Efficacy of Supplementation of Exogenous Phytase Enzyme on Productivity and Carcass Characteristics of Different Strain of Commercial Broilers

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A Thesis

By

ELARA PARVEEN

Registration No. 1205103

Semester: July-December, 2014

Session: 2012-2013

MASTER OF SCIENCE (M.S.)

IN

POULTRY SCIENCE

DEPARTMENT OF DAIRY AND POULTRY SCIENCE

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY
DINAJPUR-5200

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HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY
DINAJPUR-5200

DECEMBER, 2014

DEDICATED

TO MY

BELOVED PARENTS

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The author.

ABSTRACT

An experiment was conducted to investigate the effect the efficacy of supplementation of exogenous phytase enzyme on productivity and carcass characteristics of different strain of commercial broilers at the open sided poultry shed in Hajee Mohammad Danesh Science and Technology University, Dinajpur. There were four strains of commercial broiler such as Fast feather, Arbor acres, Cobb-500 and Hubbard classic each having 78 number used for the experiment for a period of 5 weeks. A total number of 312 day old straight run broiler chicks were distributed to two dietary treatments i.e. basal diet (Control-T_0) and basal diet supplemented with phytase enzyme @ 1gm/kg feed. The results indicated that broilers given diets supplemented with phytase have enhanced body weight and weight gain when compared with these fed basal diet ($P<0.05$). The final body weight was increased significantly ($P<0.01$) on T_1C (Cobb-500 fed diet with 1g phytase enzyme/kg feed) and T_1F (Fast feather fed diet with 1g phytase enzyme/kg feed) compared to control. There were significant difference ($P>0.05$) among different treatments in relation to feed consumption. Significant differences ($P<0.01$) were found in feed conversion ratios among birds fed on diet treated with phytase enzyme. Feed conversion ratios during the 5^{th} week of age was 1.88, 1.87, 1.82, 1.86, 1.77, 1.72, 1.75 and 1.70 in T_0F, T_0A, T_0C, T_0H, T_1F, T_1A, T_1C and T_1H treatment groups respectively. Livability was similar in different treatments. Phytase supplementation had no significant effect on carcass cuts and dressing percent compared to non-phytase group. Dressing parameters were almost similar in different treatments and the differences were insignificant among treatment but the dressing weight percentage, thigh weight percentage and drumstick weight percentage were significant ($P>0.01$). Profitable ratios of the phytase groups were always higher than the control group. The cost of production was the highest in treatment T_1F followed by treatment T_1C, T_0F, T_1A, T_0C, T_0A, T_1H, and T_0H. Net profit per live broiler was the highest in treatment T_1A followed by treatment T_1C, T_1F, T_1H, T_0C, T_0F, T_0A, and T_0H respectively. Result of the present study suggests that the addition of dietary phytage was found to increase production performance and reduced cost of production.

Keywords: Phytase, different strain, broiler performance.

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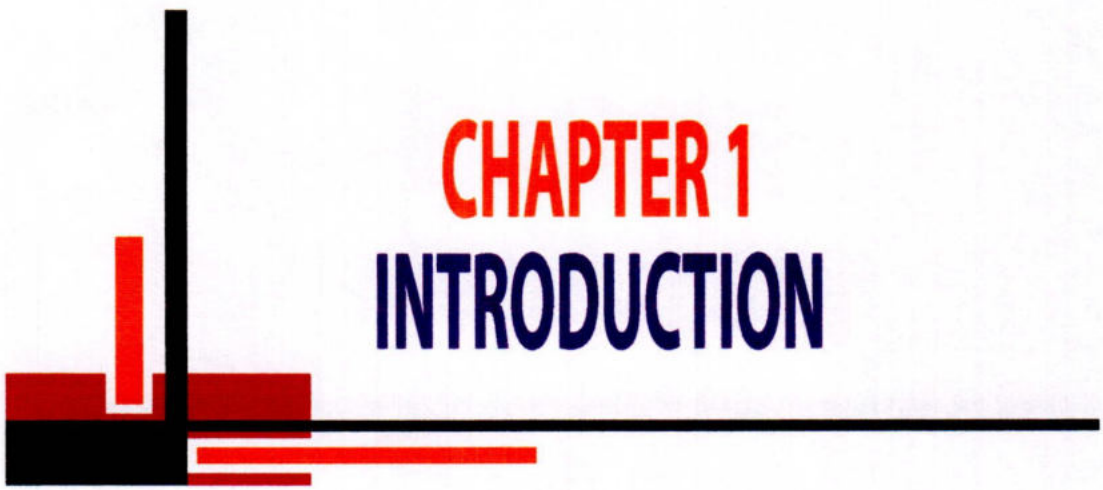
LIST OF ABBREVIATIONS AND SYMBOLS

ABBREVIATIONS		ELABORATIONS
BASF	=	Badische Anilin- & Sodafabrik
DSM	=	Dutch State Mines
FTU	=	Phytase units
IU	=	International unit
FCR	=	Feed conversion ratio
MS	=	Master of Science
PM	=	Post mortem
AME or AMEn	=	Apparent metabolisable energy
mg	=	Miligram
g	=	Gram
kg	=	Kilogram
Lit	=	Liter
ml	=	Mililiter
kcal	=	kilo-calorie
CP	=	Crude protein
CF	=	Crude fiber
DM	=	Dry matter
Dr.	=	Doctor
Prof.	=	Professor
SEM	=	Standard Error of Means
Tk.	=	Taka
P	=	Phosphorus
S	=	Sulphur
Ca	=	Calcium
K	=	Potassium
Mg	=	Magnesium
Mn	=	Manganese
Na	=	Sodium
NS	=	Not significant
%	=	Per cent
&	=	and
@	=	At the rate of
+	=	Plus/and
/	=	Per/or
>	=	Greater than
<	=	Less than
±	=	Plus-minus



CHAPTER 1
INTRODUCTION

CHAPTER 1

INTRODUCTION

In commercial poultry ration, nutrients are fortified through accumulation of different feed ingredients furnished with necessary micro nutrients. Protein costs involve about 45 percent of the total feed cost. The daily requirements of dietary protein are furnished from different animal and plant sources. But the sources of plants are sometimes become harmful for the poultry as because plant sources contain some anti nutritional factors like phytate phosphorus, trypsin inhibitors, non-starch polysaccharides (NSP), oligosacchariedes and lections (Deshpande and Cheryan, 1984; NRC, 1994) which decrease feed consumption but increases growth rate and feed utilization. Phytate phosphorus reduces the phosphorus and calcium availability in poultry. It is well documented that phosphorus is one of the basic mineral elements in all feed rations, having a greater influence on biological systems. Feeds of plant origin protein contain significant amount of this mineral; however, 50-80% of phosphorus is bound in phytates that cannot be broken down by endogenous enzymes in poultry (Deshpande and Cheryan, 1984). As a consequence, phosphorous from plant sources is poorly digested and cannot meet nutritional requirements of poultry regardless the fact that phytate phosphorus amounts in cereal grains can be as high as 50-80%, in legumes 50-68%, in oil-producing plant seeds and their by-products 51-76% (Eeckhout and Peape., 1994; Jeroch, 1993 and Oloffs, 2000). The major proportion of the phosphorus is stored in a special way: six phosphorus molecules are bound to phytic acid in a ring form. This phytic acid ring is called phytate. Besides, phytate creates a large number of insoluble salts with divalent and trivalent cations such as calcium, magnesium, potassium, Iron, manganese or zinc. The interaction of protein/phytate and starch/phytate obstructs the digestion of protein and carbohydrates (Knuckles, 1989; Zyla, 1992). Therefore, just like phosphorus, these valuable nutritive substances are also lost to animal as excreted in the faeces. Phytic acid also suppresses the activity of certain enzymes such as a amylase, trypsin, tyrosinase and pepsin, thereby suppressing crude starch and crude protein digestion (Zyla, 1992). In order to become P available to broiler chicks, Phosphorous from plant sources must be hydrolyzed, with phytase as a catalyst, to inositols and inorganic phosphates which are readily absorbed in digestive tract. Through supplementation of microbial phytase

to the monogastric animals about 50% of phytic phosphorous may be released. Results of numerous experiments have shown that degradation of phytate by phytase has two-fold positive effect-release of phosphorous and release of minerals. It is the enzyme known to release the orthophosphate group from the phytate molecule. Improving the availability of phytate, P would reduce the necessity to include feed phosphates in the diet and enable a reduction of the dietary P contents, without jeopardizing the bird's health and productivity. In turn, this would result in a lower P excretion per unit of edible product (eggs, meat), and reduce P-linked environmental pollution problems by intensive livestock production (Kornegay and Ravindran, 1996; Van, *et al.,* 1997).

