SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF GRADUATED STUDIES

Evaluation of using Garlic(*Allium sativium*), Ginger (*Zangibir officinal),* Spearmint (*Meanthea spicata*) and Hot Red Pepper (*Capsicum* Fruitcences) Powders in Broiler diets as Natural Growth Promoters.

تقييم استخدام مسحوق نبات الثوم، الجنزبيل، النعناع و الشطة الحمراء الحارة فى علائق الدجاج اللاحم كمحفزات نمو طبيعية

By

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الاستهلال

قال تعالي

(وَلَحْمِ طَيْرٍ مِّمَّا يَشْتَهُونَ)

صدق الله العظيم

سورة الواقعة الآية 21

DEDICATION

To the soul of my father,

To my family.

Huda

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I would firstly like to thank my God for giving me patience and support to complete this study and make it a reality.

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ABSTRACT

Four experiments were conducted to evaluat the response of broiler chicks to diet containing various levels of dietary natural herbs powder which are Garlic (*Allium Satavium*), Ginger (*Zangiber Officinal*), spearmints (*Meanthe Spicatat*) and Hot red pepper (*Capsicium Fruitcences*) as natural growth promoters.

Experiment parameters covered growth performance; slaughter, carcass value, serum metabolite, enzyme activities, electrolytes and economical appraisal. The experimental design used was complete randomize block design. A total of 200, five days old 93 gm initial weight, un sexed Cobb broiler chicks were used in each experiment. Chicks were divided into five groups of 40 birds in each and randomly assigned to five treatment diets, each treatment has four replicates. The first group A, fed on basal diet as Negative control diet,(NC) without antibiotic or natural growth promoter, the second group B, fed diet with antibiotic (Neomycin 16 mg /kg) as positive control (PC), the other groups of chicks C, D, and E were fed basal diet with one of tested herbs, in each experiment at different levels of (1%, 2%and 3%) for garlic (0.25%, 0.5% and 0.75%) for ginger (1, 1.5% and 2%) for spearmint and (0.5%, 1% and 1.5%) for hot red pepper.

The basal diet was formulated to meet the nutrients requirements of broilers according to NRC, (1994). Experimental diets were fed 6 weeks.

The results showed that the addition of all tested herbs at different level improved significantly (P> 0.05) in the body weight gain, and feed conversion ratio compared with NC, while no significant difference were observed among all treatment groups in terms of feed intake. No mortalities were recorded throughout the experimental period.

The results indicate that, the dressing percentage was increased significantly ($p > 0.05$) in bird fed on 1% and 1.5% of hot red pepper compared to those fed the NC, whereas, the differences were not significant among other treatment groups.

No significant differences ($p<0.05$)were observed among the different treatment groups in the percent of, giblets, commercial cuts and their percent of separable tissue and subjective meat quality values (color, juiciness, tenderness and flavor) of broiler chicks.

The abdominal fat values were decreased significantly ($p>0.05$)by the addition of garlic, spearmint and hot red pepper powder in the diets compared to (NC) and (PC) whereas the dietary ginger powder had no significant effects ($p<0.05$) on the abdominal fat.

The results of serum metabolites showed that addition of the tested herbs at different levels in the diets reduced significantly ($p>0.05$) the cholesterol values., while no significant differences were recorded on total protein, glucose and urea values, the treatment effect on electrolytes and enzyme activities was not significant in Ca and P and ALP, were it is lower significant ($p>0.05$) in asaparated amino transefer (AST) in the group fed on natural feed additives compared to NC and PC control.

The results of economical evaluation of experimental diets, showed that the addition of garlic, ginger spearmint hot red pepper at various levels to the diet of broiler caused more net profit compared to NC.

The results of this study showed that use of all tested natural feed additives powder in broiler diets have similar effect on the performance of broilers as that of antibiotics growth promoters without any adverse effects.

المستخلص

تم اجراء اربعة تجارب لتقييم مدى استجابة الدجاج اللاحم للعلائق المحتوية على مستويات مختلفة من مسحوق الاعشاب الطبيعية والتى شملت الثوم، الجنزبيل ، النعناع، الشطة الحمراء. كمحفزات نمو طبيعية .

شملت قياسات التجربة، الاداء الانتاجى، قيم الذبح والذبيحة مئيضات المصل، النشاط الانزيمى والمعادن والتقييم الاقتصادى. صممت كل تجربة باستخدام النظام العشوائى الكامل تم استخدام 200 كتكوت عمر 5 ايام بوزن ابتدائى 93 جرام من سلالة كب غير مجنسة في كل تجربة، تم تقسيمها الي خمس مجموعات احتوت كل مجموعة على 40 كتكوت وزعت على خمسة انواع من المعملات العلفية احتوت كل معاملة على اربع مكررات . المجموعة الاولى (A) تم تغذيتها على العليقة السالبة الخالية من المضاد الحيوي أو احد الاعشاب الطبيعية المختبرة المجموعة التانية B تغذت على العليقة القياسية مع المضاد الحيوي (النيومايسين 16 ملجرام لكل كجم) كعليقة قياسية موجبة اما المجموعات E، D،C فقد تم تغذيتها على احد الاضافات العلفية المختبرة من الاعشاب الطبيعية بالمستويات التالية الثوم (1%، 2 %، 3 %) الزنجبيل (0.25%، 0.5%، 0.75 %) النعناع (1% 1.5% 2%) الشطة الحمراء (0.5% 1% 1.5%) على التوالى تم تكوين العليقة الاساسية لتقابل الاحتياجات الغذائية للدجاج الاحم الصادرة من NRC 1994 تمت التغذية على العلائق التجريبية لمدة ستة اسابيع.

اوضحت النتائج بان اضافة مسحوق كل النباتات المختبرة بالمستويات المختلفة الى العلائق ادت الى تحسين معنوى ($p>0.05$) فى قيم وزن الجسم المكتسب ومعدل التحويل الغذائى مقارنة بالعليقة السالبة بينما لم تلاحظ اى فروقات معنوية بين العلائق المحتوية على الاعشاب والعليقة الموجبة.

