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Effect of different probiotics on the growth performance of broiler chicken

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ABSTRACT: The study was conducted from December 15, 2019 to January 26, 2020 at College of Agriculture and Forestry, Apayao State College, Cubet-Malama, Conner, Apayao, Philippines aimed to evaluate the effect of different probiotics on the growth performance of broiler chicken, specifically on the initial and weekly body weight, gain in weight, percentage rate of growth, feed consumption, dressing percentage and feed conversion ratio and efficiency, using T_1- pure Water, T_2 – commercial probiotics, T_3 – effective microorganism, and T_4 – fermented fruit juice as water additive. The experiment was laid out using the Completely Randomized Design. The probiotics and the fermented fruit juice did not show any significant effect on the growth performance of broiler chicken on body weight, gain in weight, percentage rate of growth, feed consumption, water consumption and feed conversion ratio and efficiency. The percentage livability of Treatments 1, 3, and 4 was still impressive since the standard of 5% mortality rate was not reached, which implies that the used of commercial probiotics and fermented fruit Juice or organic acids affects immunity. On the income over feed, additive and chick cost, the use of fermented fruit juice had the potential to improve the growth performance of broiler chicken in the sense that it was comparable with the effective microorganism and commercial probiotics as exhibited in the body weights, feed and water consumption, gain in weight, percentage rate of growth and feed conversion ratio and efficiency. Therefore, the use of probiotics and fermented fruit juice from banana are safe in raising broiler chicken for table meat, and it is recommended to use in the chicken production as it increases the income over feed, additive and chick cost. Further study is recommended using other ingredients of fermented fruit juice to validate the concept of probiotics as a viable modality in poultry production.

Keywords: Effective microorganism, fermented fruit juice, growth, probiotics.

INTRODUCTION

Poultry production is one of the segment of livestock production which plays an important role in the Gross National Product of the Philippines and to the world economy as well. Nowadays, global production of poultry meat has been growing faster than that of any other meat. But farmer's major problem in the Philippines is the very high cost of conventional feedstuffs, medicines and other inputs which are very important in the production. Broiler raiser faces increasing challenging to come up with positive market outlook. One of these is consumer concerns over food safety, product quality and environmental issues like global warming which is associated with the industrialized poultry production system.

Probiotics are used mainly to help ensure health status by maintaining the digestive microbial balance and reducing potential pathogenic bacteria which have the effect improving performance and productivity (growth, increases egg production, and feed conversion). Probiotics used in birds aiming to prevent and combat digestive disorders based on competitive exclusion of potentially pathogenic bacteria (*Salmonella*, *Escherichia*

coli, *Clostridium perfringens*), antimicrobial secretions (bacteriocins), the stimulation of an immune response that contributes to the maintenance or reinstallation of 'intestinal health" (Higgins *et al.,* 2008). Organic input is highly recommended to use as water additives that may contain wide array of substantial vitamins and minerals which is considered necessary to animals.

The Apayao province where the study was conducted is located deep in the Cordillera mountains of Norther Luzon, Philippines. The Apayao province is classified into upper and lower. Upper Apayao with 3 municipalities occupies 67.2% of the total land area and has mountainous topography classified by towering peaks, plateaus and intermittent patches of valleys. Lower Apayao on the other hands comprising 4 municipalities is in 32.8% of total land area described as flat with rolling mountains and plateaus (PSA, 2020). The province of Apayao is known as an agricultural province that produces agricultural commodities such as rice, corn, cassava, and banana. Based on the 2018 PSA survey, the top three crops produced by the province were casava with 76.3 percent followed by banana with 7.9 percent and squash fruit with 6.5 percent contributed to the total production in Apayao (PSA, 2018). In the formulation of Fermented Fruit Juice (FFJ), banana fruit was recommended as the best substrate and Apayao has its vast resources on this production.

Probiotic

Probiotics contribute to recover the histology of both the intestine and the thymus damaged. Probiotic bacteria are emerging as a safe and natural strategy for allergy prevention and treatment. Probiotic bacteria, their cell walls or probiotic fermented milk have significant effects on the functionality of the mucosal and systemic immune systems through the activation of multiple immune mechanisms (Maldonado Galdeano *et al.*, 2019).