The supplementation of poultry diets with exogenous enzymes to enhance their performance is not a new concept and research articles in this field date back to the early part of the 20th century (Hastings, 1946), with the first published article in 1925 (Rosen, 2010). A phytase (myo-inositol hexakisphosphate phosphohydrolase) is any type of phosphatase enzyme that catalyzes the hydrolysis of phytic acid (myo-inositol hexakisphosphate) an indigestible, organic form of phosphorus that is found in grains and oil seeds and releases a unstable form of inorganic phosphorus. Phytate (salt form of phytic acid) and phytate bound phosphorus (P) is present in all poultry diets and the partial availability of phytate-P has long been recognized (Lowe *et al.,* 1939). Warden and schaible (1962) were the first to show that exogenous phytase enhances phytate-P utilization and bone mineralization in broiler chicks.

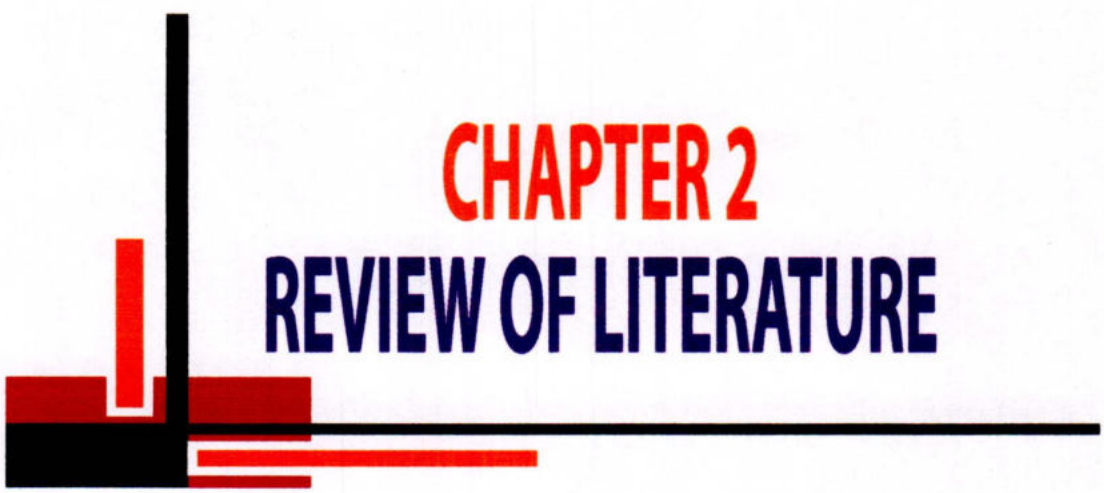
The positive effect of phytase can be expressed through better appetite, improve feed conversion ratio, increase carcass quality, increase digestibility. Also, adding phytase decreases the amount of total and soluble phosphorus in the litter, which has positive effect on the environment when poultry litter is used as fertilizer. Equally important, phytase may reduce the cost of the diet by reducing the amount of soybean meal, fat and crystalline amino acids that must be added. Research also has indicated that the improvement in growth performance observed in chicken, fed phytase were associated with increased feed intake and feed efficiency which might be due to release and utilization of P from the phytate mineral complex (Qian *et al,* 1996; Sebastian *et al,* 1996) or

utilization of inositol (Simans *et al,* 1990) or increase starch digestibility (Knukles and Betschart, 1987) or increased utilization of protein and amino acids (Rama Rao *et al,* 1999) or overall utilization of nutrients (Miles and Nelson, 1974). Phytase has been shown to increase the availability of some trace minerals, including copper, manganese, iron and zinc. Because of the positive effect of phytase on trace mineral utilization commercial use may lead to removing trace minerals in diets where phytase is added. It has been shown that removing the trace mineral premix from poultry diets from hatch to 42 days has no effect on growth performance, but it does have negative effects on bone growth. This negative effect was not overcome with the addition of phytase, indicating that phytase may not be able to replace the trace mineral premix in diets for broilers. Therefore, the present research work was designed with the following objective:

i) To investigate the effect of exogenous phytase enzyme on different strains of commercial broilers.

ii) To examine the productivity and carcass characteristics of different strains of commercial broiler.

iii) To evaluate the benefit of rearing broiler after feeding phytase enzyme.



CHAPTER 2
REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

The review of literatures as presented covers recognition of potential sources of vital information about the analogous researches study conducted by other workers and helps to identify the basic concepts of different components blended in researches. The contributions made by numerous research workers are pertinent in this research are discussed below.

2.1 Phytase

A phytase (myo-inositol hexakisphosphate phosphohydrolase) is any type of phosphatase enzyme that catalyzes the hydrolysis of phytic acid (myo-inositol hexakisphosphate)-an indigestible, organic form of phosphorus which is found in grains and oil seeds and releases a usable form of phosphorus (Mullaney *et al.,* 2000). Phytases have been found in animals, plants, fungi and bacteria (Mullaney *et al.,* 2003).

2.2 Phytate

Phytate, the mixed cation salt of phytic acid (Myo-inositol-1, 2, 3, 4, 5, 6-hexakis dihydrogen phosphate), is a naturally occurring compound present in feedstuffs of plant origin (Reddy *et al.,* 1982). Phytate was identified as isolated small, unknown particles from a variety of plant seeds (Hartig, 1855; Reddy *et al.,* 1982). Phytate serves as the primary storage form of P and inositol in seeds (Hidvegi & Lasztity, 2002). It is also involved in controlling homeostasis of P levels in seeds (Lott *et al.,* 2000) and plays an important role in plant growth and seed germination (Aureli *et al.,* 2011). In some plants, phytic acids binds potassium (K2+), magnesium (Mg2+) and to a lesser extend calcium (Ca2+) to form phytin (Maenz, 2001). Phytin is stored in vacuoles known as protein bodies. It is distributed in dense aggregates called globoids or can be distributed throughout the proteinaceous matrix (Maenz, 2001). Phytate accumulates in the aleuronic layer in monocotyledonous seeds (wheat, rice, barley) and in the germ of corn (Hidvegi and Lasztity, 2002). The amount of phytate in plant sources is influenced by cultivar and climatic conditions. Phytate is located in the

outer parts of the kernel and therefore different milling methods can also influence the phytate content of the end products (Hidvegi & Lasztity, 2002). Phytate levels can be measured through the use of high performance liquid chromatography (HLPC) and the amount of phytate bound P can be calculated as 28.2% of the total phytate concentration (Sauvant *et al.*, 2004).

2.3 Structure of phytate

Phytic acid is a charged molecule and consists out of a myo-inositol ring (a six carbon molecule) and six phosphate groups extending from the structure (Johnson and Tate, 1969). The molecule has 12 proton dissociation sites with a high chelation capacity for multivalent cations (Cheryan and Rackis, 1980) and positively charged nutrients (Selle and Ravindran, 2007). At neutral pH, phytic acid can have one or two negatively charged oxygen atoms in the phosphate groups. Therefore there is likely to be a strong correlation interaction between cations and two phosphate groups and also a weak correlation interaction between cations and a single phosphate group (Singh, 2008).

2.4 Commercial phytase enzymes

The first successful commercial phytase (Natuphos®) was developed in 1991 by Badische Anilin- & Sodafabric (BASF). For many years, Natuphos was the only phytase enzyme in the market (Simon and Igbasan, 2002). It is a 3-phytase produced by the fungus Aspergillus. In order to produce this enzyme on large scale, BASF genetically modified the recombinant A. niger strain with the *A. ficuum* phytase gene (Zhang *et al.*, 2000). DSM marketed Ronozyme, a 6-phytase produced by the *Aspergillus oryzae* strain, transformed with a gene from *Peniophora lycii* (Simon and Igbasan, 2002). Phyzyme is classified as a 6- phytase and is produced by *Schizosaccharomyces pombe* and modified with the App A gene from E. coli (Kerr *et al.*, 2010). DSM was the first company to use synthetic genes in a phytase product. Ronozyme HiPhos is a 6-phytase (histidine acid phosphatase phytase), produced by *Aspergillus oryzae* and contains two synthetic genes that mimic a phytase gene from *Citrobacter braakii* ATCC 51113 (Guggenbuhl *et al.*, 2012). All types of commercially available phytases belong to the class of histidine acid phytases (based

on the catalytic mechanism). Acid phytases show a maximum phytate dephosphorylation at pH 5, therefore histidine acid phytases are suspected to be most efficient in the crop (pH 4.0 to 5.0) or in the proventriculus and gizzard (pH 2.0 to 5.0) of the chicken (Greiner and Konietzny, 2011). The classes of certain commercial enzymes with its production strain and gene origin are summarised in Table 2.1. Currently there are quite a few phytase enzymes available commercially.The recommended dosages to release similar amounts of phytate bound P differs greatly among different phytase source.