دلت النتائج بأن نسبة التصافى قد زادت معنويا ($p>0.5$) وذلك باضافة الشطة الحمراء الى العليقةبنسبة 1% و 1.5% مقارنة بالعليقة القياسية السالبة بينما كانت الفروق غير معنوية بين المجموعات التجريبية الاخرى. لم تلاحظ اى فروق معنوية بين المجموعات التجريبية المختلفة من نسب الاعضاء الداخلية والقطع التجارية ونسبة اللحم بكل منها وقياسات اللحم النطباعية للدجاج اللاحم.

لوحظ انخفاض معنوى($p>0.05$) فى قيم دهن الحشوى وذلك باضافة مسحوق الثوم، النعناع و الشطة الحمراء بالمستويات المختلفة فى العلائق مقارنة بالعليقتين القياسيتين السالبة والموجبة بينما لم تتاثر معنويا باضافة مسحوق الجنزبيل.

اظهرت النتائج الخاصة بمئضات المصل بان اضافة النباتات المختبرة بالمستويات المختلفة ادت الى خفض معنوى($p>0.05$) فى مستويات الكوليسترول معنويا مقارنة بالعليقتين القياسيتين السالبة و الموجبة بينما لم يتم تسجيل اى فروقات معنوية بين المعاملات المختلف($p<0.05$) فى قيم البروتين الكلى واليوريا والجلكوز .لم تظهر المعملات اى تاثير معنوى على النشاط الانزيمي والمعادن بالنسبة لقيم الكالسيوم والفسفور وALP بينما كان هنالك تاثيرها معنوى ($p>0.05$) علي قيم ال AST والتى كانت اقل فى المجموعات المغزاة على الاضافات العلفية الطبيعية بمستوياتها المختلفة مقارنة بمجموعتى العليقة القياسية السالبة والموجبة.

اظهر التقيم الاقتصادى للعلائيق التجريبية بان اضافة مسحوق الثوم، والجنزبيل والنعناع، والشطة الحمراء بجميع المستويات الى العلائق قد احدثت ربحية صافية اعلى مقارنة بالعليقة القياسية السالبة.

اوضحت نتائج هذه الدراسة بان استخدام مسحوق كل الاضافات العلفية الطبيعة المختبرة فى العلائق لها نفس تاثير المضادات الحيوية كمحفزات للنمو فى علائق الدجاج اللاحم بدون تاثيرات جانبية ضارة.

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CHAPTER ONE

INTRODUCTION

Currently, consumers around the world are increasingly more conscious and awareness of the nutritional value and safety of their food and its ingredients. The poultry industry is an important segment of the world's food industry. The production and supply of meat and eggs to meet the people's dietary demand for animal protein is of great concern. Poultry production, particularly broiler production is the quickest way to increase the availability of high quality protein for human consumption to provide the high-quality with low-cost protein requirements of the human population, worldwide broiler quality improvement may be depending on the selected feed ingredient. In poultry nutrition, it is a solid fact that feeding cost is considered the most important item in the whole production process. Therefore, attempts are usually made to reduce feed cost without adversely affecting performance or product safety. As a result, supplementing broiler diets with some feed additives may be considered as an alternative to improve growth and feed conversion efficiency. For many years feed additives have been widely used to increase animals' performance. Antibiotics have been used as a growth promoter for decades and have been shown to improve digestibility, nutrient uptake and inhibit proliferation of pathogenic bacteria by establishing themselves in the gut of poultry animals (Noah, 2001). The World Health Organization (WHO) recently identified antibiotic resistance as a major problem for public health on a global scale. In many countries currently banding usage of synthetic drugs including antibiotics which were used as growth promoters due to their negative side effects on both poultry and human .Many attempts had been made to use natural feed additives such as herbs and edible plants which have some properties as growth enhancers to replace synthetic drugs (Patterson and Burkholder, 2003). It is now well accepted that many medicinal

food herbal products are highly effective promoting host defense mechanisms against microbial and coccidiosis infections, tumors, and oxidative stress (Park *et al*., 2004; Shim 1995)The positive effect of herbal plants on broilers have been reported by many studies, their anti biotical potential, hypo cholestrolemic effects, also it is well known that plant extracts improved the digestibility of the feeds in broilers(Hernandez *et al*., 2004 , and Dieumou, *et al* .2009).

The present study was carried out to evaluate the effect of various levels of dietary Garlic (*Allium Satavium*) Ginger (*Zangiber Officinal*) speirment (*Meanthe Spicatat*) and Hot red pepper (*Capsicium Fruitcences*) as a natural growth promoters on performance, carcass characteristics blood serum metabolites and enzyme activity and economic efficiency.

CHAPTER TWO

LITERATURE REVIEW

2.1 Feed Additive

The diet of animals contains a wide variety of additives. However, in poultry diets, these additives are primarily intended to improve the efficiency of the bird's growth and/or laying capacity, prevent disease and improve feed utilization, they are generally used to improve feed intake and to increase the growth rate in broilers, (Scott *et al*., 1982, Fadlalla *et al*., 2010, and Abouelfetouh *et al*., 2012). In some instances additives are added to the animal's diet in order to enhance their value for human consumption and digestive enzymes production and activities improvement (Lee *et al.*, 2004). Common feed additives used in poultry diets were mentioned by (Tekeli et al. 2006; Lee et al,2004; Samarasinghe *et al*., 2003; Angel *et al*., 2005; Pirgozliev *et al*., 2008; Yang *et al*., 2008). they include antimicrobials, antioxidants, emulsifiers, binders, pH control agents and enzymes. Compared with the synthatic antibiotic or inorganic chemicals, these plant drived products have proven to be as ideal feed additives in animal production food (Hashemi *et al* ., 2008).

