ECONOMIC EFFICIENCY OF THE BROILER AT DIFFERENT HERBAL WATER SUPPLEMENT

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ABSTRACT This study was conducted to determine the effect of different herbal extracts as water supplement on the growth and economic characteristics of broilers. A Completely Randomized Design (CRD) was used with four (4) treatments and one (1) control and replicated three (3) times. The treatments that were used in the study was the following: Control-no herbal extract supplement; Treatment A-10% Lemon Grass (Cymbopogon citrullus); Treatment B-10% Gotu kola (Centenella asiatica); Treatment C-10% Oregano (Origanum vulgare); and Treatment D-10% Horseradish tree (Moringa oleifera). The analysis shows a significant difference between the final weight and weight gain of broiler at different treatments, wherein treatment D showed the most significant effect followed by treatment C and treatment B while treatment A and control shows the same treatment effect. The supplementation of Horseradish tree extracts into the water commensurate a better growth performance of broiler. Also, in terms of feed conversion efficiency, treatment D shows the best feeding efficiency compare to other treatments while control, treatment A and B show the least feeding efficiency and shows lower efficiency compare to treatment C. There is a significant effect of supplementing Horseradish tree extract at 10% level of solution to the growth performance and feeding efficiency of broiler. The water supplementation of Horseradish extract was economically efficient, which commensurate the highest income among other herbal extracts and those with no supplementation.

Keywords: Growth Performance, Economic Efficiency, Broiler, Herbal Extracts

INTRODUCTION

Background of the study

Poultry is the most progressive animal enterprise today. It is one of the world's foremost and fastest producers of meat. While in the Philippines, it has been a significant contributor to the country's agricultural sector. In 2010, the chicken population in the Philippines were estimated 159 million, slightly higher (0.2 percent) than last year's level. Layer and native chicken inventory grow by 13 ad 2 percent, respectively and almost 50 percent of the total chicken population were accounted for native or village chicken raised in backyard farms while the remaining 32.8% (broilers) and 18% (layers) were taken up by commercial broilers.

Medicinal plants have been identified and used throughout human history. Plants can synthesize a wide variety of chemical compounds that are used to perform important biological functions and defend against attack from predators such as insects, fungi and herbivorous mammals (Krishnaveni, Amala, Priya, Rasik, & Mekala, 2019). High levels of production and efficient feed conversion are the need of the modern poultry industry, which to a certain extent could be achieved by the use of specific feed additives. Antibiotic feed additives as growth promoters have long been supplemented with poultry feed to stabilize intestinal microbial flora, improve general performances and prevent some specific intestinal pathology. Organic treatments composed of individual acids and blends of several acids have been found to perform antimicrobial activities similar to those of antibiotics (Hassan et al., 2010; Wang et al., 2009 cited in Khan, 2016).

Organic farming systems have attracted increasing attention over the last decade because they are perceived to offer some solutions to the problems currently besetting the agricultural sector. Organic farming has the potential to provide benefits in terms of environmental protection, conservation of nonrenewable resources and improved food quality.

Objectives

This study was conducted to determine the effect of different herbal extracts as water supplements on the economic performance of broilers. Specifically, this study aims to determine the following: (1) the economic characteristics of broilers supplemented with different herbal extracts in terms of capitalization, cost of production, net income, profit, Internal Rate of Return (IRR), and break-even analysis, and (2) the significant differences between the economic characteristics of broilers supplemented with different herbal extract in terms of capitalization, cost of production, net income, profit, IRR, and break-even analysis.

Significance of the Study

This research will help and give a guide to the farmers and poultry raisers who want to engage in broiler production. This will give them some knowledge on the usefulness of the herbs as a supplement in making the broiler economically productive and healthy. This research was free for antibiotics which are safe for human consumption.

