

Sources and Levels of Natural Growth Promotants for Redbro Chicken



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ABSTRACT: Fortification of animals' diets with antibiotics in promoting the growth and development has increased the public's concern about the safety of animal products and their adverse effects on human health and natural immunity.

The study conducted at Mabilbila Sur, Santa, Ilocos Sur from January 12, 2021 to February 28, 2021. The study determined the best sources (garlic, oregano, turmeric) and levels (2g, 4g, 6g) of natural growth promotants and their interaction as an alternative to antibiotics. It aimed to determine the effects on the growth performance, carcass trait, sensory traits, and economic analysis of red broiler chicken. One hundred eighty (180) experimental birds were distributed into nine treatments (6 chicken/pen) including one floating control replicated thrice in a Strip-Split Plot Design.

Supplementation of four grams turmeric infusion resulted to the heaviest chicken thus, higher profit above feed cost. Most efficient feed conversion attained with the supplementation of two grams garlic and oregano.

KEYWORDS: natural growth promotants, phytochemical, red broiler, sensory trait

INTRODUCTION

Situation Analysis

Corona virus creates a huge impact on human life where it excuses no one, from less fortunate to the highest class of the community. From a single city, it become widely spread to many countries where millions of casualties and many people were infected. The world became stagnant, and hunger commit to universal problem due to global lockdown caused by pandemic. Worst scenario when sufficient supply of food is badly needed, many industries collapsed, businesses turned down to bankruptcy, food security and supply chain interrupted from farm to transportation to the market. One of the affected sectors is the animal industry, where it ruins the livestock production worldwide particularly pig and poultry. Producers were encouraged to slow growth rates, and some had to cull animals on farm in ways that likely included suffering and caused considerable upset to owners and workers. The global poultry production in 2019 expanded to 130 million tons, growing by 3.7% from 2018 and expected to continue its growth for succeeding years. With a combined 45% share of global production, the countries recorded the highest volumes of poultry production in 2019 were: The US (23 million tons), China (20 million tons) and Brazil (16 million tons). According to the global forecast of Food and Agriculture Organization (FAO) in 2020, global poultry meat production is estimated to reach 137 million tons, with growth anticipated in China, the EU, Britain, Brazil and Mexico. It is expected to increase the production in the EU and the UK because of new investments for processing capacity. However, this positive outlook can possibly turn to negative fall due to new cases of HPAI that could hinder production growth and the terrible impact of Covid-19 pandemic as stated in the IndexBox report

Global poultry market in 2019 increased by 6% to US\$ 231.5 billion, rising for the 3rd consecutive year. Global consumption peaked in 2019 and a continued upward consumption trend is expected, according to an IndexBox report. Based with the combined 40% share of global consumption, the countries with the highest volumes of poultry consumption in 2019 were China (20 million tons), the US (19 million tons) and Brazil (12 million tons). The countries that recorded the highest levels of poultry per capita consumption in 2019 were Malaysia (63 kg per person), the US (58 kg per person) and Brazil (57 kg per person).

On the latest report of Philippine Statistics Authority (PSA) as of July 1, 2020, the total inventory of chicken was recorded at 186.47 million birds, decreased by 2.7 percent from the 191.70 million birds recorded in the same period of 2019. Stocks of broiler chicken and layer chicken lower by 11.1 percent and 1.4 percent, respectively. On the other hand, native/improved chicken inventory increased by 3.6 percent.

Among the regions, the highest inventory of native/improved chicken of 13.13 million birds or 15.4 percent of the total native/improved chicken inventory was recorded in Western Visayas. Broiler chicken inventory was highest in Central Luzon at 18.86 million birds or 30.8 percent of the total broiler chicken inventory. Meanwhile, CALABARZON shared the highest inventory of layer chicken of 14.35 million birds or 36.2 percent of the total layer chicken inventory.

Redbro (red broiler) is a breed surpassed other hybrid species of congeners in quality, for which it became popular in all continents. The flagship in breeding the breed is the Hubbard Company and it was originally bred in England. It is a crossbred between Cornish and Malaysian fighting. This breed of chicken is admired because of its ability to accept easily adverse conditions, it have young survival rate, strong immunity and great endurance, they produce 300 eggs per year, moderate feed consumption and it has attractive exterior. Farmers find the Redbro breed profitable, because it only requires little effort and material costs applied to produce the final product. Redbro chickens look attractive, and they are characterized by such signs: big head, dark color of the eye iris (usually black or brown), neat yellow beak, developed lobes and painted in bright red, massive torso with bulging breasts and round belly, strong lower limbs yellowish and thick plumage. They are born in light brown down and they reach 40 grams in weight. They are freedom-loving, and a spacious coop is required for keeping.

Redbro are among the most popular broilers in Europe and America particularly raised for both meat and egg. These crosses are bred on a personal plot and on poultry farm. The feeding habit of an adult bird consumes as many calories per day (about 3.5 thousand kcal) and needs of plenty of clean water. The correct ratio of feed and water is 1:1.7. Give chicken 1 kg of feed and provide 1.7 liters of water. Adult females grow up to 3 kg while males up to 4.5 kg and they both gain in weight quickly. In the age of one month, individual birds reaches 1200 g, and the same

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increase is noted the next 30 days. Thus, the maintenance and feeding of redbro chicken can be compared with both broilers and ordinary domestic chickens.

The chicken industry is one of the most successful sectors especially broiler production that began from being fragmented and locally oriented backyard enterprise and evolved into a sophisticated integrated contract farming operations which increasingly supplying customers nationwide and around the globe. Broiler production is a promising business venture because of its optimistic considerations such as: chicken is an in demand good source of protein, broiler are efficient converters of feeds into meat, quick return of investment, and presence of organized market niche. However, one of the arising threats in the poultry industry and even in the different livestock sector is the emergence and re-emergence of zoonotic disease in relation to improper utilization of antibiotics. Now this became the worldwide challenge to many animal health practitioners and livestock raisers on how they will address the issue on rampant misuse of antibiotics and the possible alternatives (natural growth promoters) to boost the immunity and improved the health of chickens in the absence of antibiotics and for safe human consumption.

The discovery of antibiotics was a success in controlling infectious pathologies and increasing feed efficiencies (Engberg *et al.* 2000). Antibiotics are practically used to prevent proliferation and destroy bacteria either natural or synthetic origin. However, scientific evidence found out that the massive use of these compounds is the driven factor of antibiotic resistance (Forgetta *et al.*, 2012).

Antibiotic tolerance in humans and animals (especially bacteria) is now a common topic, and it is expected to be continuous public health hazard. Fortification of animals' diets with antibiotics to promote growth has increased the public's concern about the safety of animal products and their adverse effects on human health and natural immunity. The impact of antibiotic on the gut flora leads to enhanced digestion and absorption, and, thus, the availability of nutrients for production due to an improved gut ecosystem that favors beneficial microorganisms. Nonetheless, antibiotics can also amplify the occurrence of drug-tolerant bacteria.

Generally, when an antibiotic is used in any setting, it eliminates the susceptible bacterial strains leaving behind those with traits that can resist the drug. These resistant bacteria then multiply and become the dominating population and as such, are able to transfer both horizontally and vertically the genes responsible for their resistance to other bacteria (Madigan *et al.*, 2014). Resistant bacteria can be transferred from poultry products to humans via consuming or handling meat contaminated with pathogens. Once these pathogens are in the human system, they could colonize the intestines and resistant genes that could be shared or transferred to the endogenous intestinal flora, jeopardizing future treatments of infections caused by such organisms (Marshall *et al.*, 20011).

There are heightened concerns globally on emerging drug-resistant superbugs and the lack of new antibiotics for treating human and animal diseases. In agricultural industry, there is an urgent need to develop strategies to replace antibiotics for food-producing animals, especially poultry and livestock. The 2nd International Symposium on Alternatives to Antibiotics was held at the World Organization for Animal Health in Paris, France, December 2016 they discuss recent scientific developments on strategic antibiotic-free management plans, to evaluate regional differences in policies regarding the reduction of antibiotics in animal agriculture and to develop antibiotic alternatives to combat global increase in antibiotic resistance. They discussed recent research and promising novel technologies that could provide alternatives to antibiotics for use in animal health and production: assess challenges associated with their commercialization; and devise actionable strategies to facilitate the development of alternatives to antibiotic growth promoters (AGPs) without hampering animal production. Scientists from industry and academia and government research institutes shared their experience in developing and applying potential antibiotic-alternative phytochemicals commercially to reduce AGPs and to develop a sustainable animal production system in the absence of antibiotics (Lillehoj *et al.* 2018). In 2013, the US Food and Drug Administration (FDA) called for major manufacturers of medically important animal drugs to voluntarily stop labeling them for animal growth promotion and published its final rule of the Veterinary Feed Directive (VFD) in 2015.

On the article released by the National Chicken Council, as of April 2019, more than 50% of U.S. broiler chicken production is raised without any antibiotics. They support FDA's proposed Veterinary Feed Directive (VFD) that ensures that all antibiotics administered to food producing animals are only done under the supervision and prescription of licensed veterinarians. In fully cooperating with FDA on these measures, both chicken producers and animal health companies continue to preserve the value and effectiveness of antibiotics used to treat human illness and decrease the resistance of foodborne pathogens.

