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ABSTRACT

The study was conducted at the Benguet State University Poultry Experimental Station from December to January 2010 to evaluate the effect of fermented fish extract on the growth performance of Cobb broilers. Specifically, it aimed to determine growth rate, feed consumption, feed conversion ratio, morbidity and mortality rate of broilers as affected by the supplementation of fermented fish extract through drinking water.

Following the Complete Randomized Design, 160 heads of one day-old Cobb broilers were distributed randomly into four treatments, which were replicated four times with ten birds per replicate comprising a total of forty birds per treatment.

Based on the results of the study, revealed that there were no significant differences between treatments in terms of initial weight, feed consumption, feed conversion ratio, and the feed cost to produce a kilogram gain in weight. Highly significant differences were observed in the final weight and gain in weight and a significant difference were observed in the water consumption of the birds.

Birds given 20 and 40 ml FFE supplementation had heavier weights at the end of the study and had higher gains in weight compared to the control birds or those given no FFE supplementation. Increasing, however, the level of FFE supplementation to 60 ml per liter of water did not result to a further increase in the final weight and gain in weight

of the birds. Instead, the higher level of FFE supplementation had greatly altered the taste of the drinking water, not to the likings of the birds, hence the lower water consumption.

Though the birds given 20 and 40 ml FFE supplementation were heavier in weights yielding to a higher net profit, still lower returns were observed from them compared to the control birds. This was because the costs of the fish and sugar used were that expensive and the increase in the net profit was not enough to offset their costs.

Based on the results of the study, adding 20 ml but not exceed to 40 ml of FFE into the drinking water of the birds results to higher gains in weight. However, it is recommended that the FFE supplementation should be done in times when the price is cheap to have higher returns.

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INTRODUCTION

The main goal of the broiler raisers is to produce meat efficiently and at the least possible cost. With this goal, a lot of feed additives have been produced which are now being used by the broiler raisers to improve the performance or to increase production of their birds. Examples of these feed additives are antibiotics and other synthetic growth promotants. However, most of the meat consumers today are now too conscious on what they eat. Just as they don't like to eat vegetables laden with pesticide residues, they don't like to eat meat laden with antibiotic residues and/or residues of other synthetic feed additives. If they have their own way and means, they would prefer to eat the so called "organic meat", a meat derived from animals fed with organic feeds and free from chemical residues or if not, the meat may contain chemical residues but it should be very minimal.

To satisfy the demand of the meat consumers of today, the broiler raisers are now geared to the use of probiotics or organic products like fermented fresh product. It is then, the aim of this study to determine the effect of fermented fish extract on the performance of broilers.

Fish is one of the very important components of our diet, because it contains essential minerals and other nutrients which our body requires that is not present into other food that we eat. As such, people tend to eat fish not just because of its low price, palatability and satiety value but also because of its nutritional content which contributes to human health. In fact some are referring to fish as "rich food for poor people.

The proximate composition of fresh fish according to Olivo (1990) is as follows: 61.34% crude protein, 6.94% ether extract, 2.23% crude fiber, 6.32% ash, 15.72%

nitrogen free extract, 90.32% dry matter, 1.80% potassium, 1.50% sodium, 0.89% calcium, 1.19% phosphorus, and 0.30% magnesium.

The result of the study will benefit not only the researcher himself but also the broiler raisers in particular and also the broiler industry as a whole. Instead of making use of some synthetic feed additives, the broiler raisers may make use of fermented fish extract most especially in places where fishes are abundant and at times when the price of fish is cheap to improve the performance of their birds. The result may also serve as reference material to other students and other researchers to come up with follow-up researches.

The study generally aims to determine the effect of fermented fish extract on the growth performance of broilers.

Specifically, it aims to:

1. Find out the performance of broilers treated with fermented fish extract in terms of growth rate, feed consumption, feed conversion ratio, morbidity and mortality rate.

