has direct effect on immune response of chickens. Gizzard of birds that feed with wheat or sorghum grain in comparison with those feed with mash grain were more active. Active gizzard is as a natural defensive mechanism of body against various types of microbes. This action prevent from degradation of oocytes (Nedeljko *et al.*, 2009).

As pressure to reduce and ultimately eliminate the use of antibiotics in poultry feed has increased, food safety standards have also been heightened. Recently, new guidelines targeted to reduce the incidence of *Salmonella* and *Campylobacter* contamination of poultry products were released by the United States Department of Agriculture's Food Safety and Inspection Service (USDA FSIS, 2010). Among the recommendations of this report are increasing the use of vaccines for these diseases, improving sanitation and biosecurity of production facilities, and depopulating flocks which are infected with *Salmonella enteritidis* (SE). More drastic steps have been taken in other countries, including a zero tolerance policy for *Salmonella* incidence on poultry meat products in China (USDA FAS, 2006).

#### MATERIALS AND METHODS

In order to conduct this research, 240 Ross 308 chicks were used in a completely randomized design with 4 treatments and 5 replicates with 12 chicks per replicate. Experimental treatments including mash, pellet, extruded and crumble diets and birds fed with them during 46 days. All diets were similar in energy, protein and nutrients level. To determine antibody production against sheep washed red blood cells, 2 chicks at 25 days age were selected and washed sheep red blood cells (1 mL) was injected through a wings vein and those chicken were marked. On day 30 chicken to determine the amount of marked antibody against sheep washed red blood cells blood testing from selected birds according to hemagglutination (HI) method were performed. One slide from each sample were prepared for counting white blood cells and the rest of the samples in the laboratory centrifuge (TDL80-2B) for 15 minutes at 3000 rpm were centrifuge. After separation of serum, it was removed and the samples were poured into microtubes and transferred to the lab. Using plasma which was prepared from blood samples, the antibodies production and specific antibodies in the serum of chickens against Newcastle influenza according hemagglutination method were determined at the age of

30 days. Antibody content for each sample were calculated as a logarithm method. Data analyses were performed by using SAS (2008) statistical software based on CRD design and mean comparison carried out by LSD mean test.

#### RESULTS AND DISCUSSION

Although the amount of antibody produced against the influenza virus under pellet treatment has increased, but there is no statistically difference among types of diet on the amount of antibody produced against influenza virus (Table 1). Antibody production against Newcastle disease virus under mash diet (2.6) showed a significant increase compared with extruded (8.4) ( $P < 0.05$ ). However, there is no significant difference between pellet and crumble. Antibody production against sheep red blood under crumbles treatment (8.8) was significantly higher than that under extruded (3.6) treatment. However, for this trait no statistical difference was obtained for mash and pellet treatments. Although pellet diet resulted in increase of heterophil: lymphocyte ratio compared with other treatments, but all the treatments were ineffective on heterophil: lymphocyte ratio and there were no significant difference among diet types (Table 3). In conclusion, none of the diet types had no significant changes on the weight of lymphoid organs (bursa Fabricius and spleen), that can be concluded diet types are ineffective on lymphoid organs weight.

Antibiotic resistance in bacterial pathogens is an important concern in human health and animal production. The use of dietary antibiotics in feed to promote growth of poultry and other livestock has been implicated in the increase in the number of strains of resistant bacteria and a rise in the number of human patients infected with these pathogens (Kramer *et al.*, 2000; Wang, *et al.*, 2005; Teuber, 2001). Recent efforts to reduce the use of antibiotics in animal agriculture have resulted in legislation which forbids the use of certain drugs in poultry feeds (Castanon, 2007) and an increase in consumer concern about the safety of animal production practice.

**Table 1: Analyze of variance of diet types (mash, pellets, extruded and crumble) effect on antibody content production against Newcastle virus and flu in 28 days age chickens and antibody content production against sheep washed red blood cells in 30 days age chickens.**

SOV	df	MS			Antibody against sheep washed red blood cells	Antibody against flu	Antibody against Newcastle virus
		Heterophil: lymphocyte (42 days)	Antibody against sheep washed red blood cells	Antibody against flu			
Treatment	3	0.02451 <sup>ns</sup>	1.9666*	1.9666 <sup>ns</sup>	4.1666 <sup>ns</sup>		
Error	36	0.019908	3.6833	1.5888		2.3611	
Total	39	-	-	-		-	

\*: significant at 5% probability.

ns: non-significant.