The quest for alternative products has clearly intensified in recent years with the increase in regulations regarding the use of antibiotic growth promoters (AGPs) and the rise in consumer demand for poultry products from "Raised Without Antibiotics" or "No Antibiotics Ever" flocks (Gadde *et al.*, 2017).

Phytochemicals, also referred to as phytobiotics or phytochemicals, are natural bioactive compounds that are derived from plants and incorporated into animal feed to enhance productivity (Gadde *et al.*, 2017). Ideal antibiotic alternatives should have the same effects of AGPs, ensure optimum animal performance, increase nutrient availability and practical alternative should exert a positive impact of feed conversion and growth. Phytochemicals can be used in solid, dried and ground form or as extracts (crude or concentrated) and can be classified as essential oils (EOs: volatile lipophilic substances obtained by cold extraction or steam/alcohol distillation) and oleoresins (extracts derived by non-aqueous solvents) depending on the process used to derive the active ingredients. The main bioactive compounds of the phytochemicals are polyphenols, and their composition and concentration vary according to the plant, plant parts, geographical origin, harvesting season, environmental factors, storage conditions, and processing techniques (Lillehoj *et al.*, 2018).

In recent years, phytochemicals have been used as natural growth promoters in the poultry, swine and ruminants' industries. A wide variety of herbs and spices (e.g. thyme, oregano, rosemary, marjoram, yarrow, garlic, ginger, green tea, black cumin, coriander and cinnamon) have been used in poultry for their potential application as AGP alternatives. In addition, various EOs (thymol, carvacrol, cinnamaldehyde, and eugenol, coriander, star anise, ginger, garlic, turmeric, basil, caraway, lemon, and sage) have been used individually or as blends to improve animal health performance (Gadde *et al.*, 2017).

Various research conducted on the mechanisms of the botanical powder and extract mainly exert their beneficial effects are as follows: (1) Disrupt cell membrane of microbes; (2) Interfere with virulence properties of the microbes by increasing the hydrophobicity, which may influence the surface characteristics of microbial cells; (3) stimulates and proliferate the growth of beneficial bacteria (e.g., lactobacilli and bifidobacteria) in the gut; (4) Act as an immune stimulants; (5) Protects intestines from microbial attack; (6) Stimulate the proliferation and growth of absorptive cells (villus and crypt) in the gastrointestinal tract and (7) Enhances the production and activity of the digestive enzymes (Jamroz *et al.*, 2003; Vidanarachi *et al.*, 2006).

Garlic, oregano and turmeric are just some of the ideal and locally available plants that can be used as source of natural growth promotants for chickens.

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Garlic

Garlic (*Allium sativum*) belongs to the Lillaceae family has been popularly known since ancient times for their medicinal potentials. Garlic and other *Allium* species, such as onions, leek, shallot, scallion and chives, have been characterized to contain a plethora of bioactive compounds such as organosulfur, polyphenols, saponins, fructans, and fructo-oligosaccharides (Kothari *et al.*, 2019). *Allium sativum* is the king of medicinal plants that have growth promoting effect in chicken production. It has reported for its antimicrobial, antibacterial, antiviral, antifungal and antiprotozoal properties in poultry (Rehman *et al.*, 2015).



Fig. 1. Garlic bulbs

Garlic consider one of the most important spices in medicinal system due to its multi-functional properties. It possesses at least 33 sulphur containing compounds, several enzymes, amino acid, and minerals (Aarti *et al.*, 2020). Allicin (allyl 2-propenethiosulfinate or diallyl thiosulfinate) is the major bioactive compound present in the raw garlic homogenate or aqueous extract (Bayan *et al.*, 2013).

Eltazi *et al.* (2014), studied the effect of feeding broiler chicks on diets containing different levels of garlic powder as natural feed additive on productive performance, carcass characteristics, and economical efficiency. Results showed that, the diet with 3% garlic powder had significantly ($P<0.05$) heaviest body weight gain, highest feed intake, best feed conversion ratio with highest dressing, and breast percentages. The birds fed on control group produced significantly ($P<0.05$) highest abdominal fat percentage. The mortality rate was not affected significantly by the addition of garlic powder in broiler diet. The profitability ratio (1.30) was recorded by the diet with 3% garlic powder as compared to other experimental diets.

An experiment conducted by Khan *et al.*, (2017) on the effect of garlic extract on growth performances and hematological parameters of broilers were studied. Live weight and weight gain of the treatment group were significantly ($P<0.05$) higher than that of the control group. Significant ($P<0.05$) higher values also observed in terms of weight of heart, live, spleen, and pancreas for the treatment group. The results suggest that better growth performance could be achieved in broilers with feed supplemented with garlic extract.

Oregano

Oregano (*Origanum vulgare*) is considered a staple herb in many cuisines around the world. It is popularly known for its strong flavor, which bring warmth and aroma to dishes, along with a hint of subtle sweetness. It can be found raw, fermented or as an oil, and all are said to have significant health benefits. Oregano is high in antioxidants, which are compounds that help fight damage from harmful free radicals in the body (Link 2017).

Oregano is an erectly spreading perennial herb and member of the plant family Lamiaceae that has been cultivated for centuries in the Mediterranean area, although it now can be found on most continents. It has fleshy stem and a heart-shaped leaves with toothed edges, and which grow for up to 9 meters in length. Oregano flowers are purple, 3–4 mm long, produced in erect spikes. Oregano also used in traditional medicines for such ailments as asthma, cramping, diarrhea and indigestion (Singletary 2010).



Figure 2. Oregano leaves

Oregano contains thymol and carvacrol, both of which have shown to inhibit the growth of bacteria, including *Pseudomonas aeruginosa* and *Staphylococcus aureus*. As reported by The World Healthiest Food (www.whfoods.com) in Mexico, researchers have compared oregano to tinidazol, a commonly used prescription drug to treat infection from amoeba *Giardia lamblia*. These researchers found oregano to be more effective against *Giardia* than the commonly used prescription drug.

Origanum vulgare as a feed supplement has antimicrobial, antioxidant, antiviral, immunodulatory and antiparasitic effect. The potential advantages of utilizing oregano extracts, in poultry diets include improved feed intake and feed conversion, enhanced digestion, expanded productive performance, down-regulated disease incidence and economic losses. The average inclusions of oregano essential oil up to 600 mg/kg in broiler diets increased body weight gain. Using 1% oregano oil in broiler diets improved feed conversion ratio and feed utilization. Inclusion of 240 mg oregano supplementation per kg diet appears to give optimum level for protecting broiler chickens from *C. perfringens* infections. Bioactive components extracted from *O. vulgare* parts could be used in poultry diets levels of 10-30 g/kg. To maximize the overall productivity

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of poultry, oregano may be used as a natural alternative to antibiotics and drugs due to the absence of side effects and residues (Alagawany *et al.*, 2019)

Many studies suggested that oregano is an excellent natural replacement for antibiotics. There are few ways to provide oregano to chickens, one of it in the form of tea. Put fresh oregano in a glass or heat-proof container then pour the hot water over the oregano. Oregano tea is a great way to help a sick chicken. A chicken that is sick will often quit eating but will continue drinking. Oregano tea can help them get over an illness by fighting off what's making them sick. It has some vitamins and nutritional value to keep them going until they start eating again which strongly claimed in similar studies that oregano may improve feed intake, the growth rate of broilers and overall body condition in meat carcasses (DeVore 2019).

In a study conducted by Giannenas, *et al.* (2016), the results of the trial showed that the group of broilers received oregano or the mixture of oregano and laurel presented better Body Weight (BW) and Feed Conversion Ratio (FCR) and mortality compared to control group. Bacterial counts for the Lactobacilli and Bifidobacteria were higher in the experimental groups compared to the control group at both ileum and caecum, and total coliforms were lower in caecum in the experimental groups compared to control or laurel ones. Oregano supplemented groups showed higher antioxidant capacity of breast and thigh meat compared to control and laurel groups. In conclusion, oregano essential oil alone or as a mixture with laurel essential oil can be used to improve growth performance and gut health in broiler chicken.

Turmeric

Turmeric (*Curcuma longa*) is a perennial herb having a short stem with large simple oblong leaves which belong to family Zingiberaceae. Its tubers (rhizomes) are oblong or ovate or pyriform and are often branched. Externally, the rhizomes are yellowish brown, while internal surface is orange in color. They possess the characteristic odor and are slightly pungent bitter to taste (Hegde 2013). Turmeric has been used for long history as traditional medicine. This spice is indigenously cultivated from rhizome or roots of flowering plant in India and other parts of Southeast Asia (Jurenka 2009).



Fig. 3. Turmeric plants and rhizomes

Turmeric contains protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrates (69.4%) and moisture (13.1%) (Yadav *et al.*, 2013). It is also a rich source of phenolic compounds, such as curcumin which is responsible for its yellow color, demethoxycurcumin, and bisdemethoxy curcumin and tetrahydrocurcumin metabolites. This polyphenolic compound has the wide range of biological properties such as antioxidant, anti-inflammatory, antiviral, antibacterial, antifungal, antihypertensive and anti-carcinogenic activities (Mahesh 2018; Masuda *et al.*, 2001).

A study on the effect of inclusion of different levels of turmeric (*Curcuma longa*) powder on broiler performance, carcass characteristics and bacterial count conducted by Al-Mashhadani (2015) showed that supplementing broiler diets with 0.4 % curcuma powder improved significantly ($P < 0.05$) final body weight, weight gain and lactobacillus count and could be used as growth promoter.

