ISSN No:-2456-2165

Efficiency of Hepato-Modulator Supplement to Broilers

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Abstract:- A study involving plant-based extract and ninety commercial Cobb broiler bird samples was conducted to evaluate the efficiency of commercial *Cynara scolymus* extract (CCSE) in the production performance traits of poultry as a potential alternative supplement source of multivitamins. The study was done in thirty-five days of rearing. Experimental chickens were randomly assigned to nine cage pens. Broilers' initial weights were gathered and recorded before giving of the experimental treatment. The inclusion of the experimental CCSE was mixed to the drinking water of the broilers approximately 1 ml and 2 ml per 4 liters water. Experimental treatments were 10 grams of commercial multivitamin granules (CMVG) in 4 L water as (T_0), 1 ml CCSE in 4 L water as (T_1), and 2 ml CCSE in 4 L water as (T_2) respectively. The growth production performance was assessed for final weight, feed conversion efficiency, weight gain, mortality rate, feed consumption, and carcass recovery and return on investment (ROI). Analysis of Variance was used to determine the difference among the three treatment means. Results showed that there were no significant differences observed among the three treatments. In totality, the inclusion of *Cynara scolymus* extract in the broilers water had an insignificant influence on the overall performance of the poultry.

Keywords:- *Cynara Scolymus, Hepato-Modulator, Multivitamins, Plant Extract, and Natural Supplement.*

I. INTRODUCTION

Conventional broiler production in the Philippines is the most common and very promising agricultural enterprises, especially for low-income farm families. It offers several advantages to the raisers such as quick return on investments (ROI) that would allow 5-6 production cycles in a year (Macapia, Mamauag, & Valiente, 2007). Broiler industry representing ~85% of poultry meat consumed by Filipinos. It is cheaper, more versatile, and is perceived to give more health benefits than red meat (Macapia, Mamauag, & Valiente, (2007). In spite of its many advantages and positive market outlook, the broiler sector is pressured of improving its production method. For example, Chang, (2007) pointed out that there is a growing concern among customers over food safety, animal welfare, product quality and environmental issues associated with industrialized poultry production systems. Some important reasons restrict the use of antibiotics such as the drug resistance in bacteria and the drug residues in meat (Issa & Omar, 2012). Thus, the use of antibiotics as a feed additive is no longer acceptable and it is prohibited in developed countries (Chattopadhyay, 2014). It is, therefore, desirable to source alternative ways to enhance and hasten the animal's growth without jeopardizing consumer's health. In pursuit of improved chicken healthiness and to fulfill consumer expectations concerning food quality, poultry producers commonly apply natural feeding supplements (Iji, Saki, & Tivey, 2001). As a consequence, it has become necessary to develop substitute material and strategies for animal growth advancement and disease prevention (Castanon, 2007); Bruce, 2016). Plant extracts and spices as single or mixed compounds can be used as a promotion of performance and health condition of the animal (Goodarzi, Nanekarani, & Landy, 2014). The utilization of growth promoters of natural origin become of interest in recent years (Castanon, 2007). Schiavone *et al.*, (2007) studied the effects of supplemented silymarin from *Silybum marianum* on broiler performance and meat quality. The positive effects of herbal/natural plants on broilers have been reported by many studies (Guo *et al.*, 2004). Their antibiotical potential, growth-promoting, and availability are the most beneficial parts of herbs (Guo *et al.*, 2004; Sarica *et al.*, 2005). Other studies have investigated the effects of other plant extracts to broiler chickens such as the artichoke (*Cynara scolymus* L.) but have focused on blood lipid parameters (e.g. Mohammadzadeh, Brumandnia, & Khaldari, 2014). The natural supplement composition is generally from *Cynara scolymus* (also known as artichoke) extract. Artichoke is an ancient plant originally home to the Mediterranean, but currently distributed and cultivated worldwide because of pharmacological usage (Ziae *et al.*, 2004). Artichoke (*Cynara scolymus*) is a pharmacological plant with hypolipidemic potentials (Ziae *et al.*, 2004). *Cynara scolymus* extract is a natural herbal compound obtained from the leaves, containing caffeoylquinic acids group-among which cynarin and chlorogenic is the most biologically active (Wang *et al.*, 2003; Schütz *et al.*, 2004). While a few studies have been done on the effects of *C. scolymus* extracts on the growth performance of broiler chickens (e.g. Abdo *et al.*, 2007; Martínez *et al.*, 2018), no study has been conducted in the Philippines. Hence, this trial aimed to determine the effects of graded levels of commercially prepared *Cynara scolymus* extract on growth, yield performance, and cost and return of broiler chicken raised under the conventional rearing system.