Table 2.1 Production strain and gene origin of commercial enzymes

Name of Phytase	Production strain/organism	Origin of phytase gene	Class	Company	Reference
Natuphose	*Aspergillus niger*	*Aspergillus ficuum*	3-phytase	BASF	Zhang *et al.*, 2000
Phyzyme	*Schizosaccharomyces pombe*	AppA gene from *E. coli*	6-phytase	Danisco	Kerr *et al.*, 2010
Ronozyme	*Aspergillus oryzae*	*Peniophora lycii*	6-phytase	DSM	Simon and Igbasan. 2002; *Kerr et al.*, 2010
HiPhos	*Aspergillus oryzae*	*Citrobacter braakii*	6-phytase	DSM	Guggenbuhl *et al.*, 2012

2.5 Effect of phytase on body weight

Piao *et al.* (1998) observed that enzyme supplemented with phytase diets increased live weight of broiler. The improvement in growth performance observed in the chickens fed phytase were associated with increased feed intake and feed efficiency, which might be due to the release and utilijation of P-from the phytate-mineral complex (Qian *et al.*, 1996; Sebastain *et al.*, 1996) or utilization of inositol (Simons *et al.*, 1990) or increase starch digestibility (Knukles and Betschart, 1987) or increased utilization of protein and amino acids (Rama Rao *et al.*, 1999) or over all utilization of nutrients (Miles and Nelson, 1974). Addition of exogenous phytase in low protein diet have been reported to improve growth performance of broiler (Lan *et al.*, 2002; Ahmed *et al.*, 2000). But result of this study contradicts with the report of Pizzolante *et al.*(1999),who reported that the dietary phytase had no effect on live weight gain of broilers. Richered *et al.* (1994) found that growth was not improved by enzyme supplementation in triticale based diet.

2.6 Effect of microbial phytase on broiler growth performance

Many authors reported that microbial phytase supplementation increased body weight gain, feed intake and feed conversion efficiency in broilers.

Table 2.2 Influence of microbial phytase on body weight in broilers.

Age (Days)	Phytase (g/kg)	Non-phytase (Phosphorus in diet)	Weight gain(%)	FCR	Sources
28	750	0.169	38	0.63	Simons *et al.* (1990)
22	500	-	13	3.4	Broz *et al.* (1994)
20	600	-	77	3.7	Aoyagi and Baker 1995
20	600	0.45	11	3.53	Sebastian *et al.* (1996)
21	600	0.20	36	2.60	Kornegay *et al.* (1996)

2.7 Effect of phytase on feed intake

Phytase supplementation increased feed consumption by partial degrading of cell wall of feed and increased digestibility of nutrients Ahmad *et al.* (2000); Naher, B. (2002); Aksakal, N. and Bilal, H. (2000). On the other hand, the result contradicts with the findings of some earlier workers (Wilson *et al.*, 1999). They found that feed consumption was decreased due to addition of enzymes since birds fulfilled their nutrient requirement by taking less amount of feed. Phytase supplementation increased feed intake of broilers fed on phosphorus deficients diets (Mondal *et al.*, 2007) where the minimum dietary level of phytax was 1000 PU/kg. Some investigators reported similar feed intake on different levels of phytase observed in duck, turkey and chicken respectively (Atia *et al.*, 2000; Orban *et al.*, 1999 and Ciftci *et al.*, 2005).

2.8 Effect of phytase on feed conversion ratio

It is reported that addition phytase at a level higher than 500 PU/kg had impact in feed conversion efficiency (Mondal *et al.*, 2007). Lan *et al.* (2002);Moshad (2001);Aksakaland Bilal (2002); Scott *et al.*, (1997) reported that feed conversion was increased due to better feed utilization by birds

2.9 Effect of phytase on livability

Pillai *et al.* (1995) found survibility was similar in control and phytase enzyme treated feed. Alam (2001) found similar livability among the different dietary groups.

2.10 Effect of phytase on feed cost

Augelovicova and Michalik (1997) Stated that enzyme supplementation in commercial broiler diet decreased feed cost by 8.81% to 9.73% for production of 1 kg broiler meat. Nahar (2002) evident that feed cost per kg was reduced for addition of enzyme and increased profitability of duck rearing. Ahmed *et al.* (2000); Kies *et al.* (2001); Ren *et al.* (1999); Augelovicova and Michalik (1997) and Morkunas *et al.* (1993) reported that reduced feed cost was for the improved feed utilization and faster growth rate of broilers.

2.11 Effect of phytase on meat yield characteristics

A increase of total meat and breast meat for supplementing enzyme have been supported by Rahman *et al.* (2009). Khawaja (2003) and Rabayaa (2003) noted higher dressing yield of broilers for dietary supplementation of phytase. Pillai *et al.,* (2006) and Angel *et al.* (2007) contradict those findings. They did not find any change in meat yield in broilers which could be attributed to phytase supplementation. A positive correlation of dressed weight with live weight or age obtained coincides with the findings of some earlier workers (McNally and Spicknall, 1949; Jaap *et al.,* 1950; Howlider and Rose, 1989)

2.12 Effect of phytase on digestibility

Phytate-Ca forms insoluble complex with starch and fatty acids in the gastrointestinal tract of broilers, which depress the digestibility of carbohydrate and lipid (Rama Rao *et al.,* 2001). Therefore supplemental phytase had positive effects on dry matter digestibility by releasing bound organic nutrients (Ravindran *et al.,* 2000). Improved nitrogen digestibility due to added phytase has been reported in several studies (Kornegay, 1996; Sebastian *et al.,* 1997; Ravindran *et al.,* 2000). The interaction of

phytic acid and protein forms phytate-protein (Cheryan, 1980). They phytate also binds with major proteolytic enzyme, trypsin (Caldwell, 1992) eventually leading to lowered digestibility's of nitrogen and amino acids. It is therefore, lively that when phytase hydrolyses the ester bonds to release P from the phytic acid molecule, it will also release the phytate bond protein and removes the negative effects of phytic acid on proteolytic enzymes, thus increasing the digestion and absorption of protein and amino acids (Ravindran *et al.*, 2000).

2.13 Effect of phytase on environment

With the public concern over pollution due to P excretion with feces considerable attention has been generated in the recent years on broiler and layer chickens (Sebastian *et al.*, 1996; Zhang *et al.*, 1999; Ravindran *et al.*, 2000). Phytase supplementation decreased P excretion in the manure and reduced the potential environmental problems (Jalal *et al.*, 2001; Biehl and Baker 1997). Exogenous phytase supplementation seems to be a solution to combat phytate issues, thus leads to bioavailability of P economically and reduces P load on environment (Shelton *et al.*, 2004).

2.14 Effect of phytase on energy utilization

Early studies involving dephytinised feed ingredients showed that phytate negatively influences energy utilization in broilers (Rojas and Scott, 1969; Miles and Nelson, 1974). Exogenous phytase has consistently increased AME of broiler diets based on wheat and/or sorghum in many studies. (Ravindran *et al.*, 1999, 2000, 2001; Selle *et al.*, 1999, 2001, 2005).These studies *and* several other researches (Driver *et al,* 2006; Namkung and Leeson, 1999; Shirley and Edwards, 2003) are summarized in Table 2.3. Overall, phytase supplementation increased AME by an average of 0.36 MJ kg−1 DM (or 2.8%) over the non-supplemented controls. The percentage responses in AME following phytase supplementation are negatively correlated to the energy density of the control diets.

Table 2.3 Effects of phytase supplementation on energy utilization (AME or AMEn) in broiler chicken.

No.	Diet type	AME (MJ kg^{-1} DM)		Response		Phytase (FTU kg^{-1})
		Control	Phytase	MJ kg^{-1} DM	%	
1	Maize-soy	12.49	12.62	0.13	1.0	24,000 *Aspergilus niger*
2	Sorghum	12.80	13.10	0.3	2.3	750, *Aspergilus niger*
3	Wheat	14.88	14.96	0.08	0.5	Mean of two phytase
4	Wheat (pre-pelleted)	14.2	14.1	-0.1	0.7	600, *Aspergilus niger*
5	Wheat-sorghum 2.3 g kg	13.33	13.52	0.19	1.4	400+800 *Aspergilus niger*
6	Wheat-sorghum 4.5 g kg	12.67	13.38	0.71	4.6	400+800 *Aspergilus niger*
7	Wheat-sorghum blend	14.22	14.55	0.33	2.3	500, *Aspergilus niger*
8	Barley per se	12.36	12.69	0.33	2.7	700, *Aspergilus niger*

Derived from the studies Ravindran *et al.* (2000: 2001)

2.15 Effect of phytase on mineral retention

The microbial phytase supplementation of broiler diets has very significant beneficial effects on the mineral retention. A study showed that with increasing level of supplemental phytase increase the Ca (up to 9%), P (up to 10%) *and* Zn (up to 16%) retention (Brenes *et al.*, 2003). This effect is summarized in Table 4.4.

Table 2.4 Effects of dietary levels of microbial phytase on calcium, phosphorus, & magnesium & zinc retention in broiler chicks from 0 to 3 weeks of age.