An experiment conducted by Isroli *et al.* (2017) on the effect of decocted turmeric on performance, hematological parameters and carcass traits of broiler chicken were studied. Result showed, providing decocted turmeric through drinking water helped to improve stress responses and increased the weight of breast meat of broiler chickens.

It has been a repeated practice for decades the use of antibiotics as growth promoter (GPA) in animal feeds to prevent from diseases and enhance their production performance in modern animal husbandry. In the present time, due to the unreasonable and improper utilization of antibiotics there is now a concern in increasing risk of bacterial resistance where prompted efforts to develop alternative antibiotics (Cheng 2014). Therefore, the search for new plant origin alternatives to replace the GPA's such as herbs, spices, plant extracts and/or essential oils to be use as antimicrobials and to also make them available to contribute to animal nutrition (Castillo-Lopez *et al.*, 2017). However, alternatives to antibiotics must deeply analyzed and studied if it can be possibly and evidently used as substitute natural antibiotic in veterinary medicine in the foreseeable future.

OBJECTIVES OF THE STUDY

This study was conducted to determine the growth performance, carcass traits, profit above feed medicine and stock cost, and sensory traits of redbro chicken as affected by different sources of natural growth promotants at different levels.

Specifically, it aimed to:

1. Determine the performance of redbro chicken as influenced by different sources (garlic, oregano, turmeric) of natural growth promotants in terms of final weight, gain in weight, feed consumption, feed conversion ratio, dressing percentage, percent leaf fat, liver weight and gizzard weight and profit above feed, medicine and stock cost;
2. Determine the performance of redbro chicken as influenced by the different levels (2g, 4g, 6g) of natural growth promotants in terms of final weight, gain in weight, feed consumption, feed conversion ratio, dressing percentage, percent leaf fat, liver weight and gizzard weight and profit above feed, medicine and stock cost;
3. Determine the interaction effects of different sources of natural growth promotants at different levels of herbal plant tea on the growth performance and carcass traits of broilers; and
4. Determine the sensory traits and acceptability of the steamed meat samples from the different treatment combinations.

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TIME AND PLACE OF THE STUDY

The study was conducted at the researcher’s residence Barangay Mabilbila Sur, Santa, Ilocos Sur from January 12, 2021 to February 28, 2021 (45 days).

DEFINITION OF TERMS

- For a better understanding of this research, the following terms were operationally defined:
- Ad libitum feeding* refers to giving unlimited amount of feed to the experimental animals.
- Antibiotic* refers to a medicine used to prevent and treat bacterial infections.
- Antibiotic resistance* refers to the ability of bacteria and other microorganisms to resist the effects of an antibiotic to which they were once sensitive
- Broiler* refers to any chicken that is bred and raised specifically for meat production.
- Brooding* is the management of chicks from one day old to about 8 weeks of age, and it involves the provision of heat and other necessary care during chicks’ early growing period.
- Carcass traits* refer to the dressing percentage, percent leaf fat, liver weight and gizzard weight of the broilers.
- Culling* is the process of eliminating undesirable birds or those birds which do not possess the qualities for giving enough benefit in return for their culture.
- Efficacy* the ability to produce a desired or intended result.
- Garlic Bulb* is a bulb-like modified underground stem and covered with whiteish papery outer scale.
- Feed conversion ratio (FCR)* refers to the efficiency of an animal’s body to convert utilized feed into the desired output.
- Natural Growth Promoters (NGP)* refer to plant derived products (leaves, roots, tubers or spices) with antimicrobial properties added to feed in order to improve broiler’s performance.
- Herbal plant infusion* refers to the powdered herbal plants like turmeric, oregano and garlic infused to cold or hot water.
- Infusion* the process of or result of extracting flavors from plant materials in a water by letting the material to remain suspended in the solvent over time.
- Probiotics* are beneficial bacteria for chickens that are commonly added to poultry feed or drinking water to help support birds’ health, performance and growth.
- Redbro chicken* a red feathered bird with both broiler and layer characteristics This breed has clearly defined head features with short beak, regular straight red comb and bright ear lobes.
- Rhizomes* are fleshy underground stem and elongated usually horizontal often thickened that produces shoots above and roots below this includes turmeric and ginger.

METHODOLOGY

Research Design

The study was laid out in a Strip-Split Plot Design. Strip-Split Plot Design was used to determine the significant difference between levels of each factor and their interactions. A total of 180 heads day-old chicks were distributed into nine treatments (6 chicken/pen) including one floating control replicated thrice.

The following treatments were used:

Factor A – Sources of Natural Growth Promotants

- A₁ – Garlic (bulbs)
- A₂ – Oregano (leaves)
- A₃ – Turmeric/Yellow Ginger (rhizome)

Factor B – Levels of Natural Growth Promotants

- B₁ - 2 grams Pulverized herbal plant infusion + 1 Liter
- B₂ - 4 grams Pulverized herbal plant infusion + 1 Liter
- B₃ - 6 grams Pulverized herbal plant infusion + 1 Liter

Floating Control – Antibiotics

Interactions:

- A₁B₁ - 2 grams Pulverized Garlic Bulb Infusion
- A₁B₂ – 4 grams Pulverized Garlic Bulb Infusion
- A₁B₃ – 6 grams Pulverized Garlic Bulb Infusion
- A₂B₁ – 2 grams Pulverized Oregano Leaves Infusion
- A₂B₂ – 4 grams Pulverized Oregano Leaves Infusion
- A₂B₃ – 6 grams Pulverized Oregano Leaves Infusion
- A₃B₁ – 2 grams Pulverized Turmeric Rhizome Infusion
- A₃B₂ – 4 grams Pulverized Turmeric Rhizome Infusion
- A₃B₃ – 6 grams Pulverized Turmeric Rhizome Infusion

Experimental Layout

I	II	III
A ₁ B ₁	A ₁ B ₁	A ₁ B ₁
A ₁ B ₂	A ₁ B ₂	A ₁ B ₂
A ₁ B ₃	A ₁ B ₃	A ₁ B ₃
A ₂ B ₁	A ₂ B ₁	A ₂ B ₁
A ₂ B ₂	A ₂ B ₂	A ₂ B ₂
A ₂ B ₃	A ₂ B ₃	A ₂ B ₃
A ₃ B ₁	A ₃ B ₁	A ₃ B ₁

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A ₃ B ₂	A ₃ B ₂	A ₃ B ₂
A ₃ B ₃	A ₃ B ₃	A ₃ B ₃
C	C	C

Experimental Treatments and Descriptions

Treatments	Descriptions
C - Antibiotics	Drinking water with antibiotics following the recommended dosage
A ₁ B ₁ - Pulverized Garlic Bulb Infusion (2g)	2g of pulverized garlic bulb infusion for every liter of water
A ₁ B ₂ - Pulverized Garlic Bulb Infusion (4g)	4g of pulverized garlic bulb infusion for every liter of water
A ₁ B ₃ - Pulverized Garlic Bulb Infusion (6g)	6g of pulverized garlic bulb infusion for every liter of water
A ₂ B ₁ - Pulverized Oregano Leaves Infusion (2g)	2g of pulverized oregano leaves infusion for every liter of water
A ₂ B ₂ - Pulverized Oregano Leaves Infusion (4g)	4g of pulverized oregano leaves infusion for every liter of water
A ₂ B ₃ - Pulverized Oregano Leaves Infusion (6g)	6g of pulverized oregano leaves infusion for every liter of water
A ₃ B ₁ - Pulverized Turmeric Rhizome Infusion (2g)	2g of pulverized turmeric rhizome infusion for every liter of water
A ₃ B ₂ - Pulverized Turmeric Rhizome Infusion (4g)	4g of pulverized turmeric rhizome infusion for every liter of water
A ₃ B ₃ - Pulverized Turmeric Rhizome Infusion (6g)	6g of pulverized turmeric rhizome infusion for every liter of water

MATERIALS AND PROCEDURES

Materials:

The materials used in the research study were: 180 heads redbro chicken, poultry house/cage, commercial feeds, vetracin, feeding troughs, waterers, electric wire with bulb, old sacks, old newspapers, placards, record notebook, weighing scale.

For the treatment process: oregano (leaves), turmeric (rhizomes), garlic (bulb), knife, container, blender, and chopping board.

PROCEDURES:

Collection of Plant Materials

Oregano leaves were gathered from Mabilbila Sur, Santa, Ilocos Sur. Yellow ginger rhizomes were purchased from Cervantes, Ilocos Sur. Garlic bulbs were purchased from Duyayat, Sinait, Ilocos Sur. The plant materials were washed with tap water to remove the foreign materials that might have adhered to it.

Preparation of the Herbal Infusion

Freshly collected plant materials were chopped into tiny pieces and sundried until it became crisp in texture for 5 days. Yellow ginger rhizomes, oregano and garlic were pulverized using a blender. Pulverized plant materials were stored in clean and dry containers. Pulverized oregano, turmeric and garlic were place into transparent plastic with their recommended measurement. The pulverized treatments were infused in ½ liter hot water for 10 minutes and were mixed in ½ liter cold water for their drinking formulation.