Delimitation of the study

The study was used to determine the economic efficiency of broilers as influenced by the four different medicinal plants as water supplements. Arbor acre day-old chickens were used in the study. There were five (5) treatments and three (3) replications. The treatments of the study were the following: (a) Control (without herbal extract); (b) Lemon Grass (Cymbopogon citrullus; (c) Gotu kola; (d) Pot Marjoram (Origanum vulgare) and (e) Horseradish tree (Moringa oleifera). Each treatment Bages have ten (3) heads of birds that were replicated three (3) times. The study have a total of 45 heads of birds. The parameters that were used in data gathering were capitalization, cost of production, net income, profit, IRR, and break-even analysis.

MATERIALS AND METHODS

Materials

The materials needed in the conduct of the study in gathering the data are bowl jars, feeding through were used in feeding and watering the broilers. Bulb, switch, electrical wire, outlet and socket were used in lighting the chickens. Weighing scale, zip lock, containers, and butchering knife were used for slaughtering the broilers.

Methods

Experimental Design and layout. A Completely Randomized Design (CRD) was used in this study. The study will have four (4) treatments and one (1) control that was replicated three (3) times. The experiment was within 40 days. The treatments that were used in the study were the following:

Control- no herbal extract supplement
Control-Lemon Grass (Cymbopogon citrullus) (10% of the amount of water)
Treatment A-Gotu kola (Centenella asiatica)(10% of the amount of water)
Treatment B- Oregano (Origanum vulgare) (10% of the amount of water)
Treatment C- Horseradish tree (Moringa oleifera) (10% of the amount of water

A	Control	C
C	D	B
B	C	Control
D	B	A
Control	A	D

Randomization Treatments. All treatments were represented by letters and were distributed randomly through draw lots.

Construction of the Poultry House and Cages. The poultry house was made up of light materials such as Nipa, Bamboo, and nails. The building measuring 18ft. by 10ft.

Booking and Selection of the Stocks. The experimental stocks were books from Commercial Hatchery. The Chicks were paid cash during the delivery at Php 35/ head. The chicks were selected to ensure healthy stocks. Select only healthy birds. This is important for two reasons:

- It increases the chances of winning the price since healthy birds will have good physical condition and a bright appearance.
- It reduces the chances of spreading diseases to other birds present in the show.

Floor Space, Feeder Space and Waterer Space.

The floor is covered with a 5 to 10 cm deep layer of rice hull. During the brooding period, the day-old chicks were confined in a brooder cage measuring 3 meters by 1.5 meters. During the rearing period, the birds were fully confined in a cage. Each bird requires a floor space of 1squared ft. The feeder and waterer space also varies depending on the environmental temperature and health condition of the birds.

Disinfection of the Area. The area was prepared and disinfected a week before the arrival of the stocks.

Transporting the Birds. Transporting the birds in a clean cage with straw or wood shavings as bedding material. Do not provide water since it will spill and spoil the bedding material. If the birds are to be transported to a long distance, water should be provided at intervals during transport.

Arrival of Stocks. One (1) hour before the arrival of the stocks, the electric bulb inside the brooder was switched on to make the floor and wall heated and to have the desired brooding temperature. Bowl jars were filled with clean and potable drinking water. Upon the arrival, the chicks were placed inside the brooder and will keep them undisturbed for more than four (4) hours.

The broiler chicks were provided with 5% sugar solution for drinking within three (3) hours of arrival. The purpose of adding sugar to their water is that it helps replenish the depleted energy in the chicks due to a long period of transportation. It may also stimulate the chicks to consume the feed. Sweet water can also loosen up the impacted intestine and prepares the gut linings of chicks for the incoming feeds. Thereafter, they were given fresh feeds and water.

Brooding Management

Feeding. According to Flavio Henrique, specialist (Cobb-Vantress South America), the brooding period–the first 14 days of the broiler's life– is the most sensitive period because the bird changes from an immature thermoregulation system to a mature one.