Effect of fermented fruit juice and effective microorganism (EM) to animals

Fermented fruit Juice (FFJ) can be used as spray to animal beddings to hasten manure decomposition. Fermented Fruit Juice contains beneficial microorganisms that help in the decomposition process. FFJ, likewise use as a nutritional drink- a 20% Fermented Fruit Juice solution makes an excellent drink for both human and livestock. (Business Diary Philippines, 2019).

It was concluded that fermented feed influences the bacterial ecology of the gastrointestinal tract and reduces the levels of eneterobacteriaceae in the different parts of the gastrointestinal tract (van Winsen *et al*. 2001).

Effective microorganism (EM) products that are for poultry production are Stock EM, Multiplied EM and Bokashi (solid form of EM). Stock EM is the basic, concentrated EM solution that contains all beneficial microorganisms. Stock EM is not a fertilizer, a chemical or a synthetic. It is not also genetically engineered. Stock EM is a basic dominant form of EM and is therefore usually used to produce multiplied EM (M-EM). Multiplied EM is the activated, secondary form of EM. It consists of S-EM (1-3%), molasses (3-5%) and water ((94%). The molasses serves as a nutrient source for the microorganism, consequently leading to the growth and multiplication of the microorganisms. EM Bokashi is an essential supplement feed for animals. It is made from 1 to 2% Multiplied EM, 1% molasses and 98% water, which is then added to organic feed materials. It has various applications, but is mostly used as a form of animal feed.

According to Chantsawang and Watcharangkul (2003), EM was first introduced and used extensively in Asia; the technology was later introduced to other various countries. The use of EM in animal husbandry nowadays is very well identified in many parts of the world. In a study conducted in Belarus by Konoplya and Higa (2000), EM was successfully used in poultry and swine units as feed constituent and sanitation spray. In south Africa, EM was used to increase productivity in integrated animal units and poultry farms (Hanekon *et al.,* 2001). Result of EM experiment conducted on 27000 Kuroki broilers in Japan was reported by Higa (1994). EM was administered in drinking water, EM Bokashi in feed slicing and cleaning out the hen coops with an EM dilute solution. Of the 27000 chicks reared by this operation, survival rate increased to 97% for the birds raised by EM methods. In actual figure, this made an increase of 3780 fowls ready and shipped to market. An alternative is the use of probiotics, prebiotics and symbiotic (feeding probiotic microorganism together with prebiotic substances) which might contribute to digestion due to the development of beneficial microorganisms in the gastro-intestinal tract (Pelicano *et al*., 2004).

Effective Microorganisms (probiotics) may be suitable replacements of antibiotics. According to Fuller (1992) and Reid *et al*. (2003), probiotic is defined as live microorganisms that, when administered in adequate amounts, confer a health benefit on the host. There is now mounting evidence that selected probiotic strains can provide health benefits to their human host. Besides their use for controlling pathogenic bacteria, probiotics have also been used to improve the growth of poultry (Stavric and Kornegay 2008).

Effects of probiotics on the performance of chicken

Probiotics are defined as live microbial food supplements, which beneficially influence human (Songisepp *et al.,* 2005) and animal health (Carroll *et al.,* 2007; Messaoudi *et al.,* 2011; Lee *et al.,* 2008; Gratz *et al.,* 2010). Al-khalaifa *et al*. (2019) said that probiotics and prebiotics can be used

in chicken feed safely and without any adverse effects on the productive parameters and immune status of the flock. The resulting inhibition of nuclear factor-kB and increased expression of heat shock proteins may account for the anti-inflammatory and cytoprotective effects reported for probiotics and may be a novel mechanism of microbial-epithelial interaction (Petrof *et al*. (2004). Several studies reported the antioxidant activity on probiotic bacteria using assays *in vitro* (Shen *et al.,* 2011). Widely, probiotics contain different lactic acid producing bacteria: bifidobacteria, lactobacilli or enterococci (Songisepp *et al*., 2005). For the chicken, the intestinal lactic acid bacteria are mainly *Lactobacillus* and *Enterococcus* (Mitsuoka, 2002).