Fig. 6. Flowchart in the Preparation of Native Garlic Bulbs Treatment

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Fig. 7. Flowchart in the Preparation of Oregano Leaves Treatment.



Fig. 8. Flowchart in the Preparation of Turmeric Rhizomes

Construction of Experimental Cages

The experimental cages were constructed following the recommended space allowance 1 x 1 square meter per cage, made of steel bars enclosed with fish net. The cages were cleaned thoroughly using soap and water, sundried and disinfected five days before the arrival of the experimental animals. Electric bulbs were individually installed in the brooding cages. Old sacks were placed along the walls to avoid the effect of draft.

Care and Management Practices

Pre-treatment Procedure. Upon the arrival of chicks, electrolytes were supplied to their drinking water for 3 days.

Feeding Management. *Ad libitum* feeding was employed. The chicks were fed with commercial chick booster during the first two weeks. Starter feeds were given after two weeks and finisher feed thereafter until the termination of the study. Feeding troughs were regularly checked to always ensure the availability of feeds.

Water Management. The experimental chicks were supplied with freshwater *ad libitum* after the 21 days implementation of the treatments. Feeding troughs and plastic waterers were cleaned regularly.

Sanitation. Old sacks were placed underneath the cages to facilitate the collection of bird droppings. Collection and disposal of the chicken manure was done twice a day, at around 6 o'clock in the morning and 5 o'clock in the afternoon.

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Source of the Stocks

Experimental birds were purchased from Bounty Fresh 179 Mariano Ponce St., Caloocan City. The chicks are uniform in sizes, with active eyes, and equal sizes of beak and shank upon arrival.

Sensory Evaluation

Ten adult (5 males, 5 females) and ten teenager (5 males, 5 females) were selected as panelists. The 20 panelists were asked to independently evaluate each sample for juiciness, texture, taste, aroma and general acceptability. Each panelist was instructed to rinse his/her mouth with water after evaluating each sample.

DATA GATHERED

The following parameters were gathered:

Initial Weight. The initial weight of the experimental broilers was taken at day-old before placing them in the experimental cages.

Weight at 21 Days. The chicken weight was taken after the implementation of treatments in 21 days.

Final Weight. The final weight of the broilers was taken after the termination of the study.

Gain Weight. This was determined by subtracting the initial weight from the final weight.

Feed Consumption. Feed consumption refers to the total amount of feed consumed by the experimental broilers from day-old until the termination of the study.

Feed Conversion Ratio. This was computed by dividing the amount of feed consumed by the gain in weight of the experimental chicken.

Dressing Percentage. Dressing percentage was computed by dividing the dressed weight by the live weight, multiplied by 100.

Leaf Fat Percentage. This was obtained by dividing the weight of leaf fat by the total dressed weight, multiplied by 100.

Liver Weight. This was obtained by weighing and recording the individual liver of the experimental animals.

Gizzard Weight. This was obtained by weighing and recording the individual gizzard of the experimental animals.

Profit above Feed, Medicine and Stock Cost. This was obtained by subtracting the cost of feeds, herbal plants and stocks, from the total sales.

Sensory Traits. The following parameters were gathered: tenderness, juiciness, texture, aroma, and general acceptability, using hedonic scale.

Data Analysis

Gathered data on growth performance and dressing percentage, leaf fat, liver weight and gizzard weight were analysed using Analysis of Variance (ANOVA) in Strip-Split Plot Design using Statistical Tool for Agricultural Research (STAR). Significant differences between and among treatments were subjected to Least Significant Difference (LSD) Test.

RESULTS AND DISCUSSION

Initial Weight

The initial mean weight of the experimental birds assigned to the different treatments was 74 grams. Analysis of Variance revealed no significant differences among the treatment means.

Effects of Different Sources of Natural Growth Promotants on Growth Performance

Weight at 21 Days

After the consumption of the different sources of natural growth promotants, A₃ (0.67 kg) receives the heaviest weight at 21 days, A₁ (0.63) follows thereafter whereas A₂ (0.62 kg) gains the lowest. The data gathered in Table 1 manifested a highly significant differences between A₃ and A₂ and A₃ and A₁ but do not show significance between A₁ and A₂. This implies that chicken received with pulverized turmeric rhizome infusion at 21 days significantly performed better than those given with pulverized oregano leaves infusion and pulverized garlic bulb infusion.

The result of the study is in agreement with the findings of El-Rayes et al. 2018, their experiment was carried out to evaluate the impact of different levels of turmeric (*Curcuma longa*) as a phytobiotic on the performance and bacterial count of broiler chickens. Results showed that final body weight and weight gain were significantly increased in birds fed diet supplemented with different levels of turmeric powder as compared to control group.

Table 1. Effects of Different Sources of NGP on the Weight of Redbro Chicken at 21 days

Sources of Natural Growth Promotants	Weight at 21 Days (kg)**
A ₁ – Garlic	0.63 _b
A ₂ - Oregano	0.62 _b
A ₃ - Turmeric	0.67 _a

Means with the same letter are not significantly different.

Final Weight

The final weight of the redbro chicken as exposed to the sources of natural growth promotants as illustrated in the table 2, suggests that there is a high significance between A₃ and A₂; and A₃ and A₁ but do not show any significant difference between A₁ and A₂. As shown in the table, A₃ (1.55 kg) obtains the largest weight increase, with A₂ (1.47 kg.) comes afterward and A₁ (1.46 kg.) the least.

Table 2. Effects of Different Sources of NGP on the Final Weight of Redbro Chicken

Sources of Natural Growth Promotants	Final Weight (kg)**
A ₁ – Garlic	1.46 _b
A ₂ - Oregano	1.47 _b
A ₃ - Turmeric	1.55 _a

Means with the same letter are not significantly different.

The present result of the study corroborates the findings of Kumari et al. (2007) that the addition of turmeric as feed additive resulted in better growth rate in the treated broilers. It also justified the result by the findings on the study of Labay, et al. (2003) that oregano extract significantly improved the average live body weight of broilers.

Sources and Levels of Natural Growth Promotants for Redbro Chicken

Gain Weight

As revealed in Table 3, the gain weight of the redbro chicken after the consumption of the different treatments show a high level of significant differences between A₃ and A₂; and A₃ and A₁, however, treatments A₁ and A₂ do not show any difference. Moreover, A₃ (1.47 kg) attains the heaviest gain weight as opposed to A₁ (1.39) and A₂ (1.39) which obtains the least.

Based on Ukoha and Onunkwo (2016) recorded the highest muscle weight of breast meat in poultry fed with diet containing 3% turmeric powder which stimulates protein synthesis by the enzymatic system of birds and can increase the amount of lean meat (Hussein 2013).

Table 3. Effects of Different Sources of NGP on the Gain in Weight of Redbro Chicken

Sources of Natural Growth Promotants	Gain Weight (kg)**
A ₁ – Garlic	1.39 _b
A ₂ - Oregano	1.39 _b
A ₃ - Turmeric	1.47 _a

Means with the same letter are not significantly different.

Feed Consumption

As shown in Table 4, redbro chicken that received Turmeric (A₃) as a source of natural growth promotants consumed the highest (4.30 kgs) which is significantly different to the redbro chicken of A₁ (Garlic) and A₂ (Oregano) which consumes 1.29 kgs.

Table 4. Effects of Different Sources of NGP on Feed Consumption of Redbro Chicken

Sources of Natural Growth Promotants	Feed Consumption*
A ₁ – Garlic	4.29 _b
A ₂ - Oregano	4.29 _b
A ₃ - Turmeric	4.30 _a

Means with the same letter are not significantly different.

Results supported the findings of Rodriguez, et. al. (2016) supplementation of turmeric extract in the drinking water of broilers significantly affects their feed consumption. Same findings of Kumari et al. (2007) that the addition of turmeric as feed additive also resulted in better feed consumption in the treated broilers.

Feed Conversion Ratio (FCR)

On feed conversion ratio on redbro chicken, shows comparable results that A₁ and A₂ gains the best (1.47) conversion ratio which registered a high level of significant difference to the redbro chicken of A₃ in a span of 45 days.

The results agreed on the findings of Attia (2016) wherein turmeric supplementation at 1 g/kg feed significantly improved feed conversion ratio of broilers. Based on the study of Raguindin (2018) it shows that NGP's used including turmeric and oregano revealed not significant results on the conversion of feeds into meat. Though, broilers given with turmeric were the most efficient in the conversion ratio among the other treatments given. Results on the study of Urusan (2017) states that turmeric powder improved the feed conversion ratio.

Table 5. Effects of Different Sources of NGP on Feed Conversion Ratio of Redbro Chicken

Sources of Natural Growth Promotants	Feed Conversion Ratio (FCR)**
A ₁ – Garlic	1.47 _a
A ₂ - Oregano	1.47 _a
A ₃ - Turmeric	1.55 _b

Means with the same letter are not significantly different.

Effects of Different Sources of Natural Growth Promotants on Carcass Trait

As gleaned in Table 6, the dressing percentage of the redbro chicken is almost identical to one another which ranges from 72.86 to 73.58 % with A₂ registering the highest (73.58%) followed by A₁ (73.49%) and A₂ (72.86%), the smallest. This supports the outcomes from the analysis of variance which clearly illustrates that there is no significant difference between and among the treatments A₁, A₂ and A₃ that were given to the redbro chicken. This finding agreed by the study of Mehala and Moorthy (2008) reported that supplementation of turmeric had no significant impact on carcass parameters.