2. Determine the level of fermented fish extract that will give the best broiler performance.

3. To determine the profitability of raising broilers given fermented fish extract.

The study was conducted at the BSU Poultry Experimental Station, La Trinidad, Benguet. The experiment used a total of 160 Cobb broilers fed from December to January, 2010 or for a period of 42 days.

REVIEW OF LITERATURE

Campbell-Platt (1987) has defined fermented foods as those that have been subjected to the action of microorganisms or enzymes so that a desirable biochemical change causes significant modification to the food.

Fish is a rich source of vitamins, particularly vitamins A and D from fatty species, as well as thiamin, riboflavin and niacin (vitamins B1, B2 and B3). Vitamin A from fish is more readily available to the body than from plant foods. Vitamin A is required for normal vision and for bone growth. Fatty fish contains more vitamin A than lean species. Studies have shown that mortality is reduced for children under five with a good vitamin A status. As sun drying destroys most of the available vitamin A better processing methods are required to preserve this vitamin. Vitamin D present in fish liver and oils is crucial for bone growth since it is essential for the absorption and metabolism of calcium. Thiamin, niacin and riboflavin are important for energy metabolism. If eaten fresh, fish also contains a little vitamin C which is important for proper healing of wounds, normal health of body tissues and aids in the absorption of iron in the human body (Lachica, 2003).

Olivo (1990) cited that the proximate composition of fish is as follows: 61.34% crude protein, 6.94% ether extract, 2.23% crude fiber, 6.32% ash, 15.72% nitrogen free extract, 90.32% dry matter, 1.80% potassium, 1.50% sodium, 0.89% calcium, 1.19% phosphorus, 0.30% magnesium. He also cited that proteins are important for growth and development of the body, maintenance and repairing of worn out tissues and for production of enzymes and hormones required for many body processes. The importance of fish in providing easily digested protein of high biological value is well documented.

In the past, this has served as a justification for promoting fisheries and aquaculture activities in several countries. On a fresh weight basis, fish contains a good quantity of protein, about 18-20%, and contains all the eight essential amino acids including the sulphur-containing lysine, methionine, and cysteine. As most maize-based diets lack these compounds, rural households in Africa dependent on maize greatly benefit by increasing their fish consumption. Fish also complements cassava-based diets which are generally low in protein.

Natural farming system (NFS) is a technology of agriculture that uses environmentally sound technique for raising crops and livestock that are free from most synthetic pesticide, growth hormones, and antibiotics. NFS farmers typically rely on farm inputs like pesticides, fungicides and fertilizers derived from plants, animal waste, and minerals. They incorporate biological methods such as the use of one organism to suppress another to help control pest. Methods used seek to increase soil fertility, balance insect population, and reduce air, soil, and water pollution (Tinoyan, 2006)

The lipids associated with fish are highly unsaturated and highly susceptible to be oxidized. Amino acid quality of fish is excellent, but excessive heating during the drying process can reduce digestibility of the protein fraction and complex some of the amino acids, so that they are not available. The oils associated with fish meal contain highly unsaturated and are oxidized easily (Agris, 2000)

Gill (2000) stated that to produce a quality of meat, it is best to use organic feeds which are formulated ration without using synthetic chemicals. Formulated rations such as organic feeds are more economical than commercial feeds. Organic chicken refers to the animal reared in semi-out door conditions and fed diets without using chemicals. He

also reported that the threshold for organic feed components rises to 80% and it could become 100% within five years. Even synthetic amino acids such as lysine and methionine will be questionable.

Administration of probiotics via the drinking water has beneficial effects on broiler performance. In the field trials, probiotic treatment significantly improved feed conversion ratio and total final body weight and mortality was reduced (Timmerman, 2006).