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II. MATERIALS AND METHODS

The study was carried out in a Completely Randomized Design (CRD) with three treatments replicated three times having ten birds per replication. The birds were representative samples of different treatments are as follows: T_0 – Control (10 g CMVG) per 4 L of water, T_1 – 1 mL of CCSE per 4 L of water, T_2 - 2 mL of CCSE per 4 L of water.

The experiment was conducted at the livestock production area of NORSU-Pamplona Campus, Pamplona, Negros Oriental in thirty-five days trial from January 6 to February 10, 2016. Cloudy skies with light to moderate rains were experienced with an extreme temperature ranging from 180 C to 30.6 0 C with a minimum relative humidity of 50% to 74% at its maximum during the entire duration of the study.

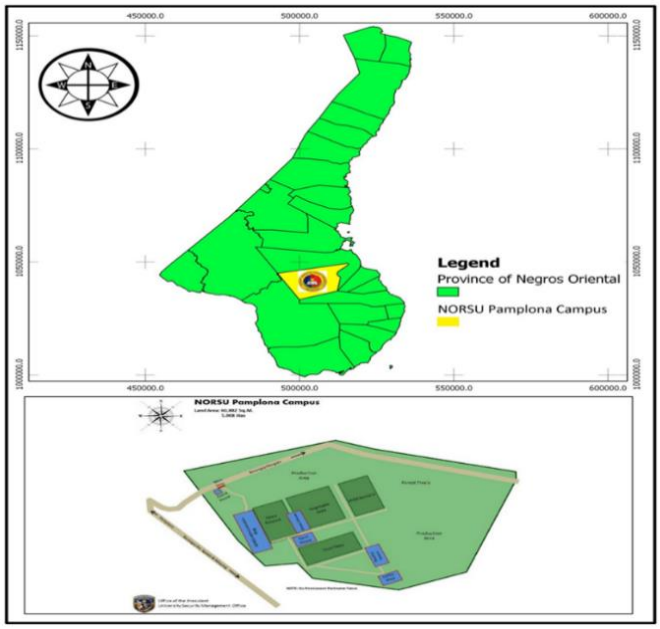

Fig 1:- Map showing the location of the livestock production area of NORSU-Pamplona Campus, Pamplona, Negros Oriental.

A total of ninety (90) heads commercial Cobb broiler chicks were purchased from Pacifica Agrivet Supply of Tanjay City, Negros Oriental and were randomly distributed to one of the nine cages. A cage measuring 0.60 m x 0.60 m made of light materials stationed in an open-sided poultry house and was suspended by four round posts elevated at about 0.70 m from the ground and spaced at 0.50 m apart were used to house the birds from brooding until harvest. Commercial feeds were provided to birds by *ad libitum* basis via plastic feeder given at 6:00 a.m. and 4:00 daily, while water in a large size plastic waterer was ensured clean and fresh with *Cynara scolymus* extract as a supplement, anti-stress and disease formula (except in T_0 set up). Replacing water in each watering trough was done twice daily (every twelve hours), i.e., once in the morning and afternoon. Flocks were cared and managed by the conventional system, lights were provided 24 hours to induce feed intake, waste was regularly swept, collected, and regularly monitored from disease outbreaks

Commercially *Cynara scolymus* extract (Bedgen 40) 500 ml bottle was purchased from a reliable source was used as natural vitamin supplement mixed in drinking water at the ratio of 1 ml and 2 ml of Bedgen 40 per 4 liters water given to birds two times daily (6:00 am and 6:00 pm) to maintain freshness of the solution, while similar schedule for the commercial multivitamins granules dissolved in drinking water at a ratio of 10 gram multivitamins for every 4 liters of drinking.