2.1.1Growth promoters:

Growth promoters are molecules that are added at low rate to animal feeds without changing considerably their composition. They speed up the growth and consequently increase the body size and weight of animals (Biovet, 2005). Most of broilers industry practioners have been given a growth promoter as additive in ration (Menten *et al.*2001). Their mechanism of action varies. Positive effect can be expressed through better appetite, improved feed conversion, stimulation of the immune system and increased vitality, regulating the intestinal micro-flora, etc. Perić *et al* (2009).

2.1.2Antibiotic:

Antibiotics have long been used to treat illnesses in humans and farm animals. About 50 years ago, the United States Food and Drug Administration (FDA) approved their use in sub therapeutic at low doses in feed to help animals' faster growth, produce more meat and avoid illness. During the last decade, antibiotic resistance by various mechanisms had been increased worldwide in human and animal infectious diseases [Earss, 2005; Harbarth 2005 and W.H.O. 2007) .

2.1.2.1Using antibiotic in animals:

Historically supplementing animal feeds with antimicrobials parallels with the isolation, identification and characterization of vitamin B_{12}. Further research in this area showed that several feed ingredients, including dried mycelia of certain fungi, were more potent as growth promoters in the diet of chicks than using vitamin B_{12} alone. The active component for growth promotion in mycelia fungi was shown to have antimicrobial activity (Jones and Ricke, 2003). In the poultry industry, bacitracin, chlortetracycline, penicillin, tylosin, and virginiamycin are some of the important antibiotics used as growth promoters (McEwen, et. al., 2002). Antibacterial feed additives are also used for controlling *Clostridium perfringens*-associated NCroticenteritis in broilers. However, currently immune prophylaxis is used to control necrotic enteritis in broilers, Feed additives thus share more than simply increasing body weight gain (Lovland *et al*., 2004).

Antibiotics have been shown to improve digestibility, nutrient uptake and inhibit proliferation of pathogenic bacteria by establishing themselves in the gut of poultry animals (Noah, 2001). The mode of action involves modification of the gut micro flora, with consequential benefits in nutrient utilization, (Coates *et al*., 1963; Deman, 1975).

2.1.2.2Ban of antibiotic:

The use of antibiotics as growth promoters in animal nutrition is facing reduced social acceptance due to the appearance of residues and resistant strains of bacteria; Yoshimura *et al*. (2000) pointed that *enterococci* isolated from fecal droppings of chickens on broiler and layer farms were found to be resistant to ampicillin, clindamycin, erythromycin, streptomycin, tetracycline and tylosin. (Schwarz *et al*., 2001) emphasis that the use of antibiotics as feed additives is hazardous due to cross resistance and multiple resistances of pathogens . Livestock are a major reservoir of bacteria resistant to antibiotics. These pathogens contained in animal meet entered human body and quickly spread in human society. Resistant bacteria also spread thanks to the use of manure as natural fertilizer. Such fertilizer, rich in drug-resistant bacteria, contaminated water and soil which had direct contact with grown plants presenting food both for humans and animals. (Witte, 2000). For this reason, the number of kinds of antibiotics approved for use in animal nutrition havebeen consistently limited.also Bent and Jesen, (2004), mentioned that The use of antibiotics however ,has resulted in the development of resistant bacteria which directly or via the meat, could be transferred from the animals to humans. Therefore, European Union has banned the application of most of antibiotics in poultry diets. (Sarica *et al*., 2005; Hernandez *et al*., 2004; Demir *et al*., 2003). This action encourages many investigators to search for alternatives to enhance performance. Patterson and Burkholder, (2003) . Beginning from 1 January 2006, the European Union introduced a total ban on the application of antibiotic growth promoters in feeds for animals bred for consumption Since that time, antibiotics have been allowed to be used as drugs only in medicinal animal feeds or in prophylactic additives (Casewell et al. 2003; Berghmann et al., 2005).

The possibilities to achieve optimum broilers performance and the need to find more efficient alternatives or combinations of different alternatives for

maintaining health and improving performance of poultry have led the producers to search for alternative promoters, in particular with the ban of using the antibiotic growth promoters. (Langhout, 2000; Lee, *et al*., 2003). Herbs could be expected to serve as feed additives due to their suitability and preference, lower cost of production, reduced risk of toxicity, minimum health hazards and environment friendliness (Devegowda, 1996).

2.3. Medicinal Herbs

Aromatic plants have been used since ancient times for their preservative and medicinal properties and to impart aroma and flavor to food. Hippocrates, the 'father of medicine', used plant extracts and prescribed perfume fumigations. For cen-turies, aromatic plants, also known as herbs and spices, their essential oils and herbal extracts have been used as natural pharmaceuticals in traditional medicine and veterinary medicine. However, their use has not been based on rigorous scientific investigation, but has stemmed from ethno veterinary or even folkloric sources (Chang, 2000). Their active principles are chemical compounds present in the entire plant or in specific parts of the plant that confers them therapeutic activity or beneficial effects (Martins *et al*., 2000). These substances have low molecular weight and are derived from the plant secondary metabolism, including glucosides, alkaloids (alcohols, aldehydes, ketones, ethers, esthers, and lactones), phenolic and polyphenolic compounds (quinones, flavones, tannins, and coumarins), terpenoids (mono- and sesquiterpenoids, and steroids), saponins, mucilages, flavonoids, and essential oils (Martins *et al*., 2000) . The antimicrobial activity of plant extracts depend not only on phenolic compounds, but also the property is contributed by the presence of different secondary metabolite like hydroxyl groups on the active constituents. The biologically active constituents of plant extract are considered as antimicrobial agents, because of the ability of these substances to bind to bacterial adhesions and by doing so they disturb the

availability of receptors on the surface (Branter 1996). Windisch, *et al*., (2008).Stated that feed supplements with natural herbs as growth promoting, increased stability of feed and beneficially influence the gastrointestinal ecosystem mostly through inhibition of pathogenic microorganism's growth, as a result health status of digestive system improved, animals are less exposed to the toxins of microbiological origin. Consequently herbs and spices help to increase the resistance of the animals exposed to different stress situations and increase the absorption of essential nutrients, thus improving the growth of the animals.