Organic acids inhibit the growth of bacteria through several proposed mechanisms. One of the accepted mechanisms involves the disruption of cell membrane transport functions that allow bacteria to maintain relatively state of equilibrium with their environment by absorbing nutrients and excreting waste. In addition to reducing the growth of pathogenic bacteria, organic acids facilitate the growth of *Lactobacillus and Bifid bacteria* throughout the digestive tract of poultry and other animals. These bacteria improve gut health by producing lactic, acetic, propionic, and butyric acid, organic acids that further limit the growth and colonization of pathogenic bacteria throughout the digestive tract (Poultry International, Inc. 2006).

Many poultry nutritionist in Europe and other parts of the world that are not using antibiotics, agree that organic acids can replace the growth promoting properties of antibiotics in poultry feed. In addition to enhancing and maintaining performance, organic acids have been shown to improve the meat quality, reduce the impact of poultry production in the environment and enhance the welfare of poultry (Poultry International, Inc. 2006).

Banning antibiotics as a standard additive to poultry feed has cause a lot of turmoil especially among broiler growers. Producers as well as manufacturers of feed additives are hastily looking for alternatives. Results from study works show that, to a large extent, lactic acids can take over the growth promoting properties of antibiotics (Poultry International, Inc. 2006).

Francisco (1992) mentioned that the reason why poultry and livestock farmers are giving daily feed supplements and other substances to their animals is to minimize production cost and also to improve feed efficiency and the animal's appetite.

MATERIALS AND METHODS

The materials and equipments used in the study were as follows: 160 day-old Cobb broiler chicks, weighing scale, measuring cups, spoon or syringe, cleaning materials, disinfectant, incandescent bulbs, old news paper sheets, vaccine, brooding and rearing cages, record book and feeding and drinking troughs. For the production of fermented fish extract (FFE), the following materials were used: Fish (Decapterus macrosoma) commonly known as Galongong or Bulilit, crude sugar, earthen jar, string, clean sheet of paper to cover the jar.

Two weeks before the arrival of the chicks, the broiler experimental house most especially the brooding/rearing cage are divided into 16 compartments to accommodate the four treatments, each with four replications of the study. Electric wirings were also installed ready to be provided with incandescent bulbs. Furthermore, the brooding/rearing cages were thoroughly cleaned with water and laundry soap after which these were disinfected.

Two days before the chicks arrived, the old newspaper sheets were spread on the floor of the brooding cage. This was to help conserve heat and to minimize the entrance of draft inside the brooding cage. It also served as receptacle for the feeds for the first few days. Incandescent bulbs were provided and these were lighted few hours before the chicks arrived so that the brooding cages were already warm when the chicks were placed inside it.

Upon arrival, the chicks were distributed to the different treatment following the completely randomized design (CRD) and were placed inside the brooding compartment

assigned to them. However, before the chicks were placed in their respective compartment, their weights were obtained and recorded.

There were four treatments in the study. Each treatment had four replications with 10 birds per replication making a total of 40 birds per treatment. The different treatments were as follows:

T_o= no FFE supplementation/pure water.

T_1= 20 ml of FFE supplementation per liter of water.

T_2= 40 ml of FFE supplementation per liter of water.

T_3= 60 ml of FFE supplementation per liter of water.

All of the birds were provided with the same management except on the level of fermented fish extract (FFE) added into their drinking water. Birds in the control group (T_0) were given pure water i.e. without FFE supplementation. Birds in treatment 1 were given 20 ml of FFE per liter of water, treatment 2, with 40 ml and treatment 3 with 60 ml FFE supplementation per liter of water. The FFE was introduced to the birds at day old until the end of the study or until the birds were 42 days old.

Ad libitum feeding was employed from the start until the end of the study. Chick booster was given to the chicks for the first two weeks of age. This was shifted to broiler starter mash for the next two weeks (15^{th} -30^{th} days) and then to finisher ration until the end of the study (31^{st} days to 42^{nd} days old). Water was always available at all times. Washing of the drinking gallons was done every late in the afternoon and early in the morning.

Lighting of the brooding cages was done day and night. However, as a precaution, light was turned-off for a period of 1 hour daily which was done every 5-6 pm daily

during the first two weeks. This was done for the purpose of making the birds accustomed to dark surroundings so that they should not be greatly affected during brown outs.