One common mistake is to think only of maintaining the proper temperature. We need to take care of other issues, too. A way to define these other issues is the 80-20 rule (Pareto's Law), which means that 80% of the consequences come from 20% of the causes. We should always think in our brooding about temperature, air quality, water, and feed. Proper management of these areas was the key factor to uniformity, which results in a good performance. We will assume that we receive good quality chicks from the hatchery, which means that the day-old chicks are active with bright eyes wide open, with strong and shiny shins, navels healed, without physical defects, no pathogens and with good maternal immunity.

The first week corresponds to 23% of the life of the 1.75g broiler, according to the latest Cobb Weight Supplement (April 2012). This first week represented 11% of the entire life in 1978 to achieve the same weight. So the proper commitment to a good start is very important for the broiler, and each good point achieved was rewarded in a good performance. In many countries, some producers think that the birds are already adults by the second week and stop giving them external help to maintain good conditions. This could lead to one of the worst situations in the brooding period.

Linear feeding troughs were installed before the stocks were introduced in their respective treatment Bages. A feeding space requirement of 65 cm/bird was followed in making the linear feeders (PNS, 2003). Organic commercial feeds were provided to the birds on an ad libitum basis for the first week of brooding and were change to restricted feeding after a week until maturity.

For the first week of brooding, in addition to the feeding troughs, a small amount of feeds were provided to assist the chicks to easily access the feeds. This helps the chicks find the feed more successfully in the first few days. The feeds and watering devices were placed close to each other during the first week to ensure that the chicks eat and drink the feeds and water provided to them.

After initial brooding, feeds were placed away from the waterers to prevent wet feed and dirty water. Feeder heights were adjusted regularly. After one week of brooding, the feeds were given on a restricted basis (Beutler, 2007).

Water Management. According to Chance Bryant, Technical Service Manager (Cobb- Vantress. Inc), water management is one of the most crucial components in a top-performing broiler flock. Broilers have advanced to grow faster, become larger with more breast meat, eat more feed at younger ages and be far more efficient than their predecessors, increasing their demand for water.

All this has put more emphasis on the need for ample water supply and storage so birds can perform successfully. Here, we focus on water flow rates and water temperature - factors that sometimes get overlooked.

In high performing flocks, at around 21˚C, modern broilers on average will consume 1.8 to 2 times more water than feed, in weight. Consumption is dependent on house temperature. In hot climates, flocks can consume up to 5 times in weight the amount of feed they intake.

Water consumption will vary depending on environmental temperature, feed quality and bird health:

- ☐ Water consumption increases by 6% for every increase in 1˚C between 20-32°C.
- ☐ Water consumption increases by 5% for every increase in 1˚C between 32-38°C.
- ☐ Feed consumption decreases by 1.23% for every increase in 1˚C above 20°C

Any substantial change in water usage should be investigated as this may indicate a water leak, health challenge or feed issue. A drop in water consumption is often the first indicator of a flock problem. To evaluate the flock performance properly we need to know how much water birds are consuming every day. More advanced water meters record not only 'daily' consumption attainable but also enable an understanding of consumption at critical times of the day and critical times during the flock--both very relevant in assuring maintaining proper water intake. These critical times can include feed changes, turning birds out from the brood area to three quarters or full house, transitioning from power ventilation to tunnel, field vaccinations, etc. If you monitor consumption during these periods, you can better understand if flocks are being properly managed.

Light Management. According to Naheeda Portocarero (2011), light is an important management tool in broiler production. If used successfully, it can influence aspects of growth, productivity and behaviour, and is therefore the subject of intense research. From presentations at the 2010 PSA meeting in the USA, it became clear that proper lighting regimes will lead to good flock performance.