(Adopted from Brenes *et al.*, 2003)

Mineral	PHY (U/kg)	Plasma Level (mg/dl)
Calcium	0	0.64
	200	0.66
	400	0.67
	600	0.70
Phosphorus	0	0.61
	200	0.63
	400	0.65
	600	0.66
Magnesium	0	0.37
	200	0.37
	400	0.39
	600	0.39
Zinc	0	0.24
	200	0.25
	400	0.28
	600	0.28

CHAPTER 3
MATERIALS AND METHODS

CHAPTER 3

MATERIALS AND METHODS

3.1 Statement of the experiment

The experiment was conducted at the open sided poultry shed under the Dept. of Dairy and Poultry Science in Hajee Mohammad Danesh Science and Technology University, Dinajpur. There were four strains of commercial broiler such as Fast feather, Arbor acres, Cobb-500 and Hubbard classic each having 78 number used for the experiment for a period of 5 weeks. A total number of 312 day-old straight run broiler chicks were used to find out the effect of exogenous phytase enzyme on the production performance of broiler.

3.2 Experimental birds

Three hundred twelve day-old chicks were collected via local traders for the experiment.

Table 3.1 Different strains of chicken (broiler) used for the experiment.

Strains of chicken (Broiler)	No. of chicks	Name of the farms
Fast feather	78	Paragon Poultry Ltd.
Arbor acres	78	Kazi Farm Ltd.
Cobb-500	78	Kazi Farm Ltd.
Hubbard classic	78	Aftab Bahumukhi Farms Ltd.

3.3 Layout of the experiment

The chicks were randomly distributed to eight dietary treatment groups (T_0F, T_0A, T_0C, T_0H, T_1F, T_1A, T_1C, T_1H) having three replications in each treatment. The chicks were reared in separated pens according to treatments and replications, each dietary treatment group consisted of 39 chicks and numbers of chicks in each replication was 13.

The layout of the experiment is shown in the following Table 3.2

Table 3.2 Layout of the experiment

Dietary Treatment	No of chicks in each replication			Total number of chicks per treatment
	R_1	R_2	R_3	
T_0F	13	13	13	39
T_0A	13	13	13	39
T_0C	13	13	13	39
T_0H	13	13	13	39
T_1F	13	13	13	39
T_1A	13	13	13	39
T_1C	13	13	13	39
T_1H	13	13	13	39

Here,

T_0F : Fast feather + giving diet without phytase enzyme.
T_0A : Arbor acres + giving diet without phytase enzyme.
T_0C : Coob-500 + giving diet without phytase enzyme.
T_0H : Hubbard classic + giving diet without phytase enzyme.
T_1F : Fast feather + giving diet having 1g phytase enzyme/kg feed.
T_1A : Arbor acres + giving diet having 1g phytase enzyme/kg feed.
T_1C : Cobb-500 + giving diet having 1g phytase enzyme/kg feed.
T_1H : Hubbard classic + giving diet having 1g phytase enzyme/kg feed.

3.4 Preparation of the experimental house

The experimental house was properly washed and cleaned using tap water. Ceiling, walls and floor were thoroughly cleaned and subsequently disinfected with Timsen (1gm/lit). After proper drying, the house divided into 24 pens of equal size using wire net. Each of pens was 12 sq feet floor spaces for 13 chicks. Fresh dried rice husk was used as litter material on the floor at a depth of 4 inch.

3.5 Experimental ration

3.5.1 Collection of enzyme

The phytase enzyme (SQZYME SSF) was manufactured by F. Hoffmann-La Roche Ltd, Switzerland and were supplied by Square limited, Bangladesh for conducting the research work.

3.5.2 Experimental diet

Broiler starter and finisher diets were provided between 0 to 14 days and 15 to 35 days of age respectively. The diets were formulated using locally available feed ingredients such as Maize, Rice polish (Auto), Soybean meal (44), Protein Concentrate, Oyster shell, DCP, Soybean oil, Common salt, Vitamin-mineral premix (Rena premise) and coccidiostat (DOTT) were added to the experimental diets as per recommendation of the manufacturer and mixed properly with the whole ration. It was done by mixing premix and DOTT (Coccidiostat), first with a small quantity of mixed feed and then with gradually increased in quantity by adding remaining mixed feed. Finally, total amount of feed was mixed thoroughly. The whole procedure was followed for both starter and finisher diets. The amount of ingredients used and the detail composition of different experimental ration are shown in Table 3.3.

Fig 1: Preparation of the experimental diets

Table 3.3 Composition of the experimental starter and finished diets fed to broilers.

Feed ingredients	Amount (kg/100kg feed)	
	Starter (0-14 days)	**Finisher (15-35 days)**
Maize	53.5	57.00
Rice polish (Auto)	10.0	10.0
Soybean meal (44)	23.0	18.0
Protein concentrate	10.0	10.0
Oyster shell	1.0	0.75
DCP	0.5	0.75
Soybean oil	1.5	3.0
Common salt	0.25	0.25
**Vitamin- mineral premix	0.25	0.25
Total	**100kg**	**100kg**
Nutrients	**Calculated composition**	
	Starter (0-14 days)	**Finisher (15-35 days)**
ME (kcal/kg)	2977	3074
CP (%)	21.21	19.40
CF (%)	5	5
Ca (%)	1.00	0.95
Available P (%)	0.74	0.75
Ash (%)	6	6
Lysine (%)	1.02	0.89
Methionine (%)	0.35	0.35

Note: Phytase enzyme used in enzyme grouped diet @ 10g/100kg.

**Vitamin-mineral premix composition (each 2.5 kg contained): Vitamin A 12000000 IU, Vitamin D_3 2000000 IU, Vitamin E 15000mg, Vitamin B_1 100mg, Vitamin B_2 4000mg, Vitamin B_6 3000 mg, Vitamin B_{12} 10mg, Vitamin K_3 201K) mg, Folic acid 1500mg, Nicotinic acid 25000mg, Pantothenic acid 11000mg, Biotin 15mg, Iron 32000mg, Copper 8000mg, Manganese 64000mg, Cobalt 300mg, Zinc 40000mg, Iodine 800mg, Selenium 200mg, Lysine 30000mg, Methionine 50000mg, Antioxidant 10000mg.

3.6 Management of the experimental birds

At the beginning of the experiment,chicks were individually weighted and recorded as initial body weight. The following management procedures were followed during the experimental period.

3.6.1 Litter management

The birds were reared on rice husk litter floor having a depth of 4 inch. At the end of each week, litter was stirred to break its compactness and maintain proper moisture. At the end of the 4 weeks of age, droppings were cleaned from the surface of the litter.

3.6.2 Brooding

Additional heat was provided for brooding the chicks when it was necessary up to the end of 1st week. Brooding temperature was maintained as bird's requirement from 33°C to normal environmental temperature of the house. Additional heat was managed by fitting 100 watt electric bulbs at the center of the pen, about 6 inches above of the floor. The height of the bulbs increased by raising the bulb gradually as per temperature requirement.

Fig 2: Brooding and housing of birds during experimental period

3.6.3 Lighting

The birds were exposed to a continuous lighting of 23 hours and 30 minutes and a dark period of 30 minutes in 24 hours. Supplementary light at night was provided using electric bulb by hanging at a height of 2.8 meters to provide necessary lighting.

3.6.4 Floor, feeder, waterer space

Each pen allotted for 13 birds, therefore floor space for each pen was 12 sq ft. One round feeder and one round waterer provided in each pen for 13 birds, additional feeder and waterer added according to size of the flock.

3.6.5 Feed and water management

The birds were reared in separate pens. Feed was given *ad-libitum* throughout the experimental period. Phytase enzyme was given in feed.

Fig 3: Feeding management of birds during experimental period

5.6.6 Vaccination Schedule

The experimental birds were vaccinated against Baby chick Ranikhet Disease and Gumboro Disease as per following schedule:

Table: 3.4 Vaccination schedule followed for the experimental broiler strains.

Name of the vaccine	Age of the bird	Dose and route of administration of diluted vaccine
BCRDV	4th day	1 drop in each eye
Gumboro Vaccine	14th day	1 drop in each eye
BCRDV	21st day	1 drop in each eye

3.6.7 Medication

An antibiotic named Docolis (0.5g/liter of drinking water) used for first 3 days to prevent early chick mortality. Eskavit WS (0.2g/liter drinking water), Electrocare + (0.5g/liter of drinking water) were given to prevent strives.

3.6.8 Sanitation

Proper hygienic measures and sanitation program of the experimental houses was taken during experimental period.

3.7 Post-mortem examination

Dead birds were diagnosed promptly at the Dairy and Poultry Science Laboratory of Hajee Mohammad Danesh Science and Technology University, Dinajpur. After postmortem examination, the result were collected and necessary measures were taken to solve the problem without applying medicines.