During the rearing period, the light intensity was reduced especially in the afternoon. Depending on the weather condition, lightning was only being done at night time.

To maintain the good health of the birds, strict hygiene and sanitation were maintained. Manure of the birds was scraped daily. Newspaper sheets that were used for the first 3 weeks were changed daily.

Weeks before the start of the study, the FFE was prepared. To produce it, fresh fishes (Decapterus macrosoma locally known as galongong or bulilit) were purchased directly from the fish vendors in the locality early in the morning. The fishes were washed thoroughly after which, these were drained to remove excess water. These were then placed inside a basin and were sliced into small pieces or even mashed. Into the mashed fishes, crude sugar was added at the level of 1 kg for every kilogram of mashed fished and the mixture were mixed thoroughly. The mixture was transferred into a bottle container, with a clean sheet of cloth or paper and a string was tied around it to secure the cover. The bottle was placed in a cool, dry and shaded area to allow the fishes to ferment for a period of 2 weeks. After the fermentation period, the concoction of the fishes was extracted by using a strainer or by putting the fish mixture inside a clean cloth and then the cloth was squeezed to extract the concoction. To minimize contamination of the fish concoction or from being affected with molds, this was poured into several small clean containers and sealed properly and well stored in a clean, cool, dry and shaded room.

A good FFE can be determined is through its smell especially after fermentation wherein, its smell is similar to that of wine, vinegar, or banana. There should be no molds present, strong fish smell, and other symptoms of contamination.

Data Gathered

The data gathered were as follows:

1. Initial weight (kg). This was obtained by getting the weight of the chicks at the start of the study.

2. Final weight (kg). This was obtained by getting the individual weights of the birds at the end of the study or 42 days old.

3. Feed offered. This was taken by weighing the amount of feeds offered to the birds during the experimental period.

4. Water offered. This was taken by measuring the amount of water offered to the birds each day.

5. Feed left-over. This was obtained by taking the weight of the feed left-over of the birds. This was done every morning before feeding time.

6. Water left-over. This was obtained by taking the measurement of the water left-over of the birds. This was done every early in the morning and late in the evening.

7. Morbidity. This refers to the number of birds that got sick during the experimental period.

8. Mortality. This refers to the number of birds that died during the study.

9. Cost of production. This refers to the cost of each of the materials used in the study.

From the above data, the following was computed:

1. Gain in weight (kg). This is the difference between the initial weight from the final weight of the birds.

2. Feed consumption (kg). This refers to the amount of feed given to each experimental bird throughout the experiment.

3. Water consumption (ml). This refers to the amount of water given to each experimental bird throughout the experiment.

4. Feed Conversion Ratio (FCR). This was obtained by dividing the total fed consumption by the gain in weight of each bird.

5. Feed cost to produce a kg broiler. This was obtained by multiplying the FCR by the cost of a kg of feed.

6. Morbidity rate (%). This was obtained by dividing the number of birds that got sick by the total number of birds at the end of the study multiplied by 100%.

7. Mortality rate (%). This was obtained by dividing the number of birds that died by the total number of birds multiplied by 100%.

8. Net profit. This was obtained by deducting all the cost of production from the total sales.

9. Return on investment (ROI). This was obtained by dividing the net profit by the total cost of production multiplied by 100%.

RESULTS AND DISCUSSION

Initial Weight

Table 1 shows that the mean initial weights of the birds in the different treatments which ranged from 40.10 g t0 41.50 g was not significant. This indicates that the experimental birds were more or less of the same weight at the start of the study.

Final Weight

The mean final weights of the birds are shown in Table 2. It is shown in the table that the control group had a mean of 1.73875 kg while the 20, 40, 60 ml groups had means of 1.84500 kg, 1.84875 kg, and 1.72125 kg, respectively.