The experiment on growth performance, yield characteristics, and cost and return of broiler chicken treated with graded levels of commercial *Cynara scolymus* extract under conventional production system were terminated after thirty-five (35) days trial. All chickens from each house were harvested. Surviving chickens per cage were collected and counted and measured individually for bodyweight using the digital weighing scale. Surviving chickens were brought back to their respective cages and withdrawn from feeding for 8 hours before slaughtering.

III. DATA GATHERING

Upon distribution of experimental birds to individual cages, the birds were weighted using the digital weighing scale to get the initial weight of birds per treatment. The total feed is given and total feed refused were weighed and recorded daily to arrive the feed consumption and feed conversion ratio. Two heads broiler chicken weighing close to the average weight per cage was slaughtered to assess the yield characteristics. The return of investment was taken by subtracting the income per treatment by the cost per treatment multiplied by one hundred.

The One-Way Analysis of Variance (ANOVA) was used to determine the significant difference among treatments based on the data gathered and tabulated from the experiment. A significant difference among treatment means was computed using Waller- Duncan Test. Spearman's correlation was used to identify the strength of the relationship between gains in weight and feed conversion efficiency and feed consumption of broilers in each treatment. In this analysis, values were ranked in ascending order. The difference between the rank tests was calculated as well as the square of the difference. Sum of all values obtained was recorded to be used in the Spearman's correlation formula:

$$\rho = 1 - 6\ \Sigma di2/N\ (N2-1)$$

Wherein, ρ is the correlation coefficient, di is the difference of ranks of the two observations and N is the number of values ranked. The correlation was performed using PAST3 software (Hammer, 2013).

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IV. RESULTS

The tables and figures were arranged chronologically to match with the problems raised in this study. Moreover, the succeeding analysis and interpretation presented were based only on the results and observations obtained by the researcher during the period of experimentation.

The average initial and final weights of broiler chickens treated with CCSE are shown in Table 1. The weight increment, i.e., final weight-initial weight, is a critical point in determining whether or not growth was evident for each experimental treatment compared to the control (did not receive *C. scolymus*). The average initial weights of the birds were determined when the broilers were one-day-old.

F-test revealed that there was no significant difference ($p > 0.05$) among the initial weight of birds in different treatments. This means that all broiler chickens belong to the same cohort or batch and hence appropriate for the experiment. In other words, the body weights of birds were more or less identical and numerical differences were too small to cause significant variation. This is very important to minimize potential bias (different weight right from the start in the experiment). After 30-days of rearing, all broilers subjected to the experiment were re-weighed and compared. F-test, however, showed that the final weight of broilers did not differ significantly ($p > 0.05$) between treatments (Table 2).

The weekly feed consumption versus weight gain of broilers supplemented with different levels of CCSE is presented in Table 2. Birds treated with CMVG (T_0) have the highest feed consumption of 643 g compared with birds that received only 2 ml of CCSE (T_2) with a mean consumption of 591 g and 563 g as the lowest mean from broilers given with 1 ml of the extract (T_1). The lowest fed consumers were the broilers given with 2 ml extract of the artichoke (T_2) with a mean of 4150, 6330 and 7500 g, correspondingly. Birds treated with 1 ml *Cynara scolymus* extract consumed a high amount of feeds than the other birds on the other treatments but the slight differences in the number of feeds did not cause the data to be statistically negligible when subjected to ANOVA.

The weekly accumulated gain in weight shows no significant differences between treatments during the first four consecutive weeks when data were subjected to ANOVA. However, birds supplemented with 1mL and 2mL CCSE, respectively, showed higher mean weight gain ($p < 0.05$). Nonetheless, weight gained during the 5th week of rearing the birds, significant differences were revealed among treatments.