**Table 2: Effect on mean antibody content production against Newcastle virus and flu in 28 days age chickens and antibody content production against sheep washed red blood cells in 30 days age chickens.**

Treatments	Heterophil: lymphocyte (42 days)	Antibody against sheep washed red (Log 2)	Antibody against flu (Log 2)	Antibody against Newcastle virus (Log 2)
Mash	0.487	7.9 <sup>ab</sup>	4.8	6.2 <sup>a</sup>
Extruded	0.53	6.3 <sup>b</sup>	4	4.8 <sup>b</sup>
Crumble	0.442	8.8 <sup>a</sup>	4.8	6.1 <sup>ab</sup>
Pellet	0.555	8 <sup>ab</sup>	5	5.9 <sup>ab</sup>
SEM	0.0225	0.3257	0.2011	0.25

Different letters at each column indicate significant difference at p < 0.05.

**Table 3: Analyze of variance of diet types (mash, pellets, extruded and crumble) on lymphoid organs weight at 42 days age broiler.**

SOV	df	MS	
		Spleen	bursa Fabricius
Treatment	3	0.0015 ns	0.0018 ns
Error	36	0.0007	0.0009
Total	39	-	-

## CONCLUSION

The results of this study showed that different types of diet (mash, pellets, extruded and crumbles) had different effects on the immune response of broiler chicks. Types of diets on the amount of antibody produced against influenza virus had no significant effect, but significant effects of diet type were obtained for immune response of chickens. Titer of antibodies against Newcastle disease significantly increased under mash diet compared with extrusion. Crumble diet resulted in increase of antibody production against washed RBCs compared with extruded, but other treatments (mash and pellets) are not statistically different. All treatments had no significant effects on heterophil: lymphocyte ratio and lymphoid organs weight.

## REFERENCES

- Behnke, KC. (1994). Factors affecting pellet quality. In: Proceedings of Maryland Nutrition Conference. Dept. of Poultry Science and Animal Science, College of Agriculture, University of Maryland, College Park.
- Briggs, JL., Maier, DE., Watkins, BA. & Behnke, KC. (1999). Effect of ingredients and processing parameters on pellet quality. *Poultry Science*. **78**(10): 1464-1471.
- Castanon, JIR. (2007). History of the use of antibiotic as growth promoters in European poultry feeds. *Poultry Science*. **86**: 2466-2471.
- Jafarnejad, S., Farkhoy, M., Sadegh, M. & Bahonar, AR. (2010). Effect of crumble-pellet and mash diets with different levels of dietary protein and energy on the performance of broilers at the end of the third week. *Veterinary Medicine International* <http://dx.doi.org/10.4061/2010/328123>
- Kramer, JM., Frost, JA., Bolton, FJ. & Wareing, DRA. (2000). Campylobacter contamination of raw meat and poultry at retail sale: identification of multiple types and comparison with isolates from human infection. *Journal of Food Protection*. **63**:1654-1659.
- Nedeljko, LJ., Tica, LJ., Dorde, G., Okanovic, G., Nladislar, NZ. & Slarjo, SF. (2009). The effect of extruded Corn on the economic results of broilers production. *Food & Feed Research*. **36**(3-4): 59-64.
- Nir, I., Twina, Y., Grossman, E. & Nitsan, Z. (1994). Quantitative effects of pelleting on performance, gastrointestinal tract and behaviour of meat-type chickens. *British Poultry Science*, **35**(4): 589-602.
- Teuber, M. (2001). Veterinary use and antibiotic resistance. *Current Opinion in Microbiology* **4**(5): 493-499.
- United States Department of Agriculture Food Safety and Inspection Service (USDA). (2010). Compliance guide for controlling Salmonella and Campylobacter in poultry, 3rd edition.
- United States Department of Agriculture Foreign Agricultural Service (USDA FAS). (2006). Global Agriculture Information Network (GAIN) report: People's Republic of China Fresh and Frozen Poultry Product Standard (GB16869-2005).
- Wang, J., Adelson, DL., Yilmaz, A., Sze SH Jin, Y. & Zhu, JJ. (2005). Genomic organization, annotation, and ligand-receptor inferences of chicken chemokines and chemokine receptor genes based on comparative genomics. *BMC Genomics*. **6**(45): 1-17.