Statistical analysis revealed that there were significant differences between treatments means. The birds given fermented fish extract at 20 and 40 ml had significantly heaveir final weights compared to the control group and the birds given fermented fish extract at the level of 60 ml. This observation implies that 20 to 40 ml of FFE is the optimum amount needed to increase the weight of the birds because when the amount was raised to 60 ml, no significant increase in the final weight was observed.

Table 1. Mean initial weights of birds in the different treatments

TREATMENT	INITIAL WEIGHT (g)
Control	41.5000[a]
20 ml of fermented fish extract	41.1250[a]
40 ml of fermented fish extract	40.7500[a]
60 ml of fermented fish extract	40.1000[a]

*Means with the same letters are not significantly different at 0.05 DMRT

Table 2. Mean final weights of the birds in the different treatments

TREATMENT	FINAL WEIGHT (kg)
Control	1.7387[b]
20 ml of fermented fish extract	1.8450[a]
40 ml of fermented fish extract	1.8487[a]
60 ml of fermented fish extract	1.7212[b]

*Means with the same letters are not significantly different at 0.05 DMRT

Total Gain in Weight

Table 3 shows the mean total gain in weight of birds per treatment. It is shown that the control group had a mean of 1.6897 kg while the broilers given 20, 40 and 60 ml FFE had means of 1.8037 kg, 1.8080 kg, and 1.6939 kg, respectively.

Statistical analysis revealed that there were highly significant differences between treatment means.

Table 3. Total gain in weight of birds from 1 to 42 days of age

TREATMENT	GAIN IN WEIGHT (kg)
Control	1.6897[b]
20 ml of fermented fish extract	1.8037[a]
40 ml of fermented fish extract	1.8080[a]
60 ml of fermented fish extract	1.6939[b]

*Means with the same letters are not significantly different at 0.05 DMRT

The birds given 20 and 40 ml FFE supplementation had significantly higher gains in weight compared to the control group or those given no FFE supplementations and surprisingly even those given 60 ml FFE supplementation. This result implies that mixing FFE into the drinking water of Cobb broilers at the level of 20 to 40 ml per liter of water had improved their growth rates resulting to the higher gains in weight. The higher gains in weight could have been attributed by the additional protein intake which the birds obtained from their drinking water as this was supplemented with FFE and also the other

growth promoting properties of FFE as an organic acid.

Fish, according to Olivo (1990), provide easily digested protein of high biological value and proteins are important for growth and development of the body maintenance and repair of worn out tissues and for production of enzymes and hormones required for many body process.

Also, as cited in the Poultry International, Inc. (2006), organic acids can replace the growth of pathogenic bacteria. It also facilitates the growth of Lactobacillus and Bifid bacteria throughout the digestive tract of poultry and other

animal. These bacteria improve gut health by producing lactic, acetic, propionic, and butyric acid. Organic acid that further limit the growth and colonization of pathogenic bacteria throughout the digestive tract.

No further increase in the gains in weight however was observed from the birds given 60 ml FFE supplementation. This was probably because the birds did not like the taste of their drinking water as evidenced by their lower water consumption.

Total Feed and Water Consumption

Table 4 presents the total feed and water consumptions of the birds in the different treatments during the entire duration of the study.

Statistical analysis showed that there were no significant differences among the four treatments in the feed consumptions of the birds which ranged from 3.6869 to 3.9150 kg. This means that FFE did not alter the feed consumption of the broilers. It also
implies that the experimental birds in all the treatments consumed more or less the same amount of birds.

With regards to the water consumption, statistical analysis revealed that the birds in the control group and those given 20 ml FFE supplementation had higher water consumption compared to the birds given 40 and 60 ml FFE supplementation. This result implies that the FFE when given at the level of 20 ml per liter of water did not affect the water consumption of the

birds. However, when the level of FFE was increased to 40 and 60 ml, the water consumptions of the birds were reduced. This means that the FFE could have possibly altered the taste of the water which was not relished by the birds, hence the lower consumption.