Additives such as enzymes, probiotics, organic acids, plant extracts and also supplements improve food flavour and palatability. Numerous studies show that probiotics have a positive effect on chicken performance – growth and feed efficiency (Ahmad, 2006; Abaza *et al.,* 2008; Cakır *et al.,* 2008) and on health and immune response (Audisio *et al., 2000*; Koenen *et al.,* 2002; Griggs and Jacob, 2005; Demeterova *et al.,* 2008).

Probiotics are microorganisms that are fed to animals to colonize the intestinal environment and promote a better flora balance. Besides, these microorganisms are responsible for the production of vitamins and the B complex and digestive enzymes, and for stimulation of intestinal mucosa immunity, increasing protection against toxins produced by pathogenic microorganisms. Some authors reported advantages of probiotic administration (Jensen and Jensen, 1992; Maruta, 1993; Correa *et al.,* 2000; Vargas Jr. *et al.,* 2002), whereas others did not observe improvement when probiotics were used (Quardos *et al.,* 2001).

Objectives of the study

The general objective of the study was to evaluate the effect of probiotics using Commercial Probiotic (Protexin), Effective Microorganism (EM-1) and Fermented Fruit Juice (FFJ) as water additive for broilers. Specifically, the study aimed to determine the performance of broiler chicken in terms of the following: Initial and weekly body weight; gain in weight; percentage rate of growth; feed consumption; water consumption; feed conversion ratio and efficiency; dressing percentage with and without giblets; and economic importance in using Commercial Probiotic (Protexin), Effective Microorganism (EM-1) and Fermented Fruit Juice (FFJ) as water additive for broilers.

METHODOLOGY

Brooding

A brooding house was constructed using lumber, screen as walling and flooring and was subdivided into 12 compartments, surrounded by curtains and electricity was installed using incandescent bulb of 100 watts. Each pen measured about 24 x 24 inches. The chicks were cared and managed for 14 days before they were transferred to the growing house. It was subdivided by 12 experimental units with a measurement of 1 x 1 m. The study was conducted at the Agriculture Instructional, Research, and Production Unit, College of Agriculture and Forestry, Apayao State College, Cubet-Malama, Conner, Apayao. The experimental house so as the feeding and drinking jars were thoroughly cleaned with powder soap and disinfected with Lysol mixed with water for one week before the arrival of the chicks. Likewise, proper hygiene, sanitation, and strict biosecurity measures were observed throughout the study to prevent the occurrence of diseases. One hundred twenty (120) day-old Minerva broiler was used in the study. These were purchased at Belstenn Commercial and Farm Supply, Public Market, Roxas, Isabela. The brooder pen was matted with rice hull which was checked daily to maintain cleanliness and sanitation for the chicks. Curtains were made up from empty sacks and placed around the housing to conserved heat inside the brooder. Light was switched from 6:00 PM until 6:00 AM to maintain heat requirements.

Feeds and feeding management

To meet the crude protein requirement of the birds at young stage, a commercial chick booster was given. They were fed for 7 days and gradually shifted for 3 days with 75% commercial, 50% commercial and 25% commercial. The formulated mash from home mixed rations with 20% crude protein was given to the birds to all treatments in full after gradual shifting process up to harvesting period using the chemical composition of the different feed ingredients used in the study. The feedstuffs used in the preparation of the experimental diets were as follows; corn grits, soybean, rice bran (D1), fish meal, limestone, salt, vitamin/mineral premix (Table 1). These were purchased at Belstenn's Commercial Farm Supply, Public Market, Roxas, Isabela. The experimental birds in the different treatments were fed on *ad libitum*. The birds were placed in their semi-automatic feeding jar regularly checked to ensure the availability of the feeds for the birds. The feed consumed per day was recorded daily. The formulated feeds given to the experimental birds second week following the shifting process for three days until six weeks and reached the average body weight of 1.5 kg.