2.3.1Using Herbs and spices in poultry nutrition:

Herbs and their products including extracts or essential oils are introduced as candidates for use in broiler diets in which their beneficial effects as phytogenic feed additives had been proven (Bolukbasi and Erhan, 2007; Sultan *et al*.,2008 and Dalkiliç *et al.*, 2009). Herbal extracts supplements have also shown to have beneficial effects on carcass and stored meat quality (Cross *et al*., 2007), and improve immune system(Mathivanan *et al*., 2003). The positive effects of herbal supplements on broiler performance, carcass quality and quality traits of meat have been demonstrated, Herbs have been used for natural therapy as pharmaceuticals; (Mikulski *et al*., 2008).

Herbal growth promoters had significant improvement of the body weight, weight gain, feed conversion and lowered mortality rate in broilers. Herbal growth promoter associated with the higher digestibility of nutrients and reduction of *E. coli* and *Clostridium* sp counts. In the intestine and feces of broiler chickens as stated by (Giannenas et al., 2003). Some herbs or herbal extracts can beneficially affect feed intake, secretion of digestive tract juices and immune system of animals (Mikulski *et al*., 2008). Also essential oils which are derived mainly from herbs and spices and their purified compounds have antimicrobial properties (Faleiro *et al*., 2003). Bassett (2000) reported that adding herbal essential oils to the feed or

water increases feed conversion and weight of broiler chickens. Some researchers reported that herb extracts have antibacterial characteristics (Azaz et al., 2002; Dorman and Deans, 2000),They also had antioxidant activity (Botsoglou et al.,2004), and also enhance digestibility by stimulating endogenous enzyme activity and facilitating nitrogen absorption (Gill, 2001).

The product resulted of the use of natural promoters from herbs and spices are of a more favorable acceptance by the consumer. (Griggs and Jacob, 2005; Hanczakawsha *et al.*, 2007; Buchanan *et al*., 2008; Olemedo *et al*., 2009). The most frequently studied plants in animal nutrition today are cinnamon, cloves both appetite and digestion promoters, oregano, which has antimicrobial properties, and red pepper, which has anti diarrheal and anti-inflammatory potential (Kamel, 2001). In previous studies the positive effects of herbal supplements on production performance and carcass quality have been demonstrated by (Tekeli et al., 2006).

2.4 Garlic

Garlic (*Allium sativum*) is common food and spice used in many world cuisines. It is native to central Asia (Ensminger, 1994) and has long been a staple in Mediterranean region(simonetti, 1990), Garlic has been used as a spice and a native medicine since long ago(Rivlin, 2001).

2.4.1 Botanical description:

Perennial, herb with blub divided into segments (cloves), basal liner leaves and erect steam terminated by an umbel with numerous small bulblis between the purplish-white flowers. The flower cluster is enclosed by a sheath (spathe) of papery bracts. The fruits is a capsule with black seeds do not ripen in cultivated plants (Singh and panda, 2005)

2.4.2 Chemical constituent:

Garlic contains hundreds of constituents, with at least 23of them are identified as sulphur compounds. Allicine is one of the most active ingredients, and its break

down produces other sulphur compounds, such as allyl sulphides, ajoenes, oligosulphides and vinyldithiines. It is enzymes content were stated by Sendel, (1995) and Kokh and lwason, (1996), which are Allinaze, perooxidases, myrosinase, catalses, superoxide , dismutase, argniase and lipase. According to results of gas chromatography coupled with mass spectrometry (GM/MS) analysis Dieumou *et al* (2009) found that garlic essential oils contain,1-propene (0.7%), 1-propene, 3, 3- thiobis-sulfide (1.4%), methyl–trans-propenyl-disulfide (1.1%), disulfide, diet-2-propenyl (37%), trisulfide,di-2-propenyl (5.6%) , 2-vinyl-4h1, 3dithiin (0.9%), trisulfide, di-2propenyl (49.6%) anddiallyl tetrsulphide (1.8%) . Other costituantes are proteins e.g.(glutamyle peptides), amino acid, eg argnine, glutamic acid, aspargic acid, methionine therionin, Sendel, (1995)

2.4.3 Medicinal uses

Garlic (*Allium sativum*) is well known as a spice and herbal medicine for the prevention and treatment of a variety of diseases ranging from infections to heart diseases (Javandel , 2008). Bioactive components of garlic like sulfur containing compounds (Alliin, Diallylsulfides and Allicin) may be responsible for some specific characteristics of this plant (Amagase, *et al*, 2001; Agarwal ,1996). It has been indicated that these compounds have antibacterial, anti parasite, and antiviral(Racesi et al., 2010), antioxidant, properties have been documented for garlic in vivo and vitro hence garlic inhibit the formation of free radicals support endjouns readicale scaving mechanisin, inheance cellular antioxidiant enzymes ,(Koch and Lawson, 1996). Some studies, however, suggested that commercial garlic oil, garlic powder and commercially available garlic extract may be hypo cholesterol-lemic (Aporn *et al*, 2008). Also Blumenthal *et al* (2000) stated that, garlic can be used in the treatment of mild hypertension. Garlic exhibits hypolipidemic, antiplatelet, and procirculatory effects. It prevents cold and flu symptoms through immune enhancement and exhibits anticancer and chemopreventive activities (Imai

et al, 1994). Garlic extracts have significant inhibtory effects against microorganisim associated with dental caries Massadeh *et al*.(2006).Other potential health penefets include their anti- inflamatory effect. Further mor their role in prevention and treatment of various cancers were statedBianchini, et.al.,(2001) Garlic powder, as a natural growth promoter can be a potential alternative for common artificial growth promoters like antibiotics and to this respect, it can improve performance and carcass characteristics in broiler chickens (Demir, 2003 ,Lewis,2003).