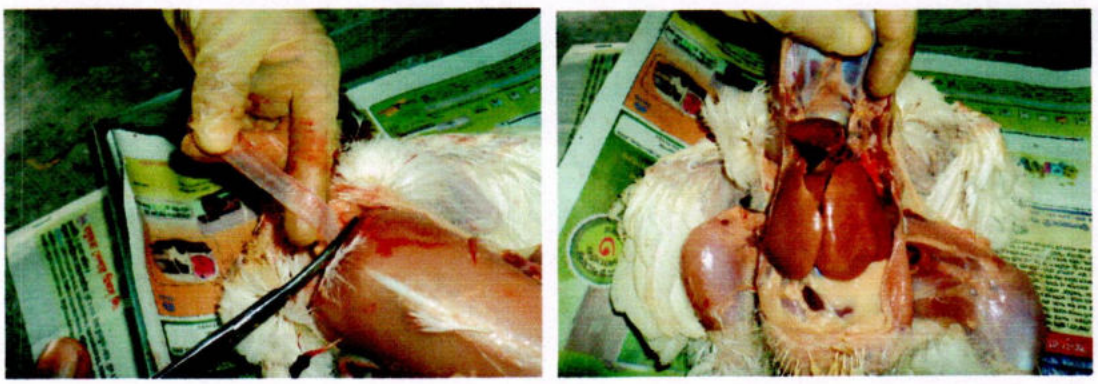


Fig 4: Postmortem examination of birds during experimental period.

3.8 Data collection and record keeping.

The following data were kept during the 5 weeks of rearing period:

a. Body weight: Initial and at the end of each week.
b. Feed consumption: Weekly
c. Feed conversion ratio: weekly
d. Survivability: Recorded from mortality.
e. Dressing yield: At the end of experiment two broiler were slaughtered from each replication to estimate dressing yield including dressed weight, thigh weight, Drum stick weight, breast meat weight, wing meat weight, head weight, gizzard weight, heart weight, spleen weight, shank weight, abdominal fat weight, skin weight, viscera weight.
f. Cost Benefit ratio.

Fig 5: Processing of birds during experimental period.

3.9 Statistical analysis

All recorded and calculated data were statistically analyzed by using analysis of variance (ANOVA) technique by a computer using "MSTAT statistical software" in accordance with the principles of Randomized Complete Block Design (RCBD). Duncan's Multiple Range Test was done to know the differences among the treatment means at 5% and 1% level of significance (Duncan, 1955)

CHAPTER 4
RESULTS AND DISCUSSION

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Effect of Phytase enzyme one body weight gain of broilers

Tables 4.1 and 4.2 showed the growth performance as affected by level phytase enzyme supplementation during the different weekly intervals and the entire experimental period (2^{nd} to 5^{th} wks of age). The initial (1st week) body weight in all treatment groups were similar. Significant differences ($P>0.05$) were found on body weight among different treatment groups at 5^{th} weeks of age. The body weight of T_1F (Fast Feather fed diet with 1gm phytase enzyme per kg Feed) was highest at 2^{nd} weeks of age. The body weight of T_0F (Fast Feather fed diet without phytase enzyme) was more than T_1A, T_1H, T_1C at 2^{nd} & 3^{rd} weeks of age. The highest body weight and body weight gain was attained by the birds of T_1F (Fast feather fed diet with 1gm phytase enzyme per kg Feed) and T_1C (Cobb-500 fed diet with 1 gm phytase enzyme per kg Feed) at 5^{th} weeks of age. Among the treatment groups significant differences ($P<0.01$) were found at T_1H in comparison with T_1C, T_1F and T_1A. The body weight of T_1C, T_1F and T_1A (5^{th} week) were similar. All the strain of treatment groups showed better body weight than control groups. Among the phytase group the result was significantly differed ($P>0.05$). The highest body weight was found in T_1C (1705.07g) and lowest in T_1H (1589.55). In comparison between treatment and control groups, all strain of treatment groups showed significantly higher body weight than the control groups. The body weight of different treatments groups were T_1C (1705.076g), T_1F (1702.49g), T_1A (1681.54g), T_1H (1589.55g) and control groups were T_0F (1650.0g), T_0C (1624.25g), T_0A (1526.10g), T_0H (1468.06g) respectively. The result was consistent with the findings of some earlier workers (Qian *et al.*, 1996; Sebastian *et al.*, 1996; Nadeem *et al.*, 2005). They reported that body weight and body weight gain were increased in chicks due to fed phytase diet and utilization of p-from the phytase mineral complex. These results are in disagreement with a number of authors (Ravindran *et al.*, 2001; Kwon *et al.*, 1999; Sohail and Roland, 1999). Similar result was also obtained by Sebastian *et al.* (1997), however, phytase supplementation had no influence on the apparent ileal digestibility in their study.

Table : 4.1 Effect of Phytase enzyme in the diet of broilers on body weight **(g/bird)**

Age (Week)	Dietary treatment groups								Level of Significance
	T_0F	T_0A	T_0C	T_0H	T_1F	T_1A	T_1C	T_1H	
Initial weight	41.67 ± 013	40.17 ± 0.13	39.83 ± 0. 13	37.50 ± 0. 23	41.67 ± 0. 13	40.83 ± 0.49	40.0 ± 0.47	39.67 ± 0.27	NS
1st	151.8 ± 3.018	132.3 ± 0.906	137.5 ± 1.752	125.4 ± 2.264	151.7 ± 2.744	133.2 ± 1.549	139.9 ± 1.199	127.5 ± 1.732	NS
2nd	339.2 ± 6.182^{ab}	300.9 ± 5.216^{d}	327.5 ± 2.364^{abc}	293.9 ± 2.551^{d}	353.6 ± 5.308^{a}	313.4 ± 4.768^{bcd}	334.2 ± 1.732^{abc}	309.1 ± 3.149^{cd}	**
3rd	690.2 ± 1.433^{b}	586.7 ± 3.485^{d}	605.2 ± 3.054^{d}	604.8 ± 4.267^{d}	746.1 ± 10.665^{a}	637.7 ± 5.197^{c}	633.5 ± 5.667^{c}	637.1 ± 3.018^{c}	**
4th	1196.35 ± 8.665^{b}	1065.43 ± 5.247^{cd}	1173.04 ± 1.874^{b}	1017.17 ± 3.00^{d}	1317.38 ± 14.423^{a}	1176.41 ± 5.215^{b}	1230.00 ± 22.671^{b}	1087.00 ± 3.389^{c}	**
5th	1650.0 ± 0.13^{bc}	1526.10 ± 9.28^{e}	1624.25 ± 10.36^{cd}	1468.06 ± 1. 86^{f}	1702.49 ± 8.32^{a}	1681.54 ± 3.95^{a}	1705.076 ± 8. 70^{a}	1589.55 ± 2.05^{d}	**

Values of different variables under different program indicates Mean ± SEM ; abcdefg mean values with dissimilar super scripts are significantly different; SEM , Standards errors of means ; ** Significant (P<0.01) ; * Significant (P>0.05); NS (Non-significant)

Here,

T_0F : Fast feather + giving diet without phytase enzyme.

T_0A : Arbor acres + giving diet without phytase enzyme.

T_0C : Coob-500 + giving diet without phytase enzyme.

T_0H : Hubbard classic + giving diet without phytase enzyme.

T_1F : Fast feather + giving diet having 1g phytase enzyme/kg feed.

T_1A : Arbor acres + giving diet having 1g phytase enzyme/kg feed.

T_1C : Cobb-500 + giving diet having 1g phytase enzyme/kg feed.

T_1H : Hubbard classic + giving diet having 1g phytase enzyme/kg feed.

Table : 4.2 Effect of Phytase enzyme on the production performance of broiler.

Parameters	Age in (Week)	Dietary treatment groups								Level of Significanc
		T_0F	T_0A	T_0C	T_0H	T_1F	T_1A	T_1C	T_1H	
Body weight (g/bird)	0-5th	1650.0 ± 0.13^{bc}	1526.10 ± 9.28^{e}	1624.25 ± 10.36^{cd}	1468.06 ± 1.86^{f}	1702.49 ± 8.32^{a}	1681.54 ± 3.95^{a}	1705.076 ± 8.70^{a}	1589.55 ± 2.05^{d}	**
Body weight gain (g/bird)	0-5th	1608.31 ± 12.84^{abc}	1485.93 ± 9.30^{d}	1584.41 ± 10.24^{bc}	1428.06 ± 1.66^{e}	1661.72 ± 8.20^{a}	1640.70 ± 4.22^{ab}	1665.28 ± 8.87^{a}	1549.88 ± 1.96^{cd}	**
Feed consumption (g/bird)	0-5th	3029.205 ± 12.84^{abc}	2788.042 ± 18.79^{c}	2883.48 ± 16.70^{bc}	2656.12 ± 20.20^{d}	2940.48 ± 8.20^{ab}	2826.78 ± 4.22^{ab}	2914.42 ± 8.70^{ab}	2638.47 ± 14.03^{d}	*
Feed conversion ratio (g/bird)	0-5th	1.88 ± 0.01^{a}	1.87 ± 0.02^{a}	1.82 ± 0.00^{ab}	1.86 ± 0.01^{a}	1.77 ± 0.01^{bc}	1.72 ± 0.01^{c}	1.75 ± 0.01^{bc}	1.70 ± 7.20^{c}	**
Livability (%)	0-5th	94.87 ± 4.18	94.87 ± 4.18	97.43 ± 2.09	92.30 ± 3.62	97.43 ± 2.09	97.43 ± 2.09	97.43 ± 2.09	97.43 ± 2.09	NS
Profit / broiler (Tk.)	0-5th	25.09	20.64	33.88	14.55	35.43	37.87	36.96	34.69	

Values of different variables under different program indicates Mean ± SEM ; abcdefg mean values with dissimilar super scripts are significantly different; SEM , Standards errors of means ; ** Significant (P<0.01) ; * Significant (P>0.05); NS (Non-significant)

Here,

T_0F : Fast feather + giving diet without phytase enzyme.