Fermented Fruit Juice (FFJ) formulation

Fermented Fruit Juice (FFJ) was formulated using substrates such as ripe banana and molasses. The banana fruits were chopped into small pieces so that the juice can be easily extracted and placed in a pail and

Table 1. Composition and calculated nutrient analysis of the broilers' diets.

Ingredients	Parts (%)
Corn	53.5
Soybean Meal	25.9
Rice Bran (D1)	12
Fish Meal (US)	5
Dicalcium Phosphate (Dicaphos)	1
Limestone	1.3
Salt	0.5
Vitamin/Mineral Premix	0.5
Methionine	0.1
Antioxidant	0.2
Total	100
Calculated nutrient analysis	
Crude Protein (%)	20.00
Metabolizable Energy (Kcal,ME)	2,944.40
Calcium (%)	0.85
% P Avail.	0.43
% Lysine	1.14
% Methionine	0.43

mixed thoroughly with molasses with a ratio of 1 kg of banana into 1 kg of molasses. The pail was covered with newspaper tied with string and allow fermentation for 7 days. The substrate was squeezed with clean and fine cloth after the fermentation processed. The fermentation extract was collected and preserved in a plastic bottle and covered with cloth to allow the gas to escape during further fermentation. It was stored in a cool dry place.

Procedures of probiotics and fermented fruit juice utilization

The probiotics and fermented fruit juice were utilized following the recommended amount for each treatment. For treatment 2, which is the commercial probiotics (protexin) was diluted with a ratio of 10 grams per litre of distilled water, treatment 3, 10 ml of EM-1 concentrated was mixed in 1 litre of water, treatment 4, 10 ml of FFJ was mixed in a litre of water. All the mixture was offered to the experimental birds all throughout the study.

Provision of probiotics and fermented fruit juice in drinking water

Fresh drinking water was mixed with the recommended volume of probiotics and fermented fruit juice for all the treatments in the study. Water with commercial probiotics, effective microorganism and fermented fruit juice was measured before and after in order to monitor water consumption. Water mixed with probiotics and fermented fruit juice was changed daily to avoid the occurrence of harmful microorganisms.

Distribution of experimental birds to different treatments

Following the Completely Randomized Design (CRD), the experimental birds were distributed into four (4) treatments and each treatment was replicated thrice (3) with 10 birds per replication. The Least Significant Difference (LSD) was used for the comparison of means for results with significant findings.

Experimental treatments

The treatments used in the study are as follows;

Treatment 1 – Control (Pure Water)
Treatment 2 – Commercial Probiotic (Diluted Protexin – 10 ml/litre water)
Treatment 3 – Effective Microorganism (10 ml/litre water)
Treatment 4 – Fermented Fruit Juice (10 ml/litre water)

Data gathered

The following data were collected and recorded base on the growth performance parameters:

Initial and weekly body weight: The initial body weight of birds was taken upon the arrival or before they were distributed to the experimental pens. Thereafter, the body weights were recorded weekly up to sixth week of the study.

Gain in weight: The gain in weight of the birds was taken by subtracting the initial weight from the final weight.

Percentage rate of growth: The percentage rate of growth of the experimental birds was determined by means of the Asmundson and Leiner's formula as follows:

$$\text{Growth Rate } (\%) = \frac{\text{W2} - \text{W1}}{½\ (\text{W2} + \text{W1})} x\ 100$$

Where: W_1 – the previous weight of birds at a given period, and W_2 – the current weight of birds at a given period.

Final body weight: This is the weight of the birds in the different treatments taken at the end of the study.

Final gain in weight: The final gain in weight was determined as a difference between the initial and final weight of the birds.

Feed consumption: The feed consumption of the birds in different treatments was done by taking into accounts the volume of feeds consumed and the volume of feeds offered. The amount of left-over was subtracted from the feeds offered to determine the actual feed consumption.