While we know that light intensity has an impact on behavior and physiology, there is debate surrounding the optimum level that should be used. A comparison of different light intensities; 1, 10, 20 and 40 lux carried out at the University of Saskatchewan showed that birds exposed to 1 lux rested more and showed reduced foraging, preening, dust-bathing, stretching and wing-flapping behaviors in comparison to birds exposed to brighter light intensities. These birds also had bigger and heavier eyes. While there was no effect of light intensity on skeletal health, deep ulcerative foot pad lesions decreased linearly as the light intensity was increased. And although diurnal rhythms of serum melatonin were unaffected, these results suggest that very low light intensities can compromise the welfare of birds.

Temperature. Litter temperature is the most important because day-old chicks are extremely dependent on floor contact to help regulate the changing temperatures. The ratio of body surface to body mass is large in the day-old chick and it decreases with age, so the young chick will therefore lose heat faster than an adult bird. The young chick's body is covered in down which has a poor insulating value, so if the temperature is not controlled, it will lose heat rapidly through radiation and conduction. We suggest having the litter preheated and stabilized 24 hours before placement, which means preheating for 48 hours in many broods, depending on the season, region and outside temperature. A comfortable chick will breathe through its nostrils and lose 1-2g of moisture in the first 24 hours. The yolk contains this amount of moisture will lose weight but not become dehydrated. If the birds are exposed to cold temperatures, they will try to save or make heat by huddling or burning feed to keep warm, which affects feed conversion ratio and is the most expensive way.

If the ambient temperature is 26ºC (78.8ºF), the same moisture loss (1-2g) in the yolk will last the chick three days. This is why, in practical terms, when we see large yolks, we can say that the bird was cooled in the first few days. In the opposite case, with temperature too high, the birds will try to remove heat or avoid producing heat, pant to lose heat (losing FCR) and stop eating. If chicks start panting, they can lose 5-10g of moisture in the first 24 hours and dehydration will occur. The correct temperature will also influence the bird's health and immunity because immune system development and stress are costing energy and when the birds are not comfortable during this development they were more sensitive to infections and less immune competent. The chick's internal temperature (cloaca measurement) should be maintained between 40.4-40.6ºC (104.7-105.1ºF); below 40ºC (104.0ºF) is cold and above 41ºC (105.8ºF) will lead to panting.

According to Muchacka and Herbut (2007), reduced and elevated air temperature during the first period of rearing reduced the rate of growth, with clear differences observed in the group of birds reared at a lower temperature. Baarendse, et al. (2006) reported that rearing chicks during the first five days of life at 28°C (82.5ºF) has a long term negative effect on further growth and development. Ideal would be 32ºC (89.6ºF) with 30-50%

relative humidity (RH) in the litter at placement.

For the first two weeks, the chicken house should feel too warm for the caretaker–if not, the temperature is likely to be too low for the chicks. We suggest the air temperature in the brooding area at placement, with 30-50% RH, begin at 33ºC (91.4ºF); at seven days, with 40-60% RH, 30ºC (86ºF); and at 14 days, same RH, 27ºC (80.6ºF). If the humidity is less than above, increase the temperature by 0.5-1.0ºC (1ºF). If the relative humidity is greater than above, reduce the house temperature by 0.5-1.0ºC (1ºF). Always use bird behavior and effective temperature as the ultimate guide to determine the correct temperature for the birds. Chicks from smaller eggs (younger breeder flocks) require higher brooding temperatures because they produce less heat (about 1ºC) for the first seven days. According to the seasonal climate, it is very important to have tools to heat and cool the air, and options to provide correct air flow and distribution. Do not forget that the broilers in a brooding phase do not need air velocity more than 0.3m/s at floor level.

Pre-Conditioning. Pre-Conditioning was done 14 days after the arrival of the birds. It will help the birds to adapt to changes in the environment, temperature, and climate.

Distribution of Stocks in Different Cages. The distribution of the stocks was done after the pre-conditioning period. There were five (5) birds per cage.

Disease Prevention. Farmers have a documented pest control program to reduce the risk of diseases being carried on to the farm by rodents. Strict records are kept by the farmer of the chickens' health, growth and behavior, so that any emerging disease problem is rapidly identified and acted upon.