T_0A : Arbor acres + giving diet without phytase enzyme.

T_0C : Coob-500 + giving diet without phytase enzyme.

T_0H : Hubbard classic + giving diet without phytase enzyme.

T_1F : Fast feather + giving diet having 1g phytase enzyme/kg feed.

T_1A : Arbor acres + giving diet having 1g phytase enzyme/kg feed.

T_1C : Cobb-500 + giving diet having 1g phytase enzyme/kg feed.

T_1H : Hubbard classic + giving diet having 1g phytase enzyme/kg feed.

4.2 Effect of Phytase enzyme on feed intake of broilers

The differences in feed intake between control groups (birds feed diet without phytase enzyme/kg feed) and treatment groups (birds fed diet with 1 gm phytase enzyme) were significant ($P>0.05$) at 5^{th} weeks of age. The result on feed intake (Table 4.2 and 4.3) demonstrates that during 28-35 days of age the birds in T_0F (Fast feather fed diet without phytase enzyme) consumed more feed than T_1F, T_0C, T_1C, T_0A, T_1A, T_0H and T_1H consequently. Among the treatment groups significant differences ($P<0.05$) were found at T_1H in comparison with T_1F, T_1C and T_1A. The feed consumption of T_1F, T_1C, T_1A (5^{th} week) were similar. All the strain of treatment groups consumed less food than the control groups. The feed consumption of different treatment groups were T_1F (2940.48g), T_1C (2914.42g), T_1A (2826.78g), T_1H (2638.47g) and control groups were T_0F (3029.205g), T_0C (2883.042g), T_0A (2788.042g), T_0H (2656.12g) respectively. Among the treatment groups the feed intake of broilers were significantly differed ($P>0.05$). The height feed intake was found in T_1F (2940.48g) and lowest in T_1H (2638.47). In comparison between treatment and control groups, all strain of treatment groups showed lower feed intake than control groups. The result was consistent with the findings of some earlier workers (Wilson *et al.,* 1999). They found that feed consumption was decreased due to addition of enzyme since birds fulfilled their nutrient requirement by taking less amount of feed. These result inconsistent with Ahmad *et al.,* (2000) who reported that in addition of phytase did not affect feed consumption.

4.3 Effect of Phytase enzyme on feed conversion ratio (FCR) of broilers

The feed conversion ratio between control groups (Birds fed diet without phytase enzyme/kg feed) and treatment groups (Birds fed diet with 1 gm phytase enzyme) were significantly different ($P<0.01$). Table 4.2 and 4.4 showed that significant differences ($P>0.01$) were found on feed conversion ratio at 5^{th} weeks of age.Results showed that among the four different strains ,Hubbard classic had the lowest FCR,suggesting that this broiler strain could utilize the feed efficiently compared to other three strains. All the strain of treatment groups showed better FCR than control groups. The feed conversion ratio of different treatment groups were T_1H (1.70), T_1A

(1.72), T_1C (1.75), T_1F (1.77) and control groups were T_0C (1.82), T_0H (1.86), T_0A (1.87), T_0F (1.88) respectively. At the end of trail, the feed conversion ratio of T_1H (Hubbard classic fed diet with 1gm phytase enzyme/kg feed) was better followed by T_1A,T_1C, T_1F, T_0C, T_0H, T_0A, T_0F, respectively. The addition of exogenous phytase improved ($P<0.05$) feed conversion ratio (Table 4.4) of the birds. In comparison between treatment and control groups, all strain of treatment groups significantly ($P>0.05$) lower feed conversion ratio than control groups. The improvement of feed conversion ratio of chicks as a result of phytase application was in agreement with the results of some earlier studies (Shirley *et al.,* 2003; Selle *et al.,* 2006; Watson *et al.,* 2006). In those studies, feed conversion ratio of different broiler groups differed significantly might be due to the increased availability of energy and amino acid digestibility by raise in phytate degradation. The improve of body weight gain and feed conversion ratio of chicks as a result of phytase application might be due to the increased availability of energy (Shirley and Edwards, 2003) and amino acid digestibility (Selle *et al.,* 2006) due to a raise in phytate degradation. The ability of phytase to improve P availability by hydrolyzing phytate-bound P in poultry diets can therefore reduce supplementation of diets with inorganic P sources.

Table : 4.3 Effect of Phytase enzyme in the diet of broilers on feed intake (g/bird)

Age (Week)	Dietary treatment groups								Level of Significance
	T_0F	T_0A	T_0C	T_0H	T_1F	T_1A	T_1C	T_1H	
1^{st}	151.7 ± 5.286	129.2 ± 1.615	140.3 ± 2.005	122.8 ± 2.852	150.4 ± 3.714	129.0 ± 1.945	141.9 ± 2.460	122.5 ± 3.389	NS
2^{nd}	460.8 ± 5.006	399.0 ± 10.711	437.2 ±4.299	397.7 ± 2.357	445.1 ± 9.775	394.2 ± 6.786	442.4 ± 6.950	388.7 ± 1.971	NS
3^{rd}	1076.40 ±8.509^{a}	896.8 ±10.192^{bc}	915.8 ± 5.858^{bc}	947.9 ± 9.797^{d}	1066.11 ± 18.188^{a}	887.3 ± 5.765^{c}	919.7 ± 3.598^{dc}	911.6 ± 12.854^{dc}	*
4^{th}	2059.66 ± 4.296^{a}	1808.42 ± 15.521^{c}	1949.06 ± 7.762^{d}	1743.44 ± 6.021^{cd}	2084.75 ± 32.331^{a}	18.09.17 ± 11.116^{c}	1918.42 ± 27.598^{b}	1713.41 ± 3.281^{d}	*
5^{th}	3029.205 ±33.88^{a}	2788.042 ± 18.79^{c}	2883.48 ± 16.70^{bc}	2656.12 ± 20.20^{d}	2940.48 ± 8.20^{ab}	2826.78 ± 4.22^{ab}	2914.42 ± 8.70^{ab}	2638.47 ± 14.03^{d}	*

Values of different variables under different program indicates Mean ± SEM ; abcdefg mean values with dissimilar super scripts are significantly different; SEM , Standards errors of means ; ** Significant (P<0.01) ; * Significant (P>0.05); NS (Non-significant)

Here,

T_0F : Fast feather + giving diet without phytase enzyme.
T_0A : Arbor acres + giving diet without phytase enzyme.
T_0C : Coob-500 + giving diet without phytase enzyme.
T_0H : Hubbard classic + giving diet without phytase enzyme.
T_1F : Fast feather + giving diet having 1g phytase enzyme/kg feed.
T_1A : Arbor acres + giving diet having 1g phytase enzyme/kg feed.
T_1C : Cobb-500 + giving diet having 1g phytase enzyme/kg feed.
T_1H : Hubbard classic + giving diet having 1g phytase enzyme/kg feed.