Water consumption: The water consumption of the birds in the different treatments was done by taking into account the amount of water consumed and the amount of water offered. The amount of leftover was subtracted from the water offered to determine the actual water consumption.

Feed conversion ratio and efficiency: The feed conversion ratio (kg) and efficiency (%) was determined by using the formula as follows;

$$\text{Feed Conversion Ratio (kg)} = \frac{\text{Feed Consumption}}{\text{Gain in Weight}}$$

$$\text{Feed Conversion Efficiency (\%)} = \frac{\text{Gain in Weight}}{\text{Feed Consumption}} x\ 100$$

Dressing percentage: The dressed weight of the sexed broilers from every replication were recorded and as basis in computing the dressing percentage.

Income over feed, additive and chick cost: The income above feed, additive and chick cost was computed at the end of the experiment by considering the value of the broilers produced less cost of feeds consumed.

The cost of feeds was computed based on the prevailing price of the different ingredients used, while the value of broilers was determined by the market price per kilogram live weight.

Statistical analysis

All the data gathered were tabulated and analysed using the Analysis of Variance following the Completely Randomized Design (CRD). The Least Significant Difference (LSD) was used for the comparison of means if the result is significant. Sirichai 6 1.0 program was used for the computation of data gathered.

RESULTS AND DISCUSSION

Characteristics of the experimental birds used in the study

All the experimental birds used in the study exhibited a healthy appearance and vigorous growth as indicated in their weekly body weights. The birds were lively, alert, good eaters and drinkers throughout the duration of the study. The birds in all treatments had a similar morphology with the uniform feathering rate and beak.

During the first up to second week of rearing, alertness and activeness was observed every time when feed and water were offered and they were all apparently healthy. As the bird grew up particularly during the third week of the study, leg problems and lameness was observed.

After 5 days from the start of the study, the yellow color was gradually changed in white color from the head, wings, tail until white colors were prevalent. Their combs showed reddish and relatively small and erect on the fourth week of the study.

Growth performance parameters

Body weight

The initial and weekly body weight of the experimental birds as influenced by probiotics and Fermented Fruit Juice are shown in Table 2. The initial weight of birds was comparable with each other with means ranging from 62.72 to 65.21 grams. The body weight of the birds from the first week up to sixth week obtained insignificant results. The results of the study imply that inclusion of Effective Microorganism (EM), Fermented Fruit Juice (FFJ), and Commercial Probiotics (Protexin) via drinking water did not influenced the body weights of the birds from the first week to sixth week of rearing based on the computed analysis of variance. Although the result was statistically comparable with all the treatments mean, Treatment 4 (FFJ) had recorded the highest body weight compared to birds in treatments 2 and 1 that consumed commercial probiotic (Protexin) and pure water respectively. It was observed that FFJ has the potential to improve body weight. This is probably due to the beneficial effects of lactic acid bacteria present on it which help digestion on chicken. The result is in contrast to the findings of Vargas Jr. *et al.* (2002).

Gain in weight

The influenced of probiotics on the weekly gain in weight of broilers is presented in Table 3. The probiotics and fermented fruit juice failed to influence the first week gain in weight of broilers with means ranging from 56.73 to 87.71 grams. No significant result was also observed on the second week, third week, fourth week, fifth week and sixth week with a mean value of 114.56 to 176.67, 236.23 to 284.67, 405.33 to 447.67, 475.33 to 558.33, and 199.67 to 332.00 grams, respectively. The total gain in weight of broilers did not revealed any significant differences among treatments with mean ranging from 1538.33 to 1776.79 grams. The result does not agree with the findings of Faria Filho *et al.* (2006) and Awad *et al.* (2009).

Table 2. Initial and weekly body weights (g) of broilers as influenced by probiotics and fermented fruit juice.