2.4.4 Using garlic in poultry feeding :

Pourli,et al., (2010) state that when feeding broiler with dietary garlic powder at levels of (0, 0.2, 0.4, 0.6, 0.5 and 1%) better performance was obtained from bird that received 0.2% garlic powder compared to other levels, with no significant differences in carcass yield ,breast, thigh, pancreas and abdominal fat. In addition Fadlalla, *et al.* (2010) found that ratio of 0.3% of garlic resulted in agood rate of growth performance, higher weight gain and better feed conversion ratio were obtained compairing to the controle and other introuduced levels of garlic (0.15, 0.45,0.6%),with no significant differences in serum total protien, albumin and globulin. Also they observed no change in hot or cold dressing percentages of bird that received treatment or control diet. Moreover they decleared that adding garlic powder in broiler diet at levels that mentioned had no significant effects on the color, flavor,tenderness and juicness in the organoleptic tests. While Eugèiuszr and Edyta, (2007) confirmed that 5gm/kg diet of dried garlic contributed to the increase of the sensory assessment of chicken meat. Alhomidan, (2005) studied the effect of using different level and stages of growth ages of *Allium cepa, Allium Sativium* and *Zangebir officinal* he found that at later stage of growth chicks fed with 2% *A.cepa* and *A.Sativium* showed the highest body weight and body weight gains

relative to the control and other treated groups. With highly significant reduction in serum cholesterol and glucose .

Javendel (2008) found that, daily feed intake influences by dietary garlic meal level, thus the birds that had fed diets with 0.125and 0.25% garlic, meal had a significantly higher daily feed intake ($p<0.05$) than the bird fed 0.5% dietary garlic meal, and birds fed with 0.125, 0.25, 0.5 had better feed conversion ratio than the control diet and 2% dietary level of garlic supplement. Although, no significant differences were observed in carcass percentage and interior organs weight between birds fed experimental diets.

(Onyimonyi , *et al*.2012) evaluated the growth of birds that fed with garlic meal in differend levels 0.25, 0.5,0.75 their results showed that bird fed 0.57 garlic powder had sgnificantly higher averag body weight , average daily gaine and feedcost/kg , with reduece drastically the level of cholestrol. Fayed , *et al*. (2011) reported that, the use of garlic 500mg/kg showed more increase in live weight and observed slight increase in dressing percentage of the birds as compared to non-supplemented and 1000 mg/kg. Although, all organ weights (heart ,liver, and gizzard) and carcass characteristics were not affected by the treatments. Similar findings observed by Dieumou, *et al* (2009) evaluated the effect of garlic organic extract (40, 60 ppm) and Streptomycin Sulphate (30ppm) on growth performance and carcass characteristics of broilers , they found that the values of daily feed intake , daily weight gain and feed conversion ratio among birds on supplemented diets were statistically similar, but were all significantly higher ($P<0.05$) than those obtained from birds fed on the basal diet also significantly increasing in dressing percentage ,heart and liver percentage of bird that fed garlic extraction than those bird fed with streptomycin or basal diet. In their study the treated bird with garlic extract showed decreasing values in abdominal fat

Rahimi, *et al.*, (2011) reported that, 0.1% aqueous extract of Garlic (*Allium sativum*) significantly reduced the serum levels of total cholesterol, low density cholesterol**.** with no significant difference in relative weight of carcass, fat pad, or digestive organs among treatments except for the small intestine, their results showed that Virginiamycin treatment presented lower small intestinal weight than that in the other of 0.1% dose of either garlic (*Allium sativum*),thyme (*Thymus vulgaris*), coneflower (*Echinacea purpurea*), or a blend of the three extracts in the drinking water**.**

2.5 Ginger

Ginger *(Zingiber officinale)* is a perennial plant .Ginger rhizome (ginger root) is widely used as a spice or condiment(Larsen et al., 1999) and medical treatment for certain diseases (Mohd-Yusof et al.,2002; Tapsell et al., 2006). Ginger well grows in the tropics, Jamica, India, China, Thaiand,Mexico , Australia, and Nigeria are famous producing countries (Kuhn and Winston 2000)

2.5. 1 Botanical description

Ginger is, spice crop where the underground rhizome is used (Das. 2006). It is an erect perennial herb with thick rhizomes underground and stems that grow 2 to 4intioes tall. Linear lanceolate leaves are 6 to 12 long. Grows in the tropics, (Kuhn and Winston 2000)

2.5.2 Chemical constituents:

Ginger possesses a mixed composition of volatile oil zingerone, shogaols and gingerols. (Ademola *et al*., 2004). Dieumou,(2009) stated that the result obtained by gas chromatography coupled with mass spectrometry analysis of the oils were as follow α-pinene 4.1 camphene 11.9, 2-β-pinene 0.3, 6-methyl-5-hepten-2-one1.1, B-myrcene 1.7, 1-phellandrene 0.6, sabinene 12.0, 1,8-cineole 5.3, α-terpinolene 0.4, citronellal0.4, endo-borneol 1.9, β-fenchyl alcohol 0.8, 6-octen-1-ol, 3,7-dimethyl 0.9 2-nonanone 0.6, α-terpinolene 1.7, citronellal 0.4, endo-

borneol 1.9, z-citral 8.2, Geraniol 2.6, geranial 10.0, 2-undecanone 0.8, citronellyl acetate 0.3, ar-curcumene 2.5, germacrene 0.8, zingiberene 14.0, farnesene 4.4, β-bisabolene 2.6, β-sesquiphellandrene 4.8, alfa-pipine 4.1, camphene 11.9, Other constituents were demonstrated by(Blumenthal, 2000) are amino acids (e.g. arginine aspartic acide, cystin,glysine , isolucine, lucine serine therionine and valine) protein about 9% , vitamins especially nicotinc acide (niacin)and vitamine A.