Table : 4.4 Effect of Phytase enzyme in the diet of broilers on feed conversion ratio (g/bird)

Age (Week)	Dietary treatment groups								Level of Significanc
	T_0F	T_0A	T_0C	T_0H	T_1F	T_1A	T_1C	T_1H	
1st	1.37 ± 0.011	1.40 ± 0.005	1.43 ± 0.016	1.43 ± 0.009	1.36 ±0.007	1.39 ± 0.007	1.42 ±0.12	1.39 ± 0.011	NS
2nd	1.54 ± 0.016^{a}	1.52 ± 0.020^{ab}	1.51 ± 0.016^{ab}	1.55 ± 0.005^{a}	1.42 ± 0.004^{c}	1.44 ± 0.012^{bc}	1.48 ± 0.012^{abc}	1.43 ± 0.022^{bc}	**
3rd	1.65 ± 0.016^{a}	1.63 ± 0.015^{a}	1.61 ± 0.014^{ab}	1.67 ± 0.009^{a}	1.50 ± 0.005^{c}	1.47 ± 0.007^{c}	1.54 ± 0.009^{bc}	1.51 ± 0.017^{c}	**
4th	1.77 ± 0.016^{a}	1.75 ± 0.023^{a}	1.71 ± 0.009^{a}	1.77 ± 0.009^{a}	1.62 ± 0.011^{b}	1.58 ± 0.014^{b}	1.60 ± 0.007^{b}	1.62 ± 0.007^{b}	**
5th	1.88 ± 0.01^{a}	1.87 ± 0.02^{a}	1.82 ± 0.00^{a}	1.86 ± 0.01^{a}	1.77 ± 0.01^{b}	1.72 ± 0.01^{b}	1.75 ± 0.01^{b}	1.70 ± 0.007^{c}	**

Values of different variables under different program indicates Mean ± SEM ; abcdefg mean values with dissimilar super scripts are significantly different; SEM , Standards errors of means ; ** Significant (P<0.01) ; * Significant (P>0.05); NS (Non-significant)

Here,

T_0F : Fast feather + giving diet without phytase enzyme.

T_0A : Arbor acres + giving diet without phytase enzyme.

T_0C : Coob-500 + giving diet without phytase enzyme.

T_0H : Hubbard classic + giving diet without phytase enzyme.

T_1F : Fast feather + giving diet having 1g phytase enzyme/kg feed.

T_1A : Arbor acres + giving diet having 1g phytase enzyme/kg feed.

T_1C : Cobb-500 + giving diet having 1g phytase enzyme/kg feed.

T_1H : Hubbard classic + giving diet having 1g phytase enzyme/kg feed.

4.4 Effect of Phytase enzyme on carcass characteristics of broilers

The meat yield characteristics are shown in Table 4.5. The result indicates that there was no significant differences among the treatments for breast meat weight, wing meat weight, head weight, gizzard weight, heart weight, spleen weight, shank weight, abdominal fat weight, skin weight and viscera weight. On the other hand, the dressing yield, thingh weight and drum stick weight was significantly different ($P<0.01$) between treatment groups (Birds fed diet with 1gm phytase enzyme/kg feed) and control groups (Birds fed diet without phytase enzyme) during 5 weeks of experimental period. The dressing yield, drumstick weight and thigh weight ware higher in T_1H, T_1C and T_1F. The increased dressing yield, drum stick weight and thigh weight on T_1H, T_1C, T_1F might be because of the increased live weight. But these findings contradicts with the observation of Bharathidhasan *et al.* (2009) who found that a marginal increase in dressing percentage in birds fed with diets containing enzyme level at 0, 250, 500, 750 and 1,000 g ton-1 of feed. Also, Jordão Filho et al. (2006) did not find differences using 500 until 1,500 FTU phytase kg-1 of feed. These results also agreed with previous findings of Angel *et al.,* (2007) but opposite to those of Pillai *et al.,* (2006) who showed that phytase supplementation significantly increased percentages of most of carcass merits compared to P-deficient diets.

4.5 Effect of Phytase enzyme on production cost and profit margin of broilers

Phytase supplementation, by improving overall production performance of broilers, may lead to economic benefits. The production cost of broiler was shown in Table 4.6. The feed cost was highest (Tk. 5316) in treatment T_0F (Control group) and the lowest (Tk. 4630) in treatment T1H (Treatment group). The opposite result was found in T_1C and T_1A (Treatment groups) where the addition of phytase enzyme resulted in increased feed cost in treatment T_0C and T_0A (Control groups). The cost per kg live weight of broiler was the highest in treatment T_1F (Tk. 180.15) followed by treatment T_1C (179.0), T_0F (178.41), T_1A (175.05), T_0C (171.82), T_0A (167.56), T_1H (166.58) & T_0H (161.61) respectively. Net profit per live broiler was the highest in treatment

T_1A (Tk. 37.87) followed by treatment T_1C (36.96), T_1F (35.43), T_1H (34.69), T_0C (33.88), T_0F (25.09), T_0A (20.64) and T_0H (14.55) respectively. The highest net profit was observed in treatment T_1A (Arber acres fed on diet treated with 1gm phytase enzyme/kg feed) and the lowest total net profit was observed in treatment T_0H (Habbard classic fed on diet without phytase enzyme). Economic wise, the addition of phytase could make reasonable profits than without its addition. The findings of the present study is similar to the observation of Islam *et al.* (2010).They reported that net profits (Kg live bird) was significantly better in broiler group fed diet supplemented with enzyme 50g/100kg which might be due to improvement of digestibility's and consequent by better utilization of nutrients. The profitability element here is based on feed, as it constitutes more than 60% of the ration cost for poultry feeding. The result was consistent with the result of Augelovicova and Michalik (1997) who stated that enzyme supplementation in commercial broiler diet decreased feed cost by 8.81% to 9.73% for production of 1 kg broiler meat. Vinil *et al.* (2000) found a reduction in feed cost in soy-wheat bran diets supplemented with phytase (25 g 100 kg-1) of about 1.00 Indian rupee (INR). Net income increased up to 9.47% in response to 300 g/ton of phytase supplementa-tion (Kundu *et al.* 2000). Singh and Khatta (2004) reported that phytase supplementation resulted in 10% and 6% re-ductions in cost per unit gain in broilers fed corn and wheat based diets, respectively. Plumstead *et al.* (2008) observed that less expensive broiler diets low in P and other nutrients supplemented with phytase resulted in optimum production. Supplementation of phytase leads to safe, economic and almost complete replacement of dietary P (dicalcium phos-phate), that ultimately causes reduction in feed cost kg-1 of weight gain (Singh *et al.* 2003a, b; Singh and Khatta, 2003a, b).

Table : 4.5 Effect of Phytase enzyme in the diet of broilers on carcass characteristics at 35 days of age.

Parameters	Dietary treatment groups								Level of Significance
	T_0F	T_0A	T_0C	T_0H	T_1F	T_1A	T_1C	T_1H	
Live wt (g/bird)	1650.0 ± 0.13^{bc}	1526.10 ± 9.28^{e}	1624.25 ± 10.36^{cd}	1468.06 ± 1.86^{f}	1702.49 ± 8.32^{a}	1681.54 ± 3.95^{ab}	1705.076 ± 8.70^{a}	1589.55 ± 2.05^{d}	**
Dressing wt (%)	81.32 ± 0.72^{e}	84.61 ± 0.22^{d}	87.75 ± 0.33^{bc}	85.71 ± 0.47^{cd}	91.24 ± 0.17^{a}	90.38 ± 0.98^{ab}	91.30 ± 0.41^{a}	92.19 ± 0.35^{a}	**
Drum stick wt (%)	8.390 ± 0.188^{d}	8.073 ± 0.242^{b}	8.407 ± 0.119^{b}	8.883 ± 0.035^{ab}	9.450 ± 0.258^{a}	9.913 ± 0.152^{a}	9.783 ± 0.034^{a}	8.953 ± 0.205^{ab}	**
Thigh wt (%)	11.60 ± 0.28^{b}	11.36 ± 0.17^{dc}	10.60 ± 0.26^{c}	10.86 ± 0.19^{bc}	12.77 ± 0.072^{a}	11.63 ± 0.115^{b}	12.57 ± 0.024^{a}	11.09 ± 0.136^{bc}	**
Breast meat wt (%)	18.61 ± 0.284	18.61 ± 0.076	17.83 ± 0.198	18.72 ± 0.145	18.29 ± 0.143	18.40 ±0.229	18.60 ± 0.086	19.07 ± 0.153	NS
Wing meat wt (%)	8.300 ± 0.11	8.280 ± 0.339	8.590 ± 0.132	8.287 ±0.056	8.620 ± 0.263	8.570 ± 0.043	8.400 ± 0.143	8.530 ± 0.251	NS
Head wt (%)	2.337 ± 0.066	2.363 ± 0.040	2.187 ± 0.051	2.493 ± 0.050	2.110 ± 0.036	2.067 ± 0.025	2.047 ± 0.035	2.140 ± 0.047	NS
Gizzard wt (%)	1.883 ± 0.107	1.967 ± 0.080	2.037 ± 0.089	2.153 ± 0.040	1.633 ± 0.056	1.733 ± 0.058	1.743 ± 0.055	1.940 ± 0.033	NS
Heart wt (%)	0.55 ± 0.012	0.56 ± 0.008	0.536 ± 0.016	0.57 ± 0.008	0.50 ± 0.009	0.52 ±0.019	0.52 ± 0.007	0.496 ± 0.002	NS
Spleen wt (%)	0.13 ± 0.005	0.14 ± 0.007	0.13 ± 00	0.15 ± 0.002	0.13 ± 0.004	0.11 ± 0.002	0.13 ± 0.007	0.13 ± 0.002	NS
Shank wt (%)	4.33 ± 0.117	4.23 ± 0.079	4.13 ± 0.10	4.31 ± 0.119	4.95 ± 0.172	4.63 ±0.073	4.80 ± 0.069	4.14 ± 0.026	NS
Abdominal Fat wt (%)	1.79 ± 0.086	1.76 ± 0.032	1.66 ± 0.087	2.08 ± 0.039	1.46 ± 0.032	1.34 ± 0.024	1.45 ± 0.034	1.67 ± 0.036	NS
Skin wt (%)	6.51 ± 0.112	634 ± 0.061	6.00 ± 0.108	7.16 ± 0.116	6.86 ± 0.115	6.45 ± 0.033	6.73 ± 0.036	6.71 ± 0.168	NS
Viscera wt (%)	10.20 ± 0.208	10.23 ± 0.198	9.79 ± 0.026	11.27 ± 0.2506	9.25 ± 0.103	9.26 ± 0.088	9.55 ± 0.150	10.16 ± 0.019	NS