Disease prevention is an essential strategy for poultry producers. It is much more beneficial to the birds and the commercial poultry producer to prevent the disease from occurring rather than relying on treatment. The agents which sound biosecurity practices attempt to prevent include bacteria, viruses, protozoa, fungi, parasites, and any other agents capable of introducing an infectious disease into a poultry flock.

To prevent and reduce the risks of diseases of the broiler, herbal extract was produced. The following are the preparation of herbal extract:

1. Prepare a clean jar for storage and a blender to get the extract.
2. Collect the desired amount of fresh leaves.
3. Wash and chop the leaves finely and place them inside the blender.
4. Pour 20% of water into the blender.
5. Blend the leaves.
6. After blending, the extract was strained through a piece of cloth and poured into a clean jar.
7. The desired volume of the extract can be used for desired purposes.

Routing Care of the Birds. Waterers were regularly cleaned to ensure that the birds are provided with clean drinking water. Water was given and libitum. Fecal droppings and rice hull were removed from feeding and drinking troughs before feeds were served.

Statistical Analysis. Data collected were analyzed using One Way Analysis of Variance (ANOVA) at 1% and 5% level of significance. Significant mean were compared using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSIONS

The Growth Performance of Broiler

Table 1 below shows the Growth Performance of Broiler supplemented with different Herbal Extract. As to the initial weight, control (control-no herbal supplementation) gained 238.3g, while treatment A (lemongrass extract) gained 246.0g, treatment B (gotu kola extract) gained 255.0g, treatment C (oregano extract) gained 270.0g, and treatment D (horseradish extract) gained 290.0g.

In terms of final weight, treatment D gained 1411.1g, treatment C gained 1314.5g, treatment B gained 1231.7g, treatment A gained 1177.6g, and control gained 1160.4g. The analysis showed a significant difference between the final weight of broiler at different treatments, wherein treatment D showed the most significant effect followed by treatment C and treatment B while treatment A and control shows the same treatment effect. The result implies that the supplementation of malunggay extract into the water will commensurate a better growth performance of broiler.

When it comes to weight gained, treatment D gained 1121.1g, treatment C gained 1044.5g, treatment B gained 976.7g, treatment A gained 931.6g, and control gained 922.1g. The analysis showed a significant difference between the weight gain of broiler at different treatments, wherein treatment D showed the most significant effect followed by treatment C and treatment B while treatment A and A shows the same treatment effect. The result implies that the supplementation of malunggay extract into the water will commensurate a better growth performance of broiler in terms of weight gained.

As observed in the total feed intake of the broiler, the analysis showed no significant differences between the feed consumption of the experimental animals wherein control consumed 2519.2g, treatment A2686.9g, treatment B2714.6g, treatment C2576.6g, and treatment D2472.4g.

The analysis showed a significant difference between the feed conversion efficiency of broilers at different treatments wherein, treatment D with FCE value of 2.21 shows the most efficient followed by treatment C with 2.47, treatment B with 2.78, treatment A2.88 and control with 2.73. The result implies that treatment D shows the best feeding efficiency compare to other treatments while control, treatment A and B show the least feeding efficiency and shows lower efficiency compare to treatment C.

The result of this study was supported by some of the related findings such that, Moringa oleifera tree contains high crude protein (CP) in the leaves (251 g/kg DM) and negligible content of tannins and other anti-nutritive compounds and offers an alternative source of protein to ruminants (Nouala et al., 2006) and non-ruminants. The seeds contain a high amount of CP, followed by flowers and leaves, suggesting that M. oleifera can be used as a protein source for both livestock and humans. The fact that the seeds contain higher CP content than other parts suggests that they can be used as a valuable source of protein. Ojukwu (2012) stated that Moringa leaves are periodically harvested to make a sauce, locally known as "mboum" or can be used to feed poultry, pigs and cattle.