The leaf fat percentage to redbro chicken's sources of natural growth promotants is presented in table 3. The analysis of variance shows that there's no significant differences with 0.11 between and among treatments, A₁ (given with Garlic), A₂ (given with Oregano) and A₃ (given with Turmeric).

Nouzarian et al. (2011) agrees of the results which there is significant decrease in abdominal fat pad in chickens fed with diets supplemented with turmeric powder. Emadi and Kermanshahi (2006) observed the same findings that dietary inclusion of turmeric powder in broilers significantly decreased the abdominal fats.

The Table 6 revealed that there's no significant differences on the liver weight among the sources of treatment given to redbro chicken. The result of the present study corroborates with the findings of Raguindin (2018); Aglipay and Rodriguez (2017) revealed that the liver weight of experimental chicken was not significantly influenced by the addition of lemon grass, oregano and turmeric in their diet.

Result on the analysis of variance on the gizzard weight revealed that there are no significant differences with 0.06% between and among the sources of treatments (garlic, oregano, turmeric) on the redbro chicken. The result of the study agrees with the findings of Raguindin (2018) that no significant influence on gizzard weight of the experimental chicken supplemented with lemon grass, oregano and yellow ginger.

Sources and Levels of Natural Growth Promotants for Redbro Chicken

Table 6. Effects of Different Sources of NGP on Carcass Trait of Redbro Chicken

Sources of Natural Growth Promotants	Dressing Percentage (ns)	Leaf Fat Percentage (ns)	Liver Weight (ns)	Gizzard Weight (ns)
A ₁ – Garlic	73.49 _a	0.11 _a	0.08 _a	0.06 _a
A ₂ - Oregano	73.58 _a	0.11 _a	0.08 _a	0.06 _a
A ₃ - Turmeric	72.86 _a	0.11 _a	0.08 _a	0.06 _a

Means with the same letter are not significantly different.

Effects of Different Sources of NGP on the Profit above Feed, Medicine and Stock Cost

Observing further at Table 7, the net income reveals that A₃ obtained the highest income with a mean of Php 102.24 bearing a highly significant differences to the redbro chicken given with A₂ and A₁ which received the lowest income with a mean of Php.84.96.

Table 7. Profit above Feed, Medicine and Stock Cost as Affected by Different Sources of NGP on Redbro Chicken

Sources of Natural Growth Promotants	Profit (Php)**
A ₁ – Garlic	84.96 _b
A ₂ - Oregano	89.11 _b
A ₃ - Turmeric	102.24 _a

Means with the same letter are not significantly different.

Effects of Different Levels of Natural Growth Promotants on Growth Performance

Weight at 21 Days

The Analysis of variance test clearly manifests that treatments B₁ and B₂ show significant difference. The weight at 21 days when the different treatments of herbal plant infusion are given to the redbro chicken, B₂ (0.66 kg) obtains the heaviest increase, followed by B₃ (0.64 kg) with B₁ (0.62 kg) getting the least.

On the study of Al-Sultan (2003), the same results he found out that higher body weight gain (1344.5 g) was observed in birds fed diet contained turmeric at level of 0.5% followed by birds received 0.25% (1329.8 g), 1% (1306 g) and control (1268.2 g).

Table 8. Effects of Different Levels of NGP on the Weight of Redbro Chicken at 21 days

Levels of Natural Growth Promotants	Weight at 21 Days (kg)*
B ₁ – 2 grams	0.62 _b
B ₂ – 4 grams	0.66 _a
B ₃ – 6 grams	0.64 _{ab}

Means with the same letter are not significantly different.

Final Weight

As indicated by the analysis of variance, the final weight of the redbro chicken has significant difference between and among the treatments B₁, B₂ and B₃ with a mean that ranges from 1.45 to 1.53 kg. Additionally, B₂ (1.53 kgs) has the heaviest final weight, B₃ (1.50 kgs) follows and B₁ (1.45 kgs) gains the least.

Table 9. Effects of Different Levels of NGP on the Final Weight of Redbro Chicken

Levels of Natural Growth Promotants	Final Weight (kg)*
B ₁ – 2 grams	1.45 _c
B ₂ – 4 grams	1.53 _a
B ₃ – 6 grams	1.50 _b

Means with the same letter are not significantly different.

The result of the study justified by the findings of Ukoha and Ononkwo (2016) that recorded the highest drained weight and muscle weight of breast meat in birds fed with an additive containing 3% turmeric powder, this may be due to optimal antioxidant activity of turmeric (curcumin a phenolic group, tetrahydro curcumin, cinnamic acid, curcumin alone, and niacin) as cited to Phuoc *et al.* (2019). Supplementing with turmeric can increase the amount of lean meat.

Gain Weight

The result in Table 10 emphasizes that there is a significant difference between and among B₁, B₂ and B₃ in terms of gain weight. This indicates that B₁ (1.45 kgs.) which achieves the heaviest gain weight, followed by B₃ (1.422 kgs.) and B₂ (1.33 kgs) the lowest, there is no difference in gain weight of the redbro chicken which is exposed to different treatments of herbal tea.

The findings of the study corroborate the on the study of Sethy *et al.* (2016) who reported that addition of *Curcuma longa* powder at 0.5% and 1% caused significant increase in body weight gain. Rajput *et al.* (2013) also found that 0.20 g/kg supplementation of pure curcumin – phytochemicals derived from turmeric increased body weight gain of broiler chickens. It also reported on the findings of Arslan *et al.*, 2017 that higher dose (1.0 and 1.5%) of turmeric supplementation improved body weight gains of broilers.

Table 10. Effects of Different Levels of NGP on the Gain in Weight of Redbro Chicken

Levels of Natural Growth Promotants	Gain Weight (kg)**
B ₁ – 2 grams	1.33 _c
B ₂ – 4 grams	1.45 _a
B ₃ – 6 grams	1.42 _b

Means with the same letter are not significantly different.

Sources and Levels of Natural Growth Promotants for Redbro Chicken

Feed Consumption

Looking at the Table 11, shows that feed consumption of the redbro chicken which received different levels of herbal plant infusion is almost similar to each other wherein 6g (B₃) receives the heaviest (4.30 kgs.). Moreover, B₃ (given with 6g) registers a high significant difference to the redbro chicken of B₁ (given with 2g) but comparable to the redbro chicken of B₂ (given with 4g).

Corroborates Halle *et al.* (2004) showed that supplementation of diet for male broiler chicks with graded levels of oregano herb (0, 2, 4, 10, and 20g/kg) significantly decreased feed intake and improved body weight and improved feed efficiency.

Table 11. Effects of Different Levels of NGP on Feed Consumption of Redbro Chicken

Levels of Natural Growth Promotants	Feed Consumption**
B ₁ – 2 grams	4.29 _b
B ₂ – 4 grams	4.30 _{ab}
B ₃ – 6 grams	4.30 _a

Means with the same letter are not significantly different.

Feed Conversion Ratio (FCR)

The different levels of herbal plant infusion given to redbro chicken for a 45-day treatment presented in the table 12, manifest a feed conversion ratio that ranges from 1.45 to 1.53 %. Treatment B₁ obtains the best FCR (1.45%) while B₂ (1.53%) attains the least. This is further elaborated with the result of the analysis of variance indicating that there is a significant difference between and among the redbro chicken that received treatments B₁, B₂ and B₃.

The result of the study agrees of Gianenas *et al.* (2005) showed that broiler BW, daily BW gain, and FCR were improved in birds fed dehydrated oregano plant (5 g/kg) as a single supplement or in combination with α -tocopheryl acetate. However, the effects of oregano at 5.0 and 7.5 g/kg were higher than those at 2.5 and 10.0g/kg of the diet. The present results also agreed by Al-sultan and Gameel (2004) observed that addition of turmeric meal at the rate of 5.0 g/kg increased body weight and feed conversion ratio of broiler chickens.

Table 12. Effects of Different Levels of NGP on Feed Conversion Ratio of Redbro Chicken

Levels of Natural Growth Promotants	Feed Conversion Ratio (FCR)*
B ₁ – 2 grams	1.45 _a
B ₂ – 4 grams	1.53 _c
B ₃ – 6 grams	1.50 _b

Means with the same letter are not significantly different.

Effects of Different Levels of Natural Growth Promotants on Carcass Trait

Treatment B₁ (73.95%) achieving the highest dressing percentage, followed by B₂ (73.22%) and B₃ (72.76 %), respectively, result of the analysis of variance proves that there is no significant difference between and among the treatments B₁, B₂ and B₃ given to the redbro chicken.

The result of present study corroborates Kafi, *et al.* (2017) they didn't find any significant differences in dressing percentages after using ginger and turmeric at 1.0 and 2.0 g/kg in broiler ration as feed additives. Contradictory to the results, Raghdad and Al-Jaleel (2012) used turmeric powder found dressing percentage significantly increased by using 0% to 1.5%.

Result on the analysis of variance on the leaf fat percentages discloses that there is no significant differences with 0.11% between and among the levels of herbal plant infusion, B₁ (given with 2G), B₂ (given with 4g) and B₃ (given with 6g) on the redbro chicken. Sugihart *et al.* (2011) made similar findings that birds fed with different levels of turmeric extract had no effect on the relative weight of abdominal fat.