Treatments	Initial weight	Weekly Body Weight (g)					
		1st	2nd	3rd	4th	5th	6th
T_1- Control (water)	64.00	132.33	309.00	593.67	1015.00	1573.33	1795.00
T_2 - Commercial	62.72	150.44	265.00	537.67	948.00	1423.33	1623.00
T_3 - EM-1	64.60	121.33	241.10	477.33	882.67	1380.00	1604.33
T_4 - FFJ	65.21	128.33	298.67	571.33	1019.00	1510.00	1842.00
ANOVA	ns	ns	ns	ns	ns	Ns	ns
C.V. (%)	4.69	16.85	12.26	9.86	11.37	8.65	9.64

Table 3. Weekly gain in weight (g) of broilers as influenced by probiotics and fermented fruit juice.

Cumulative	Weekly gain in weight (g)						Total gain in weight
	1st	2nd	3rd	4th	5th	6th	
T_1- Control (water)	68.33	176.67	284.67	421.33	558.33	221.67	1731.00
T_2 - Commercial	87.71	114.56	272.67	410.33	475.33	199.67	1560.28
T_3 - EM-1	56.73	119.77	236.23	405.33	497.33	224.33	1539.73
T_4 – FFJ	63.13	170.33	272.67	447.67	491.00	332.00	1776.79
ANOVA	ns	ns	ns	ns	ns	ns	Ns
C.V. (%)	32.62	23.62	9.17	16.23	11.78	37.33	9.98

Table 4. Percentage rate growth of broilers as influenced by probiotics and fermented fruit juice.

Treatments	Weekly Percentage Growth Rate (%)					
	1st	2nd	3rd	4th	5th	6th
T_1- Control (water)	68.81	78.86	63.32	52.19	43.74	13.08
T_2 - Commercial	80.48	66.27	67.96	55.18	40.05	12.81
T_3 - EM-1	63.10	65.94	66.05	59.51	43.76	15.17
T_4 – FFJ	63.93	80.28	62.73	56.14	39.28	19.50
ANOVA	ns	Ns	ns	ns	ns	ns
C.V. (%)	20.46	16.15	6.74	9.81	11.98	31.72

Percentage rate growth

The weekly percentage rate growth of birds as influenced by probiotics and fermented fruit juice is presented in Table 4. Insignificant results were obtained among treatments in terms of growth rate from the first week up to the end of the study. This fermented fruit juice given to the birds via drinking water found comparable with all the treatments as reflected by the analysis of variance. The study is in contrast to the study of Awad *et.al*. (2009) that the inclusion of probiotic on broiler serves as a greater growth promoter.

Feed consumption

The weekly feed and cumulative consumption of the broilers offered with various probiotics are presented in Table 5. The offering of probiotics did not influence the feed consumption of broilers on the first week up to the sixth week of the study. The cumulative feed consumption of broilers was therefore not influenced by the probiotics as showed in the result the analysis of variance in Table 5. The study implies that the inclusion of EM, FFJ and Commercial Probiotic on broiler's diet via drinking water had no effect on the feed intake of broilers. However, broilers given with Fermented Fruit Juice (FFJ) had recorded the highest feed intake as revealed in the cumulative feed consumption with 3,561.59 grams. Increasing the rate of fermented fruit juice into 20 ml by 980 ml of water may reveal significant result on the feed intake of broilers. According to Landuay *et. Al*. (2020), birds treated with 20 ml FFJ by 980 ml of water resulted in a significant increase in broilers feed intake.

Table 5. Weekly and cumulative feed consumption (kg) of broilers as influenced by probiotics and fermented fruit juice.

Treatments	Weekly Feed Consumption (kg)						Cumulative
	1st	2nd	3rd	4th	5th	6th	
T_1- Control (water)	113.37	338.17	597.33	803.00	920.50	679.30	3451.67
T_2 - Commercial	101.00	268.50	616.83	731.67	879.17	969.50	3293.67
T_3 - EM-1	108.83	304.50	578.58	734.67	860.25	736.67	3323.50
T_4 – FFJ	107.00	350.00	689.35	804.63	884.69	725.93	3561.59
ANOVA	Ns	ns	ns	ns	Ns	ns	ns
C.V. (%)	10.70	19.75	16.77	9.02	8.45	9.65	10.23

Table 6. Weekly and cumulative water consumption (L) of broilers as influenced by probiotics and fermented fruit juice.