The average weekly feed conversion efficiency of broilers supplemented with different levels of CCSE is presented in Table 3. Statistical analysis of feed conversion efficiency revealed no significant difference among the different treatments ($p > 0.05$). Birds given water incorporated with 2 ml CCSE (T_2) happened to be the most efficient with 1.5 as mean followed with control (T_0) 1.6 and T_1 with a mean of 1.7 during its initial raising week. Meanwhile, the treatment of water with 2 ml extract (T_2) remained as the most efficient with a mean of 1.3 while both T_0 (control) and T_1 (1 ml artichoke extract) had a similar mean feed conversion efficiency of 1.4 during the second growing week. In the third week, it was noted that there were very minimal numerical differences in the efficiency of the birds between the treated and not. Treated and not- treated birds appeared to have a uniform mean efficiency of 1.8 during its 30 days old of nurture. Finally, data disclosed that those animals receiving 1 ml of artichoke extract on its fifth week of age happened to be the most efficient birds with a mean of 2.1 as well as the highest feed consumer and gain in weight (Table 3) on its final growing week tailed with 2.3 (T_0) and 2.4 (T_0) correspondingly.

Table 4. Summary of Spearman Rank Correlation between feed consumption, feed conversion efficiency, and weight gain. The average carcass recovery (ACR), liver weight as yiel.

Treatment	Initial (g)	Final (g)
T0 – 10 g CMVG	64.00	1408
T1 - 1 ml CCSE	59.33	1396
T2 - 2 ml CCSE	58.33	1333
F – test	**ns**	**ns**

Table 1:- The initial and final weight of broiler chicken supplemented with CCSE. *ns - No significant difference*

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Treatment	Weekly feed consumption and gain in weight (g)									
	Week 1		Week 2		Week 3		Week 4		Week 5	
	FC	WG	FC	WG	FC	WG	FC	WG	FC	WG
T0- 10 g CMVG	643	34	2150	160	4600	293	7950	490	7500	283
T1- 1ml CCSE	563	37	1980	143	5230	331	8434	485	9150	410
T2- 2ml CCSE	591	36	2450	151	4150	324	6330	421	7500	354
F – test	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	*****

Table 2:- Weekly feed consumption versus weight gain of broilers supplemented with different levels of CCSE.
ns - No significant difference
* - significant difference

Treatment	Weekly feed conversion efficiency				
	1st	2nd	3rd	4th	5th
T0 - 10 g CMVG	1.6	1.4	1.7	1.8	2.3
T1 - 1 ml CCSE	1.7	1.4	1.5	1.8	2.1
T2 - 2 ml CCSE	1.5	1.3	1.6	1.8	2.4
F – test	**ns**	**ns**	**ns**	**ns**	**ns**

Table 3:- The average weekly feed conversion efficiency of broiler chicken treated with various levels of CCSE.
ns - No significant difference

Treatment	Feed Conversion Efficiency	Feed Consumption	Correlation Coefficient (ρ)
T0			0.8
T1			0.7
T2			0.9
	Feed Consumption	**Weight Gain**	**Correlation Coefficient (ρ)**
T0			0.9
T1			0.97
T2			0.92

Table 4:- Summary of Spearman Rank Correlation between feed consumption, feed conversion efficiency, and weight gain.

Characteristics, and mortality rate of broiler supplemented with different levels of *Cynara scolymus* are presented in (Table 5). Based on the results, 78 % was the average carcass recovery of broilers supplemented with 1 ml of CCSE (T_1) followed by T_2 (2 ml CCSE) and T_0 (10 grams CMVG) with 76.3 and 75 % respectively. Result showed that the addition of *Cynara scolymus* extract in the avian drinking water did not affect significantly the dressing percentage of the slaughtered birds when data were subjected to ANOVA ($p > 0.05$), although those given extracts showed slightly better ACR than those given with multivitamins, suggesting that *Cynara scolymus* extract is comparable to multivitamins in terms of carcass recovery. Meanwhile, the average liver weight of broiler supplemented with different levels of *Cynara scolymus* among the three treatments imposed on the study. Although the weight of the liver originally was not part of the parameters that were supposed to be gathered through the entire duration of the study, it was included because of its significance to the effects of the experimental supplement to the growth of broilers. Based on the result of the study, it was pointed out that those broilers given with 1 ml CCSE (T_1) accumulated the highest liver weight of 36.51 grams, followed by T_0 (10 grams CMVG) 35.65 grams and T_2 (2 ml CCSE) with the least mean of 30.79 grams. The mortality rate among the three treatments used, T_2 (2 ml CCSE) exhibited an abrupt mortality rating of 10 % of the total population samples that were comparatively higher from that of T_1 (1 ml CCSE) and T_0 (10 grams CMVG) recorded 0 and 0.03 % correspondingly.