2.5.3 Medicinal uses

Powdered rhizome of ginger has long been used to alleviate the symptoms of gastrointestinal illnesses as folk medicine (Afzal *et al*., 2001). gingers' medicinal properties are contained in the chemicals responsible for the taste. The most noteworthy being gingerol and shogaol. (Chrubasik et al. 2005) enzyme (Zingibain) found in ginger is believed to improve digestion as well as killing parasites and their eggs. Ginger contains about 12 antioxidant constituents, the combined actions of which have been regarded to be more powerful than vitamin C (Herbs Hands Healing 2011). Many researchers were stated that ginger has many therapeutic attributes such as antimicrobial, antithrombotic, anti-inflammatory and anticancer activity. Ginger has also demonstrated to be antimutagenic, inducers of detoxification,and preventers of DNA damage *in vitro* (Ackermann *et al*., 2001; Ohaeri and Adoga,(2006). The hypolipidemic action of ginger supplementation can be used to lower risk factor of the cardiovascular diseases and cancer either in animals or human (Ademola *et al*., 2009**).**

2.5.5 Using ginger in poultry diets:

Fakhim *et al* (2013) investigated the effects of using different concentrations of ginger extract (0, 0.25, 0.5, 0.75 and 1%) supplemented to drinking water, on performance and carcass characteristics of male broiler chickens. Bird as influenced by dietary inclusion levels of aqueous extract of ginger supplemented to

drinking water their results showed that no significant differences in feed consumption and live weight between treatment groups, also no significant differences were observed between the treatment groups in abdominal fat percentage, carcass commercial cuts percentage and liver percentage. Although carcass yield was higher in 0.75% supplemented groups than 0.25%, 0.5%, and1 % . Arkan *et al* (2012) investigated the effect of ginger at level of (0.1 and 0.2) in broiler performance, from three week of age until six week of age they found that there were significantly improvement in body weight gain, and feed conversion ratio at 5^{th} and 6^{th} week of age. While significantly decreases in serum glucose and cholesterol, were observed with no significant differences found in serum total protein.

Zhange et al. (2009) studied feeding processed particle size of 300, 149, 74, and 8.4 μm dried ginger root to the broiler chickens at level of 5g/kg of diet results indicated that overall growth of birds was not significantly affected by the addition of ginger. However, body weight, and average daily gain of birds supplemented with ginger were numerically higher than that of control birds during the grower phase in other hand the inclusion of ginger in the diet increased the carcass yield of broilers; they also found that including of ginger in 74 μm reducing cholesterol in 21 and 42 day of age, and a slightly lower abdominal fat content compared with the control.

Al-Homidan (2005) observed that broiler chicks fed with basal diet containing 6% of ginger had low feed consumption comparing to the control group at later stage of growth (4-7 week) while no significant differences were observed on the group feed in the 2% ginger, consequently this was lead to superiority in final body weight with bird that fed 2% ginger. Rafiee et al (2014) reported that , feed intake and body weight gain increased significantly when ginger and cinnamon introduced at level of 0.2% and 0.2% respectively comparison to control

(P<0.05).no significant differences were observed on dressing percentage when ginger used in 0.2% whilst highly reduction in abdominal fat and a little reduction in gizzard were observed. Also they observed that increasing in liver and heart percentage was occurred comparing with control. In addition they observed that the cholesterol level was decreased significantly in experimental groups compared to control. No change observed in concentration of Ca^{++} in ginger bird fed group while P^{++} concentration decreased significantly in both treated groups.

Barazesh *et al* (2013) studied the effect of ginger powder at level of 0.5, 1and1.5 % on performance, carcass characteristics and blood parameters of broiler chicks they reported that, all chickens were apparently healthy and mortality was not significant in the whole course of the experiment. Birds treated with ginger powder at all levels showed no significant differences in feed intake, body weight gain and feed conversion ratio. Ginger powder at level 1.5% had the lowest abdominal fat percentage; also they observed that, adding ginger powder at all levels had no effect on breast, liver, spleen percentages. Although, increasing ginger level decreased significantly glucose, and LDL percentage. Kehinde *et al.* (2011) evaluated the effect of graded level 0, 1.5, 3.0,and 4.5% of ginger in the diet of cockerel chicks on growth performance, haematological and serum biochemical parameters for seven week, their result elicited that no advers effect among treatments on feed intake, weight gaain, feed conversion ratio, hemoglobin count, weight blood cell count and urea. Zomrawi, (2013) stated that, dietary inclusion of ginger root powder at level 0.5% lower feed intake while, no significant differences between control and levels of inclusion of 1 % and 1.5%. Also she found that no differences between treatment in meat quality, meat PH, and meat color. Whereas, the bird fed 1.5% ginger root powder diet received higher percentage of tenderness and juiciness.

2.6 Spearmint (*Mentha* spicata):

The genus Mentha includes 25–30 species that grow in the temperate regions of Eurasia, Australia and South Africa. The mint species have a great importance, both medicinal and commercially**. (**Hadjlaoui, *et al* .2009) In northern African, countries and in Sudan spearmint is known by the name Elnana Elbaladi (Bbashir, 2000). The leaf, fresh or dried, is the culinary source of spearmint. Fresh spearmint is usually preferred over dried spearmint. (Grieve, 1981, Chopra *et al*., 1992).