Feed Conversion Ratio (FCR)

The mean feed conversion ratios of the birds in the different treatments are shown in Table 5. Noticeable differences between treatment means are observed, however these differences are still considered too small to cause significant effects as revealed by the statistical analysis.

Table 4. Total feed and total water consumption of the birds in the different treatments

	MEAN*	
TREATMENT	FEED (kg)	WATER (l)
Control	3.9150[a]	10.0975[a]
20 ml of fermented fish extract	3.8888[a]	10.9975[a]
40 ml of fermented fish extract	3.8563[a]	9.8875[b]
60 ml of fermented fish extract	3.6869[a]	9.8200[b]

*Means with the same letters are not significantly different at 0.05 DMRT

Table 5. Feed conversion ratio of the birds in different treatments

TREATMENT	FCR
Control	2.30250[a]

20 ml of fermented fish extract	2.15500[a]
40 ml of fermented fish extract	2.12750[a]
60 ml of fermented fish extract	2.17000[a]

*Means with the same letters are not significantly different at 0.05 DMRT

Feed Cost Per Kg Gain in Weight

Table 6 shows the mean feed cost to produce a kilogram gain in weight of the birds in all the treatment ranging from PhP 51.486 observed from the birds given 40 ml FFE supplementation to PhP 55.721 observed from the control group.

Statistical analysis revealed that there are no significant differences between treatment means. This implies that supplementing the drinking water of the birds with FFE at the rate of 20-60 ml did not alter the feed cost to produce a kilogram gain in weight of the birds in all treatments.

Morbidity and Mortality Rates

No mortality among the birds in all the treatments was incurred during the entire duration of the study despite of the very cold weather conditions particularly at night time and the hot weather conditions during the middle of the day. This was because the birds was properly monitored and managed all throughout the study. There were no illnesses incurred by the birds particularly digestive disturbances. This indicates that

Table 6. Mean feed cost per kg gain in weight

TREATMENT	FEED COST/KG (PhP)

Control	55.721[a]
20 ml of fermented fish extract	52.151[a]
40 ml of fermented fish extract	51.486[a]
60 ml of fermented fish extract	52.514[a]

*Means with the same letters are not significantly different at 0.05 DMRT

supplementing the drinking water of the birds with FFE at the level of 20-60 ml will not cause any digestive disturbances in birds. Instead, it helps protect the birds against diseases.

Return on Investment

Table 7 shows the cost and return analysis obtained from the birds in the different treatments though this parameter was not subjected to statistical analysis, results revealed that the birds given with no FFE supplementation or those assigned to the control group had the highest return on investment of 28.42 %. This was followed by the birds given 20 and 40 ml FFE supplementation with return on investment of 26.54 % and 20.14 %, respectively the birds given the highest amount of FFE supplementation of 60 ml gave the lowest return on investment of only 7.69 %.

Because of the heavier weight of the birds particularly those given 20 and 40 ml FFE supplementation, higher sales were also obtained from them compared to the birds from control group. However, still lower on investment were realized because of the higher cost of production brought about by the cost of fish and sugar used to produce the FFE. This results implies that FFE may be given to the birds at the rate of 20-40 ml per liter of their drinking water but it should be given in times when fish is cheap to have higher returns.

With what was cited in the Poultry International, Inc. (2006), an organic acid inhibits the growth of pathogenic bacteria.

Table 7. Return on investment and net profits per treatment

TREATMENT	TOTAL COST (Php)	TOTAL SALES (Php)	NET PROFIT (Php)	ROI (%)
Control	5,957.09	7,650.50	1,693.40	28.42
20 ml of fermented fish extract	6,415.63	8,118	1,702.37	26.54
40 ml of fermented fish extract	6,770.32	8,134.5	1,364.17	20.14
60 ml of fermented fish extract	7,032.67	7,573.5	540.82	7.69

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This researched aimed to determine the effect of fermented fish extract (FFE) on the growth performance of Cobb broilers when given at the levels of 20 ml, 40 ml, and 60 ml per liter of drinking water.