Malunggay (Moringa oleifera) is one of the herbs containing bioceutical agents that could substitute synthetic growth enhancers and supplements in broiler and other livestock production. Some of the published studies pertaining to its potential involved the study of Lannaon (2007). He reported that the performance of Starbro broilers given with Malunggay (M. oleifera) leaf decoction, revealed the improvement of feed consumption, daily weight gain, final weight and profit compared to the control group.

Furthermore, Du et al. (2007) evaluated the effects of dietary supplementation of Moringa oleifera on growth performance, blood characteristics and immune response of Arbor acres strain broilers. It was found out that increasing supplementation of Moringa oleifera decreases contents of uric acids, triglycerides and albumin/globulin ratio in the serum of broilers. Hence, the immune response of broilers increases significantly.

Table 1. The Growth Performance of Broiler supplemented with different Herbal Extract

Treatment	Intial Weight (grams)	Final Weight (grams)	Weight Gained (grams)	Total Feeds consume (grams)	FCE
Control	238.3	1160.4D	922.1D	2519.2	2.73C
A (Lemon grass)	246.0	1177.6D	931.6D	2686.9	2.88C
B (Gotu kola)	255.0	1231.7C	976.7C	2714.6	2.78C
C (Oregano)	270.0	1314.5B	1044.5B	2576.6	2.47B
D (Horseradish tree)	290.0	1411.1A	1121.1A	2472.4	2.21A
F-Test		**	**	ns	**
CV%		2.96	3.87	5.54	6.78

The Economic Characteristics of Broiler

Table 2 below shows the economic characteristics of Broiler supplemented with different Herbal Extract. As to the total cost, control (no herbal supplementation) gained Php 114.96, while treatment A (lemongrass extract) gained Php 118.62, treatment B (gotu kola extract) gained Php 119.23, treatment C (oregano extract) gained Php116.22, and treatment D (horseradish extract) gained 113.94. The analysis shows no significant difference among total costs in growing Broiler.

In terms of gross income, treatment D gained Php 155.22, which was significantly the highest among all treatments followed by, treatment C gained Php144.59, treatment B gained Php 135.48, treatment A gained Php 129.54, and control gained 127.64. The analysis showed a significant result between the gross income of broiler at different treatments, wherein supplementing Horseradish tree extract showed the highest.

As to net income and Return of Investments (ROI) relative to the gross income gained in supplementing different herbal water supplements, treatment D gained Php 41.27 (ROI=36.2%), which was significantly the highest among all treatments followed by, treatment C gained Php 28.37 (ROI=24.4%), treatment B gained Php 16.25 (ROI=13.6%), treatment A gained Php 10.91 (ROI=9.2%), and control gained Php 12.67 (ROI=36.2%). Therefore the supplementation of horseradish extracts commensurate the highest income among other herbal extracts and those with no supplementation.

Table 2. The economic characteristics of Broiler supplemented with different Herbal Extract

Treatment	Total Cost (Php)	Gross Income (Php)	Net Income (php)	ROI
Control	114.96	127.64C	12.67D	11.0%C
A (Lemon grass)	118.62	129.54C	10.91D	9.2%C
B (Gotu kola)	119.23	135.48C	16.25C	13.6%C
C (Oregano)	116.22	144.59B	28.37B	24.4%B
D (Horseradish tree)	113.94	155.22A	41.27A	36.2%A
f-test	ns	*	**	**
cv%	8.1%	5.6%	6.3%	4.8%

CONCLUSION

Supplementing Horseradish extract at 10% level of solution significantly enhanced the broiler's growth performance and feeding efficiency. The water supplementation of Horseradish extract was economically efficient, which commensurate the highest income among other herbal extract and those with no supplementation. Based on the study conducted, it was recommended that water supplementation of Horseradish extract (10%) to enhance the growth performance and feeding efficiency of broiler. In addition, the supplementation of this extract could provide higher income when engaging in broiler production.

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