Here,

000T_0F : Fast feather + giving diet without phytase enzyme.
T_0A : Arbor acres + giving diet without phytase enzyme.
T_0C : Coob-500 + giving diet without phytase enzyme.
T_0H : Hubbard classic + giving diet without phytase enzyme.
T_1F : Fast feather + giving diet having 1g phytase enzyme/kg feed.
T_1A : Arbor acres + giving diet having 1g phytase enzyme/kg feed.
T_1C : Cobb-500 + giving diet having 1g phytase enzyme/kg feed.
T_1H : Hubbard classic + giving diet having 1g phytase enzyme/kg feed.

Table : 4.6 Effect of Phytase enzyme on production cost and profit margin of broilers.

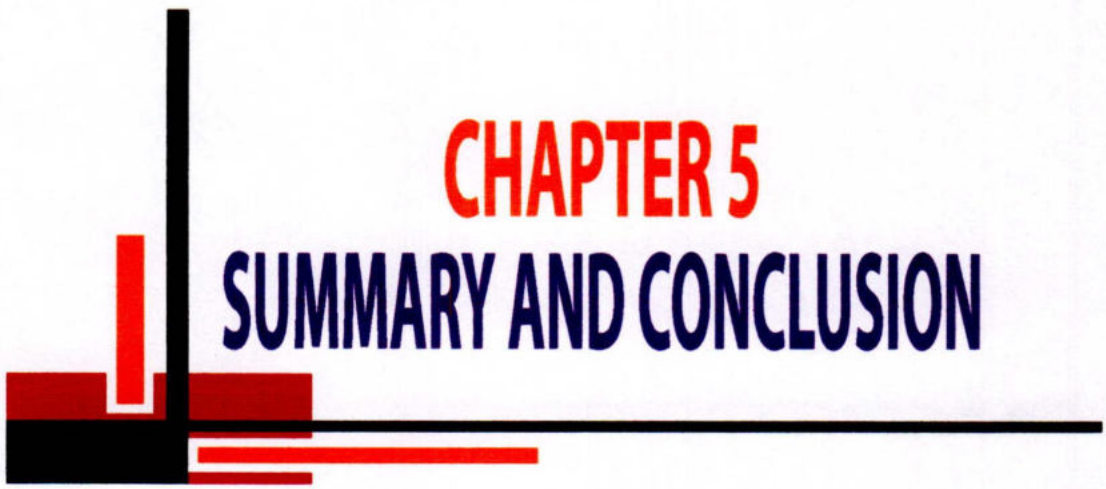
Cost of production (TK)	Dietary treatment groups							
	T_0F	T_0A	T_0C	T_0H	T_1F	T_1A	T_1C	T_1H
Feed cost @45tk/kg	5316	4893	5059	4661	5159	4960	5114	4630
Chick cost @32tk/bird	1248	1248	1248	1248	1248	1248	1248	1248
Disinfectant cost	10	10	10	10	10	10	10	10
Vaccination cost	50	50	50	50	50	50	50	50
Medicine cost	24	24	24	24	24	24	24	24
Transport cost	10	10	10	10	10	10	10	10
Depreciation cost	150	150	150	150	150	150	150	150
Litter cost	50	50	50	50	50	50	50	50
Labour cost	60	60	60	60	60	60	60	60
Water and electricity cost	40	40	40	40	40	40	40	40
Phytase enzyme cost					225	225	225	225
Total Cost	**6958**	**6535**	**6701**	**6303**	**7026**	**6827**	**6981**	**6497**
Cost/broiler	178.41	167.56	171.82	161.61	180.15	175.05	179	166.58
Total selling @ 130tk/kg	7936.5	7340.06	8022.56	6870.24	8407.88	8304.14	8422.7	7849.66
Profit/broiler	25.09	20.64	33.88	14.55	35.43	37.87	36.96	34.69

Here,

T_0F : Fast feather + giving diet without phytase enzyme.
T_0A : Arbor acres + giving diet without phytase enzyme.
T_0C : Coob-500 + giving diet without phytase enzyme.
T_0H : Hubbard classic + giving diet without phytase enzyme.
T_1F : Fast feather + giving diet having 1g phytase enzyme/kg feed.
T_1A : Arbor acres + giving diet having 1g phytase enzyme/kg feed.
T_1C : Cobb-500 + giving diet having 1g phytase enzyme/kg feed.
T_1H : Hubbard classic + giving diet having 1g phytase enzyme/kg feed.

4.6 Effect of Phytase enzyme on livability of broilers

The livability during the experimental period was 97.43, 97.43, 97.43, 97.43, 97.43, 94.87, 94.87, and 92.30 percent for T_1A, T_0C, T_1H, T_1F, T_1C, T_0F, T_0A and T_0H respectively. No significant differences were observed in livability among different treatment groups and control groups during 5 weeks of experiment. Livability of broilers fed on phytase enzyme was very much acceptable during the study period. The result of present study was consistent with the findings of some earlier studies (Pillai *et al.*, 1995; Alam, 2001).



CHAPTER 5
SUMMARY AND CONCLUSION

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The objectives of this experiment were to know the efficacy of supplementation of exogenous phytase enzyme on productivity and carcass characteristics of different strain of commercial broilers. There were 4 strains of commercial broiler such as Arbor acres, Fast feather, Cobb-500 and Hubbard classic each having 78 birds were used in the experiment for a period of 5 weeks. A total number of 312 day old straight run broiler chicks were distributed to two dietary treatments i.e. basal diet (Control-T_0) and basal diet supplemented with phytase enzyme @ 1gm/kg feed. The birds were fed on adlibitum basis and fresh drinking water was available for all the times. Body weight, feed intake, feed conversion ratio, livability, production cost and profit margin and carcass yields of different strains of broilers of different treatments were recorded.

At 5^{th} week of age, the final body weight of broilers at T_0F, T_0A, T_0C, T_0H, T_1F, T_1A, T_1C and T_1H treatment groups were 1650.00g, 1526.10g, 1624.25g, 1468.06g, 1702.49g, 1681.54g, 1705.076g and 1589.55g respectively. Live weight was increased significantly ($P<0.01$) on T_1C (Cobb-500 fed diet with 1g phytase enzyme/kg feed) and T_1F (Fast feather fed diet with 1g phytase enzyme/kg feed) compared to control. There were significant difference ($P>0.05$) among different treatments in relation to feed consumption. However, total feed consumption on T_0F, T_0A, T_0C, T_0H, T_1F, T_1A, T_1C and T_1H treatment groups were 3029.20g, 2788.04g, 2883.48g, 2656.12g, 2940.48g, 2826.78g, 2914.42g and 2638.47g respectively at 5^{th} week of age. Significant differences ($P<0.01$) were found in feed conversion among birds fed on diet treated with phytase enzyme. Feed conversion ratio during the 5^{th} week of age was 1.88, 1.87, 1.82, 1.86, 1.77, 1.72, 1.75 and 1.70 and T_0F, T_0A, T_0C, T_0H, T_1F, T_1A, T_1C and T_1H treatment groups respectively.No significant differences. were observed in livability among the treatment groups.The cost of production was the highest in treatment T_1F followed by treatment T_1C, T_0F, T_1A, T_0C, T_0A, T_1H, T_0H. Net profit per live broiler was the highest in treatment T_1A followed by treatment T_1C, T_1F, T_1H, T_0C, T_0F, T_0A, T_0H

respectively. Dressing parameters were almost similar in different treatments and the differences were insignificant among treatment but the dressing weight percentage, thigh weight percentage and drumstick weight percentage were significant (P>0.01).From this study, it can be concluded that addition of phytase enzyme had a positive effect on bird's performance i.e. supplementation of phytase enzyme can enhance the growth performance of broilers in term of body weight, weight gain, feed conversion efficiency at reduced cost of broilers. These effects appeared to be more pronounced in the thermos table phytase supplemented group. Costs of broilers rations might be reduced as commercial sources of P in rations are reduced and promoting meat quality of broiler chicken with considerable reduction in overall cost of production. However, more research is needed to support these findings.

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