V. DISCUSSION

The final weight data of broiler chickens suggest that *Cynara scolymus* extract added to the chicks' drinking water at varying levels does not affect the experimental and control group at the end of the experiment. The control group T_0 (no CCSE but with 10 grams CMVG) had the highest mean weight of 1408 grams. In contrast, Treatment 1 (1 ml CCSE) had a mean weight of 1396 grams and Treatment 2 (2 ml

ISSN No:-2456-2165

CCSE) gave the lowest mean of 1333 grams. Contrary to available published literature by Melo & Harkes, (2007), all final weights of broiler in this study (control and experimental chickens) were found to be statistically similar. This suggests that the supplementation of artichoke extract did not affect the final weight of birds. The findings of Melo and Harkes (2007) stated that the inclusion of artichoke extract in the broilers' diet results in significantly higher feed conversion efficiency from broilers fed with *C. scolymus* in terms of weekly weight gain, accumulated weight gain, and weekly mortality were not supported by this study.

Deniz, Turkmen, Orhan, & Biricik, (2006) reported that the inclusion of artichoke in the water of birds displayed no significant increase in feed intake. Likewise, similar to the results obtained above, Lertpatarakomol *et al.,* (2015) who added artichoke extract as a supplement to broilers drinking water found out that the artichoke tested group had higher mean values in daily gain and feed intake even when feed conversion ratio did not show any difference between treatments. However, based on the data shown in Table 2.0, the significant difference in weight gain was attributed to a decline in gained weight among control birds (490 g during the 4th week to only 283 g in the 5th week) while those supplemented with *C. scolymus* maintained their weight gain. The *Cynara scolymus* extract premix usage in broiler feeds appears to have the potential to improve performance in terms of maintaining body weight. This also suggests that positive effects of *C. scolymus* on broiler chickens might manifest during the 5th week. Future studies should consider this aspect

Spearman rank correlation between feed conversion efficiency and weight gain revealed a strong positive relationship in all treatments (ρ=0.7 – 0.9) as shown in Table 4. Besides, a strong positive correlation was also detected between weight gain and feed consumption (ρ=0.9). This suggests that regardless of the treatment, broiler chickens have the inherent characteristics to gain weight. Nevertheless, data revealed that as birds grow older they tend to consume much but making less efficient in converting feeds into a unit of meat. This conforms to the findings obtained from the work of Lertpatarakomol *et al.,* (2015) in terms of feed conversion ratio and that differences between treatments were statistically negligible. On the other hand, a study by Tajodini *et al.,* (2015) showed that supplementation of 3 percent artichoke powder significantly ($p < 0.05$) decreased body weight compared to control. A higher ($p < 0.05$) feed intake was observed in the group fed 1.5 percent artichoke powder resulted in higher feed conversion ratio (FCR) compared to control.

Treatment	Average carcass recovery (%)	Liver weight (g)	Mortality rate (%)
T0 – 10 g CMVG	75	35.65	3.00
T1 - 1 ml CCSE	78	36.51	0.00
T2 - 2 ml CCSE	76.3	30.79	10.00
F – test	**ns**	**ns**	**NS**

Table 5:- Average carcass recovery (ACR), liver weight as yield characteristics, and mortality rate of broiler supplemented with different levels of CCSE. ns- No significant difference

Treatment	Carcass @140	Gross Return	Total Cost	Net Return	ROI
T0 – 10 g CMVG	39.70	5,558.00	3,992.27	1,565.73	39.22
T1 - 1 ml CCSE	44.00	6,160.00	3,973.91	2,186.09	55.01
T2 - 2 ml CCSE	36.20	5,068.00	3,863.37	1,204.63	31.18

Table 6:- Cost and return analysis of broiler supplemented with CCSE.