Table 13 revealed that there are no significant differences on the liver weight among the levels of herbal plant infusion given to redbro chicken. The result of the present study corroborates with the findings of Raguindin (2018) that 0.1% to 0.3% of herbal plant meal revealed no significant difference. Same findings by Aglipay and Rodriguez (2017) which stated that addition of different levels of herbal plants to broiler's ration showed no significant difference on the liver weight.

Result on the analysis of variance on the gizzard weight revealed that there are no significant differences with 0.06% between and among the levels of herbal plant infusion, B₁, B₂ and B₃ on the redbro chicken. The result of the study agrees with the findings of Aglipay and Rodriguez (2017) that supplementation of different levels of herbal plant meals (lemon grass, oregano and turmeric) did not significantly improve the gizzard weight of broilers.

Table 13. Effects of Different Levels of NGP on Carcass Trait of Redbro Chicken

Levels of Natural Growth Promotants	Dressing Percentage (ns)	Leaf Fat Percentage (ns)	Liver Weight (ns)	Gizzard Weight (ns)
B ₁ – 2 grams	73.95 _a	0.11 _a	0.08 _a	0.06 _a
B ₂ – 4 grams	73.22 _a	0.11 _a	0.08 _a	0.06 _a
B ₃ – 6 grams	72.76 _a	0.11 _a	0.08 _a	0.06 _a

Means with the same letter are not significantly different.

Effect of Different Levels of NGP on the Profit above Feed, Medicine and Stock Cost

Table 14 shows by the analysis of variable which discloses that B₂ (4g) having the largest income with a mean of Php 99.03 is significantly differed to the redbro chicken fed with 2g (B₁) which registers the lowest income with a mean of Php 85.66 but comparable to the redbro chicken fed with 6g (B₃) with a mean of Php 91.79. This implies that 4g had significant effect on the profit.

Sources and Levels of Natural Growth Promotants for Redbro Chicken

Table 14. Profit above Feed, Medicine and Stock Cost as Affected by Different Levels of NGP on Redbro Chicken

Levels of Natural Growth Promotants	Profit (Php)*
B ₁ – 2 grams	85.66 _b
B ₂ – 4 grams	99.03 _a
B ₃ – 6 grams	91.79 _{ab}

Means with the same letter are not significantly different.

Interaction Effects of Different Sources and Levels of NGP on Growth Performance

Weight at 21 Days

The analysis of variance result showed that A₃B₂ obtains the highest (0.68 kg) weight at 21 days which illustrates that it recorded a high level of significant difference from the redbro chicken of A₁B₁, A₁B₃, A₂B₁ and A₂B₃ having a mean that ranges from 0.59 to 0.63 kg. but similar to the redbro chickens of A₁B₂, A₂B₂, A₃B₁ and A₃B₃ garnering a mean that ranges from 0.64 to 0.66 kg.

Table 15. Interaction Effects of Different Sources and Levels of NGP on the Weight of Redbro Chicken at 21 days.

Sources x Levels of Natural Growth Promotants	Weight at 21 Days (kg)**
C-Control	0.63 _{bcd}
A ₁ B ₁ – 2 grams Garlic	0.61 _{cd}
A ₁ B ₂ – 4 grams Garlic	0.65 _{abc}
A ₁ B ₃ – 6 grams Garlic	0.63 _{bcd}
A ₂ B ₁ – 2 grams Oregano	0.59 _d
A ₂ B ₂ – 4 grams Oregano	0.64 _{abc}
A ₂ B ₃ – 6 grams Oregano	0.63 _{bcd}
A ₃ B ₁ – 2 grams Turmeric	0.66 _{ab}
A ₃ B ₂ – 4 grams Turmeric	0.68 _a
A ₃ B ₃ – 6 grams Turmeric	0.66 _{ab}

Means with the same letter are not significantly different.

The findings corroborate with the study of Raguindin (2018) that varying levels of lemon grass, oregano and yellow ginger significantly influenced the gain in weight of broilers. Also supported by the study of Aglipay and Rodriguez (2017) that the gain weight was significantly influenced by the interaction of different herbal plants at different levels.

Final Weight

As indicated in the table 16, the different mixture of concentrations derived from the different sources and different levels of natural growth promotants achieved a final weight mean rating of 1.69 kgs in which 4 g turmeric (A₃B₂) obtained the highest (1.57 kgs) final weight. The data gathered from the table also show that A₃B₂ acquired a high significant difference to the redbro chicken of A₁B₁ and A₂B₁ which recorded a mean of 1.42 kgs., however, it is corresponding to the redbro chicken of A₁B₂, A₁B₃, A₂B₂, A₂B₃, A₃B₁ and A₃B₃ which receives a mean that ranges from 1.46 to 1.56 kgs.

Table 16. Interaction Effects of Different Sources and Levels of NGP on the Final Weight of Redbro Chicken.

Sources x Levels of Natural Growth Promotants	Final Weight (kg)**
C-Control	1.46 _{ab}
A ₁ B ₁ – 2 grams Garlic	1.42 _b
A ₁ B ₂ – 4 grams Garlic	1.50 _{ab}
A ₁ B ₃ – 6 grams Garlic	1.48 _{ab}
A ₂ B ₁ – 2 grams Oregano	1.42 _b
A ₂ B ₂ – 4 grams Oregano	1.51 _{ab}
A ₂ B ₃ – 6 grams Oregano	1.46 _{ab}
A ₃ B ₁ – 2 grams Turmeric	1.51 _{ab}
A ₃ B ₂ – 4 grams Turmeric	1.57 _a
A ₃ B ₃ – 6 grams Turmeric	1.56 _a

Means with the same letter are not significantly different.

The findings justified by Raguindin (2018) that significant result was observed on the final weight of broilers as affected by the combined supplementation of different growth promotants and different levels of herbal plant meal.

Gain Weight

Table 17 revealed that the redbro chicken's gain weight mean is 2.37 kgs. It shows that the redbro chicken that received 4g Turmeric (A₃B₂) and 6g Turmeric (A₃B₃) obtained the heaviest gain weight (1.48 kgs.) which registered a high significant difference between the redbro chicken of A₁B₁ and A₂B₁ with a gain weight of 1.35 kgs. but comparable to the redbro chicken of A₁B₂, A₁B₃, A₂B₂, A₂B₃, A₃B₁ which ranges from 1.39 to 1.44 kgs.

Table 17. Interaction Effects of Different Sources and Levels of NGP on the Gain in Weight of Redbro Chicken.

Sources x Levels of Natural Growth Promotants	Gain Weight (kg)**
C-Control	1.39 _{ab}
A ₁ B ₁ – 2 grams Garlic	1.35 _b
A ₁ B ₂ – 4 grams Garlic	1.43 _{ab}

Sources and Levels of Natural Growth Promotants for Redbro Chicken

A ₁ B ₃ – 6 grams Garlic	1.40 _{ab}
A ₂ B ₁ – 2 grams Oregano	1.35 _b
A ₂ B ₂ – 4 grams Oregano	1.43 _{ab}
A ₂ B ₃ – 6 grams Oregano	1.39 _{ab}
A ₃ B ₁ – 2 grams Turmeric	1.44 _{ab}
A ₃ B ₂ – 4 grams Turmeric	1.48 _a
A ₃ B ₃ – 6 grams Turmeric	1.48 _a

Means with the same letter are not significantly different.

The findings of the present study corroborate by Raguindin (2018) shows significant result was noted on gain in weight of broilers, it was observed that as the level of herbal plant meal added to yellow ginger increases, gain in weight also increases. It is also noted that broiler supplemented in the diet with oregano provide highest gain in weight. Aglipay and Rodriguez (2017) also agreed based on their findings that the gain in weight was significantly influenced by the interaction of herbal plants at different levels (1%, 2% and 3%).

Feed Consumption

The mixture of treatments using the sources and levels of natural growth promotants shown in the table indicates that 6 g Turmeric (A₃B₃), 4g Turmeric (A₃B₂), 2g Turmeric (A₃B₁), 6g Oregano (A₂B₃), 4g Oregano (A₂B₂) and 6g Garlic (A₁B₃) consumed the highest (4.30 kgs) by the redbro chicken. Analysis of variance also discloses that there is a high significant difference on feed consumption between A₃B₃ and A₂B₁ and A₃B₃ and A₁B₁ which consumes 4.28 and 4.29 kgs, respectively. On the other hand, A₃B₃ is comparable with the redbro chicken which consumed treatments, A₁B₂, A₁B₃, A₂B₂, A₂B₃, A₃B₁ and A₃B₂.

The present result agrees in the findings of Wang *et al.*, (2015) that dietary turmeric rhizome extract (TRE) supplementation had a significant effect (P<0.05) on the average daily feed intake of birds throughout the trial period.

Table 18. Interaction Effects of Different Sources and Levels of NGP on Feed Consumption of Redbro Chicken.

Sources x Levels of Natural Growth Promotants	Feed Consumption**
C -Control	4.30 _{ab}
A ₁ B ₁ – 2 grams Garlic	4.29 _{bc}
A ₁ B ₂ – 4 grams Garlic	4.29 _{abc}
A ₁ B ₃ – 6 grams Garlic	4.30 _{ab}
A ₂ B ₁ – 2 grams Oregano	4.28 _c
A ₂ B ₂ – 4 grams Oregano	4.30 _{ab}
A ₂ B ₃ – 6 grams Oregano	4.30 _{ab}
A ₃ B ₁ – 2 grams Turmeric	4.30 _{ab}
A ₃ B ₂ – 4 grams Turmeric	4.30 _{ab}
A ₃ B ₃ – 6 grams Turmeric	4.30 _{ab}

Means with the same letter are not significantly different.