Treatments	Weekly Feed Consumption (kg)						Cumulative
	1st	2nd	3rd	4th	5th	6th	
T_1- Control (water)	0.32	0.81	1.84	2.65	4.79	4.92	15.34
T_2 - Commercial	0.29	0.89	1.71	2.78	4.90	3.80	14.40
T_3 - EM-1	0.33	0.49	1.55	2.91	4.67	3.78	16.03
T_4 – FFJ	0.29	0.95	1.95	2.91	4.92	4.99	16.03
ANOVA	Ns	ns	ns	ns	Ns	ns	ns
C.V. (%)	12.80	27.70	17.88	14.74	6.89	17.90	8.47

Water consumption

The water consumption by the broilers given with different sources of probiotics from first to sixth week is presented in Table 6. Analysis of variance revealed that all the treatments were found comparable with that of the birds in Treatment 1 (Pure Water) and Treatment 2 (commercial probiotic), which means that the inclusion of different probiotics via drinking water did not show any significant effect on the water consumption of the experimental birds. Although statistically all the treatments were found comparable with each other, it was clearly observed that birds in treatment 4 with the inclusion of fermented fruit juice were consistently garnered the highest water consumption from second to sixth week of the study. Azizah (2019) stated that probiotic of lactic acid bacteria in drinking water reduce feed conversion rates but did not reduce broiler feed consumption.

Feed conversion ratio and efficiency

The feed conversion ratio and efficiency of broilers as influenced by the probiotics on the drinking water of the experimental birds is presented in Table 7. The data shows that the feed conversion ratio and efficiency were not significantly different. The result of the study conforms with the findings of Hosseini *et al.* (2013) that probiotics has no influence on FCR and FCE. This result is also in contrast to the findings of Abaza *et al.* (2008) and Cakır *et al.* (2008) that probiotics improved FCR and FCE in broilers.

Table 7. Feed conversion ratio and feed conversion efficiency (%) of broilers as influenced by probiotics and fermented fruit juice.

Treatments	FCR	FCE (%)
T_1- Control (water)	1.99	50.33
T_2 - Commercial	2.12	47.35
T_3 - EM-1	2.19	47.55
T_4 – FFJ	2.14	46.79
ANOVA	Ns	Ns
C.V. (%)	13.49	12.87

Dressing percentage

The influenced of probiotics and fermented fruit juice in the dressing percentage of birds with and without giblets is presented in Table 8. Results shows that Treatment 2 (Commercial Probiotic), Treatment 3 (EM-1), and Treatment 4 (FFJ) were not significantly different to Treatment 1 (Pure Water) which implies that there is no effect as to the offering of probiotics, FFJ and pure water on the dressing percentage with giblets with the mean values ranging from 75.37 to 85.90 percent. Likewise, insignificant result on the dressing percentage without giblets was observed having a dressing percentage from 69.74 to 79.68 percent. This conformed with the study conducted by Rehman *et.al.* (2020) that apart from dressing percentage, no interaction or individual effect of probiotics and prebiotics was observed for carcass, breast, thigh, heart, liver, and gizzard weight.

Table 8. Dressing Percentage with and without Giblets of Broilers as Influenced by Probiotics and Fermented Fruit Juice

Treatments	Dressing percentage	
	With giblets	Without giblets
T_1- Control (water)	75.37	69.74
T_2 - Commercial	81.49	76.09
T_3 - EM-1	78.62	74.00
T_4 – FFJ	85.90	79.68
ANOVA	ns	ns
C.V. (%)	9.19	8.93

Table 9. Weight (g) of giblets of broilers as influenced by probiotics and fermented fruit juice.

Treatments	Weight of liver	Weight of gizzzard	Weight of spleen	Weight of hearts	Total weight of giblets
T_1- Control (water)	45.00	42.50	1.50	10.83	99.83
T_2 - Commercial	47.83	41.67	2.00	9.17	100.67
T_3 - EM-1	43.33	39.12	2.33	9.17	93.95
T_4 – FFJ	45.00	46.67	3.33	10.00	105.00
ANOVA	ns	ns	ns	ns	Ns
C.V. (%)	27.24	12.10	41.78	19.78	17.37

Table 10. Income over feed, additive and chick cost.