In terms of carcass recovery, Deniz *et al.,* (2006) supplementation of the artichoke to broilers drinking water that was under stress induced by feed change and vaccination had no significant increase in hot carcass yield between the treated and control groups. A study by Tajodini *et al.,* (2015) on broilers supplemented with *C. scolymus* in their diet showed improved carcass traits but also cautioned that more studies are needed.

Differences in liver weight in this study conform with the findings of Gul (2009) found no significant results in the liver lipid contents of slaughtered animals where ration is added with artichoke leaves. Although previous studies by (Nateghi, Samadi, Ganji, & Zerehdaran, 2013) advocated the health effects of *C. scolymus* extracts Stoev, Anguelov, Ivanov, & Pavlov, (2000) especially on specific organs such as liver, this study found no effect of *C. scolymus* extracts on the liver weight. Uzatici & Celik, (2014) however, seemed to have similar results with the present study.

The study of Melo & Harkes (2007), observed that when artichoke was added in the broilers diet, insignificant differences were observed concerning weekly weight gain and weekly mortality. A study by Hassan, Youssef, Ali, &

ISSN No:-2456-2165

Mohamed, (2015) on the other hand, revealed that supplementation of artichoke extract or organic acids mixture significantly increased body weight gain by about 6% and improved feed conversion ratio by about 7%, compared with the control diet of no feed additives. They concluded that using artichoke extract or organic acids mixture improved broiler performance and economic efficiency of broilers fed corn-soybean meal diets.

The 10 % mortality rate in T_2 (2 ml CCSE) this study may be attributed cooler weather conditions since this was conducted during the cold month of late January to early February, 2016 (during reduced air temperatures, <25°C as reported by PAGASA) it was not unexpected that there may be few birds dying as a result of greater variations in ambient temperature. Although it was hoped that the use of the *Cynara scolymus* extract might reduce the mortality rate even in the face of cooler environmental temperatures, this was not evident in the data (Table 5), however, the average values differences among treatments showed no pieces of evidence of statistical variations. This parallels with the findings reported by Melo and Harkes (2007), that when artichoke was added in the broilers diet, insignificant differences were observed about weekly weight gain and weekly mortality.

Moreover, this study also conducted a cost and return analysis following the research design as described in the Methodology section. All expenditures incurred in the study were considered the same per treatment except for the actual value of water supplement and feed consumed by the birds. Data show that within one raising period, the net incomes of the treatments are as follows, in decreasing order: T_1 Php 2,186.09, followed by T_0 with Php 1,565.73 and T_2 with Php 1,204.63. The very low net income obtained in T_2 was attributable to a two-fold increase in the prevailing price of the supplement, from Php 6.60 per mL instead of only Php 3.30 per ml since birds in this treatment were supplemented with 2 ml artichoke extract per 4 liters of water mixture. On the other hand, the ROI (return of investment) of T_1 is 55.01 which was quite higher from that of T_0 with 39.22 and T_2 with 31.18. Thus, it only implies that it is still profitable to raise broilers using the supplement in a lesser dose.

VI. CONCLUSION

Based on the above findings, it is ascertained in this study, the supplement containing 1 ml of *Cynara scolymus* extract for every 4 L of water caused a statistically significant difference between the groups only in terms of the gain in weight at the final rearing week (5^{th} week). Additionally, broilers supplemented with 1 ml of *Cynara scolymus* extract was profitable and economically viable as it shows higher ROI compared to broilers supplemented with multivitamins only (no *Cynara scolymus* extract) and 2 ml of the extract per 4 L preparation.

RECOMMENDATION

Since the following results are preliminary, the following recommendations are given:

1. *Cynara scolymus* extract supplementation in broilers water appears to have the potential to improve performance in terms of improving body weight. Thus, the extract could be applied in field situations where the environmental conditions are challenging to test the continued viability of broilers and most likely in a higher amount because there is a possibility that the amounts used in the study were too small to cause an effect on the birds.
2. Given the localized nature of the study (one farm only), it is recommended that future investigators should consider extending the study to increase the sample size of broiler chickens.

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