Feed Conversion Ratio (FCR)

The redbro chicken which consumes A₁B₁ (given with 2g Garlic) and A₂B₁ (given with 2g Oregano) convert weight (1.42 %) the most efficient with a high significant difference between the redbro chicken of A₃B₃ and A₃B₂ which ranges from 1.56 to 1.57% but comparable with the redbro chicken of A₁B₂, A₁B₃, A₂B₂, A₂B₃, and A₃B₁ spanning from 1.46 to 1.52 %.

The results justify on the findings of Akyildiz and Denli (2016) and Yarru *et al.*, (2009) that the addition of garlic or turmeric powder at 0.5% to chickens' diet, can improve of broiler growth and feed conversion ratio (FCR) and decreased mortality rate. The improvement in yield may be related to the presence of various important alkaloids that have a positive effect on the health of broilers Krauze (2021).

Table 19. Interaction Effects of Different Sources and Levels of NGP on Feed Conversion Ratio of Redbro Chicken.

Sources x Levels of Natural Growth Promotants	Feed Conversion Ratio (FCR)**
C -Control	1.46 _{ab}
A ₁ B ₁ – 2 grams Garlic	1.42 _a
A ₁ B ₂ – 4 grams Garlic	1.50 _{abc}
A ₁ B ₃ – 6 grams Garlic	1.48 _{abc}
A ₂ B ₁ – 2 grams Oregano	1.42 _a
A ₂ B ₂ – 4 grams Oregano	1.51 _{abc}
A ₂ B ₃ – 6 grams Oregano	1.46 _{ab}
A ₃ B ₁ – 2 grams Turmeric	1.52 _{abc}
A ₃ B ₂ – 4 grams Turmeric	1.57 _c
A ₃ B ₃ – 6 grams Turmeric	1.56 _{bc}

Means with the same letter are not significantly different.

Interaction Effects of Different Sources and Levels of NGP on Carcass Traits

Result of the analysis of variance reveals that there are no significant differences between and among the treatments given to the redbro chicken's dressing percentage. The results also agreed by Raguindin (2018) that there is no significant interaction observed on the dressing percentage of broilers as affected by the interaction of different sources and levels on growth promotants. The result is also the same on the findings of Zomrawi, *et al.*, (2012) that there is no significant differences were noted among the broilers fed with varying levels of ginger powder from 0% to 1.5% in the dressing percentage.

Sources and Levels of Natural Growth Promotants for Redbro Chicken

The percent leaf fat of redbro chicken as affected by the interaction of different sources of natural growth promotants at different levels obtained 0.11g. No significant interaction effect was observed. This claim agrees with the findings of Rodriguez (2016), as cited by Aglipay and Rodriguez (2017) that different levels of turmeric powder from 1% to 3% as supplement to broilers significantly lowered the percent leaf fat.

Table 20. Interaction Effects of Different Sources and Levels on Carcass Trait of Redbro Chicken

Sources x Levels of Natural Growth Promotants	Dressing Percentage (ns)	Leaf Percentage (ns)	Fat (ns)	Liver Weight (ns)	Gizzard Weight (ns)
C-Control	73.44	0.11		0.08	0.06
A ₁ B ₁ – 2 grams Garlic	73.22	0.11		0.08	0.06
A ₁ B ₂ – 4 grams Garlic	73.84	0.11		0.08	0.06
A ₁ B ₃ – 6 grams Garlic	73.42	0.11		0.08	0.06
A ₂ B ₁ – 2 grams Oregano	74.73	0.11		0.08	0.06
A ₂ B ₂ – 4 grams Oregano	73.61	0.11		0.08	0.06
A ₂ B ₃ – 6 grams Oregano	72.39	0.11		0.08	0.06
A ₃ B ₁ – 2 grams Turmeric	73.90	0.11		0.08	0.06
A ₃ B ₂ – 4 grams Turmeric	72.22	0.11		0.08	0.06
A ₃ B ₃ – 6 grams Turmeric	72.47	0.11		0.08	0.06

The liver weight of redbro chicken as affected by the interaction of different sources and levels of natural growth promotants obtained 0.08g. Insignificant interaction effect was observed on the liver weight of experimental chicken. This implies that interaction of different sources at different levels of natural growth promotants did not significantly improve the liver weight of redbro chicken.

The gizzard weight of redbro chicken as affected by the interaction of different sources at different levels of natural growth promotants obtained 0.06 g. No significant interaction effect was noted. This implies that the different sources of natural growth promotants at any level (2g, 4g, 6g) did not significantly influence the gizzard weight of redbro chicken. This agrees to the findings of the study of Raguindin (2018) that the broiler fed with different sources and levels of herbal plant meal did not significantly affect the gizzard weight of chicken. Same findings by Hernandez *et al.*, (2004) which states the gizzard weight of the experimental broilers is insignificantly influenced by oregano extracts.

Interaction Effects of Different Sources and Levels of NGP on the Profit above Feed, Medicine and Stock Cost

As observed in the Table 21, the overall mean of the income generated by selling the redbro chicken was Php 542.43. Moreover, a high coefficient of variation (7.77) indicates that the means of income generated by selling the redbro chicken after a 45-day treatment varied. This was indicated by the high significant outcome wherein redbro chicken fed with A₃B₂ (4g Turmeric) gains the highest net income with a mean of Php 637.50 which differed to the redbro chicken fed with A₁B₁, A₁B₃ and A₂B₁ with means ranges from Php 465.17 to Php 509.33.

The result of the study corroborates the findings of Raguindin (2018) that the interaction of the different sources of natural growth promotants and different levels of herbal plant meal significantly affected the profit above feeds, medicines and stock costs.

Table 21. Profit above Feed, Medicine and Stock Cost as Affected by the Interaction of Different Levels of NGP on Redbro Chicken

Sources x Levels of Natural Growth Promotants	Profit (Php)**
C-Control	75.07 _e
A ₁ B ₁ – 2 grams Garlic	77.57 _{de}
A ₁ B ₂ – 4 grams Garlic	92.48 _{abcde}
A ₁ B ₃ – 6 grams Garlic	84.88 _{bcde}
A ₂ B ₁ – 2 grams Oregano	81.23 _{cde}
A ₂ B ₂ – 4 grams Oregano	97.86 _{abcd}
A ₂ B ₃ – 6 grams Oregano	88.25 _{abcde}
A ₃ B ₁ – 2 grams Turmeric	98.23 _{abc}
A ₃ B ₂ – 4 grams Turmeric	106.25 _a
A ₃ B ₃ – 6 grams Turmeric	102.23 _{ab}

Means with the same letter are not significantly different.

Sensory Traits and Acceptability of Steamed Meat Samples

Juiciness. The use of the different treatment combinations, sources of natural plant growth promotants and levels of herbal tea fed to the redbro chicken was observed in table 6. The juiciness acceptability values ranged from 3.67 to 5.00 with an overall response of 4.33 which was appraised as “very much acceptable”. Analysis of variance results reveal that there was no significant differences between and among redbro chicken wherein those that were fed with 4 g Turmeric (A₃B₂) and 6 g Turmeric (A₃B₃) obtains the highest juiciness acceptability score (5.00) which is “very much acceptable”, whereas, redbro chicken fed with 2 mg Oregano (A₂B₁) attains the lowest (3.67) which is “much acceptable” in the Likert Scale. In terms of juiciness acceptability, treatment combinations, A₁B₁, A₁B₂, A₁B₃, A₂B₂, A₂B₃, A₃B₁, garnered a score that ranges from 4.00 to 4.67 which is “very much acceptable”. This may imply that the treatment combinations that were given to the redbro chicken produces juiciness that were comparatively acceptable to the consumers’ panel.

Texture. As presented in table 9, the mean score of the texture acceptability of the treatments fed to the redbro chicken ranges from 4.00 to 4.67 with an overall surface mean of 4.37 evaluated as “very much acceptable”. This suggests that the treatment combinations fed to the redbro chicken did not show any difference wherein those that were given 6 g Garlic (A₁B₃), 6 g Oregano (A₂B₃), 4 g Turmeric (A₂B₃) in a 45-day treatment received a mean score of 4.67 which was described as “very much acceptable”, but redbro chicken fed with 4 g Oregano (A₂B₂) registered the lowest mean score of 4.00 which was evaluated as “much acceptable”. Other Treatment combinations that were introduced to the redbro chicken, 2 g Garlic (A₁B₁), 4 g Garlic (A₁B₂), 2 g Oregano (A₂B₁), 2 g Turmeric (A₃B₁) and 6 g Turmeric (A₃B₃) registered a mean score of 4.33 which

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was appraised as “very much acceptable”. This means that the treatment combinations fed to the redbro chicken has desirable and acceptable texture to the consumers.