Following the Complete Randomized Design (CRD), 160 broiler chicks were grouped into four treatments. Each treatment was replicated four times with ten birds per replication. Set of the birds in the different treatments were subjected to the same management from the start to the end of the study. The only difference was on the level of FFE supplementation given to them depending on what treatment were these birds assigned.

Results of the study revealed that there were no significant differences between treatments in terms of initial weight, feed consumption, feed conversion ratio, and the feed cost to produce a kilogram gain in weight. Highly significant differences were observed in the final weight and gain in weight and a significant difference were observed in the water consumption of the birds.

Birds given 20 and 40 ml FFE supplementation had heavier weights at the end of the study and had higher gains in weight compared to the control birds or those given no FFE supplementation. Increasing, however, the level of FFE supplementation to 60 ml per liter of water did not result to a further increase in the final weight and gain in weight of the birds. Instead, the higher level of FFE supplementation had greatly altered the taste of the drinking water, not to the likings of the birds, hence the lower water consumption.

Though the birds given 20 and 40 ml FFE supplementation were heavier in weights yielding to a higher net profit, still lower returns were observed from them compared to the control birds. This was because the costs of the fish and sugar used were that expensive and the increase in the net profit was not enough to offset their costs.

Conclusion

Based on the results of the study, is therefore concluded that giving FFE to the birds at the rate of 20 but not exceed 40 ml per liter of drinking water resulted to higher gains in weight. Increasing the level of FFE to 60 ml did not result to a corresponding increase in the gain in weight. It is also concluded that adding FFE into the drinking water of the birds at the rate of 20-60 ml per liter did not alter the feed consumption of the birds and did not cause any digestive disturbance. Furthermore, higher sales were obtained the birds given 20-40 ml of FFE supplementation because of their heavier body weights but still lower return on investment were realized because of the additional expenditures incurred in producing the FFE.

Recommendation

Based on the result of the study, it is recommended that FFE can be given to the birds at the rate of 20 ml but not to exceed 40 ml per liter of their drinking water, however, it should be given at times when the price of fish is cheap to have higher return on investment. It should also recommended that further study should be conducted to include the nutrient analysis of the meat derived from the birds given FFE supplementation and perhaps a similar study be conducted but should involved lower levels of sugar in the production of FFE.

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APPENDICES

APPENDIX TABLE 1. Initial weight (g)

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
T_0	42.0	41.0	41.0	42.0	166.0	41.50
T_1	42.0	40.0	42.0	42.0	166.0	41.50
T_2	42.0	42.0	40.0	39.0	163.0	40.75
T_3	42.0	42.4	41.0	39.0	164.4	40.10
GRAND TOTAL					659.4	
GRAND MEAN						41.21

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.01
Treatment	3	1.12687500	0.37562500	0.25^{ns}	3.49	5.95
Error	12	17.85750000	1.48812500			
TOTAL	15	18.98437500				

^{ns}= not significant CV = 2.97%

APPENDIX TABLE 2. Final weight (kg)

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
T_0	1.76	1.74	1.69	1.75	6.95	1.73
T_1	1.86	1.81	1.86	1.84	7.38	1.84
T_2	1.85	1.81	1.88	1.85	7.39	1.84
T_3	1.76	1.68	1.73	1.71	6.88	1.72
GRAND TOTAL					28.61	
GRAND MEAN						1.78

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.01
Treatment	3	0.05527969	0.01842656	21.99**	3.49	5.95
Error	12	0.01005625	0.00083802			
TOTAL	15	0.06533594				

** = Highly significant CV = 1.62%

APPENDIX TABLE 3. Total gain in weight (kg)

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
T_0	1.72	1.69	1.65	1.71	6.78	1.69
T_1	1.81	1.75	1.81	1.80	7.19	1.79
T_2	1.81	1.76	1.84	1.81	7.23	1.80
T_3	1.71	1.68	1.65	1.71	6.77	1.69
GRAND TOTAL					27.99	
GRAND MEAN						1.74