2.6.2 Botanical description:

It is a herbaceous rhizomatous perennial plant growing up to 30–100 cm, with variably hairless to hairy stem and foliage, and a wide-spreading fleshy underground rhizome. The leaves are 5–9 cm long and 1.5–3 cm broad, with a serrated margin. The stem is square-shaped, a trademark of the mint family of herbs. Spearmint produces flowers in slender spikes, each flower pink or white, 2.5–3 mm long and broad (Blamey, *et al*., 1989; Huxley, 1992) the name spearmint is applied to several species and varieties of genus menthe spicata, menthe vivdis and meantha gentils possing a distinct odor to high carvone content (Guenther, 1949)

2.6.3 Chemical constituent of spearmint:

Chemical analysis revealed that the major components eosin isolated from spearmint were, carvone, piperitene oxide, pipritone, caryphllene germacrene, limonene and trans- piperitone (Nori-Shargh *et al.,* 2000; Monfared *et al.,* 2002, and Rasooli and Rezaei, 2002). Also it contains vitamin A, riboflavin and vitamin C, and it is rich in mineral it also contain about 300mg/100, Ca 7.7 Mg /100 on wet weight basis. In the leaf essential oil of *Mentha spicata*, as separated by GCMS, 44 compounds were elucidated. The major component was carvone (59.40%), other components present in appreciable contents were: limonène

(6.12%), 1,8-cinéol, germacrène-D (04.66%), β-caryophyllène (2.969 %), β-bourbonène (2.796 %), α-terpinéol (1.986 %) , Terpinéne-4-ol (1.120%). (Habiba Boukhebti, 2011). The specific essential oils constituent of spearmint were also demonstrated by Amal , (2012), as follows beta-pinen 1.09%, beta- myreen 1.32% D- Limonine 34.48%, Eucalyptol 3.63%, 2 – Cychloexen – 1-one 2- methyl 1-5-(1-m) 57.98%, Bicyclo (4.3.0) non -3-ene, 3,4-dimethy 0.45%, and Cyclobutal (1,2 : 3,4) dicyclopentene,dec 0.52%.

2.6.3 Medicinal uses:

The family of Labiate, which are rich in essential oil have commercial and medical values. They are widespread through the world, that are widely used in food, flavor, cosmetic and pharmaceutical industries and its traditionally known for its medicinal and flavoring uses. (Bbashir, 2000; Savithri , *et al*., 2002). Spearmint essential oil is extensively used as flavorings in breath fresheners, drinks, antiseptic mouth rinses, toothpaste, chewing gum (Colby *et al*.1993;Grieve, 1981, Chopra *et al*., 1992). Mint is usually taken after a meal for its ability to reduce indigestion and colonic spasms by reducing the gastrocholic reflux (Spirling and Daniels, 2001). In addition, *Mentha spp.* has been used as a folk remedy for treatment of nausea, bronchitis, flatulence, anorexia, ulcerative

colitis, and liver complaints due to its ant inflammatory, carminative, antiemetic, diaphoretic, antispasmodic, analgesic, stimulant, emmenagogue, and anticatharrhal activities**.** Hadjlaoui, *et al*. (2009). Padmini, *et al* (2010), stated that, spearmint extract possessed greater antibacterial effect against *S. typhi and P. aeruginosa***.** Also Rastogi and Mehrotra, (1998) reported that in addition to the excellent antimicrobial menthe spicata possess property of antifungal, antiviral, antioxidant, and anti- hemolytic .

2.6.4 Using spearmint in poultry diets:

Bushra (2011) found that addition of spearmint in 1, 1.5 and 2% in broiler diet showed no significant differences in feed consumption, feed conversion ratio, and body weight gain although bird fed with level 1.5 have the best performance in the term of total body weight gain, total feed intake . although dressing percentage for the three treatments received addition of spearmint at 1, 1.5 , and 2% were found to be 74.17%, 73.08% and 73.47% respectively, The dressing percentage was not significantly differences (P>0.05)

Howida, (2009), also stated that the birds fed, with 1.5% spearmint were compromised the best total weight gain, feed conversion ratio, dressing percentage and feeding economic. Amal *et al* (2013) evaluated the effect of addition of various levels of spearmint essential oil as a natural growth promoter, her results showed significantly improvement in feed intake, body weight gain and feed conversion ratio with no significant (p>0.05) differences between all treatments groups in weight of carcass cuts, dressing percentage, non carcass components meat chemical composition and subjective meat values. In addition she found that all levels of spearmint oil at 50,100 and 150 mg/Kg added to broiler diets significantly increased feed intake, body weight gain and feed conversion ratio. Also her results showed that groups treated with100 mg/Kgand 150 recorded the highest profitability ratio (1.12), (1.14) respectively. Fallah, (2013) studied the effect of addition menthe extract (*Mentha piperita*) and artichoke (*Cynara Scolymus L.*) on immune cells and blood biochemical parameters of broilers. Their result show that treatment groups with 1.5% artichoke leaves meal in diet +200mg/kg menthe extract in drinking water. showed that significantly decreased amount of cholesterol and triglyceride were observed by all treated group compared to the control group, with no change in serum urea, total protein and

glucose level. Galib, *et al*., (2010) studied the performance of broiler fed diets supplemented with dry pepper mint (*Menthe piperita* L.). At levels of 0.00%, 0.25%, 0.5%, 1.0% and 1.5% incorporated into the basal diet for six weeks. The results appeared improvement in performance traits for all tested groups compared to the control group. Jafari *et al* (2011) found that addition of spearmint *(Mentha spicata)* extract on drinking water of laying hen resulted in, increase in eggs weight and improve in the feed conversion ratio of bird treated with 200ppm and 250 ppm spearmint extract. Shahram *et al* (2012) evaluated the effects of *Mentha spicata* extract and an antibiotic –virginiamycin- on the immune system, blood factors, no significant influence of experimental diets on triglyceride.

2.7 Hot Red pepper *(Capsicum frutescens)*

The fruit of Capsicum plants have a variety of names depending on place and type. The piquant (spicy) variety are commonly called chili peppers in Britin and the states, or simply "chilies". The large mild form is called red pepper, (Cromie, 2006), green pepper or bell pepper in North America and Britain and typically "capsicum" in New Zealand, (Latham and Elizabeth, 2013).