Item	T_1	T_2	T_3	T_4
Weight gain per broiler (g)	1795.00	1623.00	1603.33	1842.00
Return per broiler (PhP)	215.40	194.76	192.48	221.04
Prevailing market price per kilo	120.00	120.00	120.00	120.00
Amount of feeds consumed (g)	3451.67	3293.67	3323.50	3561.59
Cost of feeds per kg (PhP)/ Prevailing price of feed ingredients	34.15	34.15	34.15	34.15
Cost of feeds consumed	117.87	112.48	113.50	121.63
Cost per chick	40.00	40.00	40.00	40.00
Amount of additives consumed (ml)	-	11.16	12.50	14.47
Cost of additives per 10 ml (PhP)	-	0.70	0.70	0.08
Total cost of additive consumed (PhP)	-	7.81	8.75	1.09
Income over feeds, chicks and additive cost (PhP)	57.53	34.47	30.23	58.33

1. Computed based on the prevailing market prices of PhP 120 per kilo live weight.
2. Computed based on the prevailing price of the ingredients used.

Weight of giblets

The weight of gizzard, spleen and hearts are presented in Table 9. It was found out that the introduction of probiotics and fermented fruit juice showed no significant differences in terms of weight of gizzard, spleen and heart. It was also observed that total weight of giblets showed no significant differences among treatments with means ranging from 83.37 to 109.17 grams. The result of the study implies that broilers given Effective Microorganism (EM) and Fermented Fruit Juice (FFJ) had comparable weight of giblets with those birds given commercial probiotics. The results imply further that the probiotics did not influenced organ weights but inclusion of prebiotics and antibiotic in diet significantly reduced the weight of abdominal fat pad of birds (Toghyani *et al*., 2011)

Income over feed, additive and chick costs

The income over feed, additive and chick costs on broilers as influenced by probiotics and fermented fruit juice was

presented in Table 10. The results shows that the highest return was obtained from the birds given fermented fruit juice with an income of PhP 58.33 followed by Treatment 1 – control (pure water) with 57.53 and Treatment 2 – Commercial Probiotics with PhP 34.47 and the lowest was obtained from the birds with Treatment 3 – EM-1 with only PhP 30.23. It is impressive that using fermented fruit juice have a higher return in terms of income; aside of the safeness of the products when consumed. Add probiotic or symbiotic to increase weight, improve feed conversion rate and reduce feed cost of production as reflected by Abdel-Hafeez *et al*. (2017) on his study entitled: Effects of probiotic, prebiotic, and symbiotic with and without feed restriction on performance, hematological indices and carcass characteristics of broiler chicken.

Conclusion

The inclusion of probiotics and fermented fruit juice did not influence weekly body weight, gain in weight, and feed consumption of birds. The introduction of probiotics and fermented fruit juice to the birds did not affect the dressing percentage with and without giblets and weight of giblets. No significant differences were also obtained in the feed conversion ratio and feed conversion efficiency. The highest return over feed, additive and chick cost among treatments in the study was obtained by treatment 4, birds that were treated with fermented fruit juice with PhP 58.33 per bird.

The study concludes that fermented fruit juice had the potential to improve the growth performance of broilers in the sense that it was comparable with that of effective microorganism and commercial probiotics as exhibited in body weights, feed consumption, gain in weight, percentage rate of growth, dressing percentage, FCR and FCE. In terms of income over feed, additive and chick cost, the use of FFJ obtained the highest return.

Recommendation

The use of fermented fruit juice from banana is recommended in the production of chicken as it increases the income over feed, additive and chick cost. Further study using other ingredients of fermented fruit juice and/or increasing rate of FFJ with water is recommended to validate the concept of probiotics as a viable modality in poultry production.

CONFLICT OF INTEREST

The author declares no competing interests.

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