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.01
Treatment	3	0.05207821	0.01735940	20.98**	3.49	5.95
Error	12	0.00993043	0.00082754			
TOTAL	15	0.06200864				

** = highly significant CV = 1.64%

APPENDIX TABLE 4. Total feed consumption (kg)

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
T_0	4.51	3.74	3.72	3.67	15.66	3.91
T_1	3.87	4.01	3.81	3.84	15.55	3.88
T_2	3.88	3.675	4.01	3.85	15.42	3.85
T_3	3.79	3.78	3.60	3.56	14.74	3.68
GRAND TOTAL					61.38	
GRAND MEAN						3.83

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.01
Treatment	3	0.12667930	0.04222643	0.83^{ns}	3.49	5.95
Error	12	0.61104219	0.05092018			
TOTAL	15	0.73772148				

^{ns}= not significant CV = 5.88%

APPENDIX TABLE 5. Water consumption (l)

REPLICATION

TREATMENT	I	II	III	IV	TOTAL	MEAN
T_0	10.20	10.15	10.11	9.93	40.39	10.09
T_1	11.92	11.98	10.13	9.96	43.99	10.99
T_2	9.88	9.86	9.92	9.89	39.55	9.88
T_3	10.02	9.70	9.99	9.57	39.28	9.82
GRAND TOTAL					163.22	
GRAND MEAN						10.20

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.01
Treatment	3	3.55843750	1.18614583	3.72*	3.49	5.95
Error	12	3.82748750	0.31895729			
TOTAL	15	7.38592500				

* = significant CV = 5.54%

APPENDIX TABLE 6. Feed conversion ratio

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
T_0	2.62	2.20	2.25	2.14	9.21	2.30
T_1	2.13	2.26	2.10	2.13	8.62	2.15
T_2	2.14	2.07	2.18	2.12	8.51	2.12
T_3	2.21	2.23	2.17	2.07	8.68	2.17
GRAND TOTAL					35.02	
GRAND MEAN						2.18

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.01
Treatment	3	0.07272500	0.02424167	1.64^{ns}	3.49	5.95
Error	12	0.17725000	0.01477083			
TOTAL	15	0.24997500				

^{ns}= not significant CV = 5.55%

APPENDIX TABLE 7. Feed cost per kg gain in weight (PhP)

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
T_0	63.40	53.24	54.45	51.78	222.88	55.72
T_1	51.54	54.69	50.82	51.54	208.60	52.15
T_2	51.78	50.09	52.75	51.30	205.94	51.48
T_3	53.48	53.96	52.51	50.09	210.05	52.51
GRAND TOTAL					847.48	
GRAND MEAN						52.96

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.01
Treatment	3	42.59066900	0.02424167	1.64^{ns}	3.49	5.95
Error	12	0.17725000	0.01477083			
TOTAL	15	0.24997500				

^{ns}= not significant CV = 5.55%

APPENDIX 8. Return on investment (PhP)

SOURCES OF EXPENDITURE	T_0	T_1	T_2	T_3
Stocks	1,880	1,880	1,880	1,880
Materials and Equipment	165.50	165.50	165.50	165.50
Vaccine	21.87	21.87	21.87	21.87
FEE	0	483.94	870.10	1,296.40
Feeds	3,789.72	3,764.31	3,732.85	3,568.89
Electricity	35	35	35	35
Water	30	30	30	30
Labor	35	35	35	35
TOTAL COST OF PRODUCTION	5,957.09	6,415.63	6,770.32	7,032.67
Sales of broiler	7,650.50	8,118	8,134.50	7,573.50
GROSS INCOME	7,650.50	8,118	8,134.50	7,573.50
NET PROFIT	1,693.40	1,702.37	1,364.175	540.82
ROI (%)	28.42	26.54	20.14	7.69