Taste. As indicated in the table, the different treatment combinations given to the redbro chicken in a 45-day rearing did not significantly affect the taste acceptability with the highest mean of 5.00 appraised as “very much acceptable” obtained by those fed with 2 g Garlic, 4 g Garlic, 6 g Garlic and 6 g Turmeric. On the other hand, redbro chicken fed with A₂B₂ (4 g Oregano) and A₂B₃ (6 g Oregano) obtained the lowest mean score of 4.00 assessed as “much acceptable”. Other treatment combinations, A₂B₁, A₃B₁ and A₃B₂ had a mean score that ranged from 4.33 to 4.37 which was interpreted as “very much acceptable”. The overall mean responses was 4.60 and was dubbed as “very much acceptable”. This indicates that the taste acceptability as evaluated by the consumers was reasonably acceptable.

Table 22. Sensory traits and acceptability of the steamed meat samples from the different treatment combinations.

Treatments	Juiciness	Texture	Taste	Aroma	General Acceptability
C – Control	3.67 _{ma}	4.00 _{ma}	4.33 _{vma}	3.67 _{ma}	4.00 _{ma}
A ₁ B ₁ -2 g Garlic	4.33 _{vma}	4.33 _{vma}	5.00 _{vma}	5.00 _{vma}	4.67 _{vma}
A ₁ B ₂ -4 g Garlic	4.33 _{vma}	4.33 _{vma}	5.00 _{vma}	5.00 _{vma}	4.33 _{vma}
A ₁ B ₃ -6 g Garlic	4.67 _{vma}	4.67 _{vma}	5.00 _{vma}	5.00 _{vma}	5.00 _{vma}
A ₂ B ₁ -2 g Oregano	3.67 _{ma}	4.33 _{vma}	4.67 _{vma}	4.33 _{ma}	4.00 _{ma}
A ₂ B ₂ -4 g Oregano	4.33 _{vma}	4.00 _{ma}	4.00 _{ma}	4.67 _{ma}	4.33 _{vma}
A ₂ B ₃ -6 g Oregano	4.33 _{vma}	4.67 _{vma}	4.00 _{ma}	4.33 _{ma}	4.67 _{vma}
A ₃ B ₁ -2 g Turmeric	4.00 _{ma}	4.33 _{vma}	4.33 _{vma}	4.00 _{ma}	5.00 _{vma}
A ₃ B ₂ -4 g Turmeric	5.00 _{vma}	4.67 _{vma}	4.67 _{vma}	5.00 _{vma}	4.67 _{vma}
A ₃ B ₃ -6 g Turmeric	5.00 _{vma}	4.33 _{vma}	5.00 _{vma}	5.00 _{vma}	5.00 _{vma}

Legend: 4.1-5.0 - Very much acceptable

3.1-4.0 - Much acceptable

2.1-3.0 - Moderately acceptable

1.1-2.0 - Less acceptable

0.1-1.0 - Unacceptable

Aroma. As presented in the table, the redbro chicken that were tended with the different treatment combinations had a mean which ranges from 4.00 to 5.00 with an overall response mean of 4.60 appraised as “very much acceptable”. Results in the table also disclose that there was a high significant result to the treatment combinations which affected the aroma acceptability wherein A₁B₁, A₁B₂, A₁B₃, A₃B₂ and A₃B₃ obtained the highest mean of 5.00 evaluated as “very much acceptable” but comparable to the redbro chicken of A₂B₁, A₂B₂, A₂B₃ and A₃B₁ which attained means which ranges from 4.00 to 4.67 described as “much acceptable and very much acceptable”, respectively.

General Acceptability. The table reveals that the different treatment concentrations did not significantly affect the general acceptability of the redbro chicken with means that ranges from 4.33 to 5.00 wherein the overall mean of the responses was 4.57. On the other hand, redbro chicken reared with 6 g Garlic, 2 g Turmeric and 6 g Turmeric achieved the highest acceptability with a mean of 5.00 whereas those that were fed with 2 g Oregano registered the lowest acceptability with a mean of 4.00. Other treatment combinations, A₁B₁ (2 g Garlic), A₁B₂ (4 g Garlic), A₂B₂ (4 g Oregano), A₂B₃ (6 g Oregano) and A₃B₂ (4 g Turmeric) attained a mean score which ranges from 4.33 to 4.67. All the mean scores of general acceptability were evaluated as “very much acceptable” which suggests that the outcomes of the exposure of the redbro chicken to the treatment combinations were sensibly acceptable to the consumers.

Other Observations

During the conduct of the study no mortality rate and no incidence of any disease was observed among all the experimental birds. Redbro chicken also showed heavy weight and during the testing of meat samples it was observed that it contains a lot of oils/fats.

During the whole duration of the study, no flies and other insects were attracted to the chicken dung.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was conducted at Mabilbila Sur, Santa, Ilocos Sur from January 12, 2021 to February 28, 2021. The study laid out in a Strip-Split Plot Design. The research design was used to determine the significant difference between sources and levels of natural growth promotants and their interactions on the growth performance, carcass trait, profit and sensory traits. A total of 180 heads day-old chicks were distributed into nine treatments (6 chicken/pen) including one floating control replicated thrice.

The following are the salient findings of the study:

1. The heaviest weight at 21 days, final and gain weights of the redbro chicken was achieved by those fed with Turmeric (A₃) 0.63 kg, 1.55 kgs and 1.47 kgs, respectively. The least amount of consumed feeds were achieved by both A₁ (Garlic) and A₂ (Oregano) with 4.29 kgs. Moreover, the most efficient redbro chicken in converting the feeds they consumed to carcass were seen from those with the lowest FCR such as the redbro chicken given with both A₁ and A₂ with 1.47%. The highest dressing percentage was registered by A₂ with 73.58 %. Leaf fat percentage, liver weight and gizzard weight obtained the same result in all sources with 0.11g, 0.08g and 0.06g, respectively. The highest profit above feed, medicine and stock cost was administered by those received with A₃ with Php 102.24 per redbro chicken.

2. In terms of the levels of herbal plant infusion, the weight at 21 days, final and gain weights was obtained the heaviest by the redbro chicken fed with B₂ (4 g) with 0.66 kg, 1.53 kgs and 1.45 respectively. The least amount of consumed feeds were achieved by B₁ with 4.29 kgs. The most efficient redbro chicken in converting the feeds they consumed to carcass were observed from those with the lowest FCR such as the redbro chicken received with B₁ with 1.45%. The highest dressing percentage was attained by B₁ with 73.95%. The leaf fat percentage, liver weight and gizzard weight obtained the same result in all levels with 0.11g, 0.08g and 0.06g, respectively. The highest profit above feed was administered by those fed with B₂ with Php 99.03 per redbro chicken.

3. The heaviest weight at 21 days and final weight of the redbro chicken was achieved by those fed with A₃B₂ (4 g Turmeric) 0.68 kg and 1.57 kgs, respectively. Heaviest gain weight both fed with A₃B₂ (4 g Turmeric) and A₃B₃ (6 g Turmeric), respectively, with 1.48 kgs. The least amount of consumed feeds were obtained by A₂B₁ (2 g Oregano) with 4.28 kg. Additionally, the most efficient redbro chicken in converting the feeds they consumed to carcass were seen from those with the lowest FCR such as the redbro chicken given with both A₁B₁ (2 g Garlic) and A₂B₁ (2 g

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Oregano) with 1.42%. The highest dressing percentage was gained by A₂B₁ (2 g Oregano) with 74.73%. The leaf fat percentage, liver weight and gizzard weight on the interaction of different sources and different levels of natural growth promotants revealed equal result with 0.11g, 0.08 g and 0.06, respectively. The highest profit above feed was administered by those fed with A₃B₂ (4g Turmeric) with Php 106.25 per redbro chicken.

4. The sensory traits and acceptability of the steamed meat samples from the different treatment combinations in terms of juiciness, texture, taste, aroma and general acceptability with means 4.33, 4.37, 4.60, 4.60, and 4.57 as evaluated by the consumers' panel indicate a "very much acceptable" level.

CONCLUSIONS

Based on the result of the study, the following conclusions were derived:

1. The source of natural growth promotants, in which both Garlic and Oregano are used in the growth performance of redbro chickens increase the efficiency of converting feeds into carcass and higher feed consumption, wherein the latter enable better dressing percentage. However, Turmeric enhances heaviest weight and delivers highest profit.

2. The utilization of 4 grams of natural growth promotants result to better growth performance of redbro chickens such as heaviest weight, highest feed consumed and thus, highest profit. 2 grams revealed the best feed conversion and highest dressing percentage

3. Supplementation with treatment combinations given to the redbro chicken with 4 grams Turmeric gave the heaviest gain weights which result in highest profit above feed at the same time. Lowest leaf fat and dressing percentages attained when supplemented with 4 grams turmeric, but 2 grams Garlic and Oregano were the most efficient feed conversion.

4. The steamed meat samples from the different treatment combinations in terms of juiciness, texture, taste, aroma and general acceptability as evaluated by consumers bear a "very much acceptable".

RECOMMENDATIONS

Based on the conclusions, the following are hereby recommended:

1. The use of Turmeric (A₃) for broiler production is recommended

2. For better growth performance, 4 grams (B₂) of herbal plant infusion is recommended.

3. In terms of treatment combinations, 4 grams Turmeric (A₃B₂) is recommended to achieve and enhance growth performance of redbro.

4. Six grams (A₃B₂) is recommended in terms of acceptability of steamed meat.

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