2.7.1 Botanical description:

Hot red pepper (*Capsicum frutescens)* is an annual or short-lived perennial herb, the stem of is almost striate, glabrous, and highest between 1-4 feet depending on climate and growing conditions. The leaves are elliptical, slightly leathery, dark green and smooth, and measure about 2½ inches long and 1 inches in width. The flowers are typically conical or funnel form with five petals, usually white in color. The fruits are erect, ellipsoid-conical to lanceoloid, about 10-20 mm long, 3-7 mm in diameter. These fruits have range in color from green when immature to purple, red, orange or yellow when riped (AbdulGani, 2003; Kirtikar, 1980).

2.7.2 Chemical constituent:

Capsaicin (CAP) is the main capsaicinod in chilli peppers. CAP is stable in water and some animal studies indicated that it absorbed into blood stream (Diepvens, 2007). Commonly, their hot sensory taste is due to capsaicinoids which is the major group of organic compounds that closely related to the alkaloids, and are known to be biosynthesized and accumulated in the placenta of capsicum fruits (Pruthi, 1976; Tapia *et al*., 1993).

The major capsaicinoids present in most varieties of the chilli pepper are capsaicin (tran-8-methyl-N-vanillyl-6-nonenamide)and dihydrocapsaicin (8-methyl-N-vanillylnonanamide). in addition, other minor ones are also found such as nordihydrocapsaicin, norcapsaicin, homocapsaicin, nornorcapsaicin, nornornorcapsaicin and nonivamide *(Barbero et al., 2006).*

A few compounds had been isolated from *C. frutescens* like ester, terpenoids, noncarotenoids, lipoxygenase derivatives, carbonyls, alcohols, hydrocarbons 8, capsaicin, dihydrocapsaicin 4, capsiconinoid 11, capsinoid 9.(Rodríguez et al 2010) The amount of capsaicin in the fruit of Capsicums is highly variable and dependent on genetics and environment, ,(Singh *et al*, 2009)

Previous studies conducted mentioed that secondary metabolites like alkaloids, flavonoids, quinones, terpenoids and saponins were concentrated in both leaf and fruit extracts However, It has been reported that phenolic compounds have a wide antimicrobial spectrum (Dorman and Deans, 2000; and Elgayyar *et al*., 2001).The red hot pepper contains 14-12% crud protein,23% crude fiber, 15.19% crude fat, 7.48% ash and 31,87% total soluble sugars(EL-Aidy 1981), Ozer (2006) reported that hot pepper is good source of vitamin C(128 mg/100g)and Niacin(0,5%)with modrate content of vitamin A.

2.7.3 Medicinal using:

Pepper Species, commonly used in diet and traditional medicine, were assessed for their anti-oxidant potential. Red hot pepper comes from fruits in the capsicum

family. It is rich in vitamin C and pro-vitamin A (B- in particular). It is very high in potassium, magnesium and iron. The substances that give hot peppers their heat is capsaicin and several related chemicals collectively called capsinoids (Boyunaga ,1995 ; El Husseiny 2002) .capsaicin has been used in neurological research to stimulate sensory nerves and also to treat bladder inflammation. It is also found in topical ointments used for arthritis and neuralgia (Kaale *et al*., 2002), capsinoids includes antimicrobial activities, exhibited protective effects against mutagens and carcinogens, cholesterol obesity and pains (Suk-Hyun Choi *et al*., 2006). Curtis *et al*. (2004) suggested that among the different plant extracts screened, those from *Allium* and *Capsicum* sp. Showed high levels of antimicrobial activity towards plant pathogens, a novel saponin, from *Capsicum frutescens*, has shown antifungal activities against several fungi. (De Lucca *et al*., 2006).

2.7.4 Using hot red pepper in poultry diets:

Awad-ELkareem, (2007) found that addition of 1.5% hot red pepper improving body weight gain and feed efficiency comparing with the levels of 1% and 2% . Although there was no significant differences in dressing percentage was observed. Al-Kassie et al (20 10) investigate the efficiency of utilization fed supplemented with hot red pepper (Hrp) *Capsicum Annum* at the rate of (0.00%, 0.25%, 0.50%, 0.75%) and 1%to broiler on the productive performance, results showed that inclusion of hot red pepper in the diet improved body weight gain, feed consumption and feed conversion, and they observed significantly decreases in cholesterol and glucose. EL-Husseiny *et al*. (2002) conducted two experiments to study the effect of feeding broiler chicks on diets containing various levels (1,1.5 and 2%) of local natural feed additives (hot pepper and fenugreek seed) at different levels of metabolizable energy (3200, 3000 and 2800), their result indicated that chicks fed with hot pepper diets had significantly ($P<0.01$) higher in dressing percentages in addition, they had demonstrated that the addition of hot

pepper to broiler diets was decreased significantly (P<0.01) the abdominal fat authors were demonstrated that hot pepper at levels of 1, 1.5and 2% were reduced the total lipid's, cholesterol and glucose levels of the broiler plasma. Shahverdi *et al* (2013) studied the effects of added broiler feed with 0.02% red pepper, 0.02% black pepper and 0.01% red pepper + 0.01 %black pepper powders. Their result revealed that the inclusion of red and black pepper in broilers diet. significantly increase liver percentage were, They found that all bird treated with the experimental diets showed less amount in abdominal fat percentage significantly (p<0.05) compared to the control group. Their results showed that percentage of gizzard and spleen weight was higher in the 0.01% red pepper + 0.01%black pepper groups and it was at the lowest in control groups (p<0.05). in addition they stated that resulted the inclusion of red and black pepper in broilers diet depressed the cholesterol, triglyceride and glucose concentration (p<0.05).mucosa and sub mucosa of small intestine were significantly increased (p<0.05),but muscular and serosa were higher in the level of 0.02% red pepper, and the mixture of 0.01% red pepper + 0.01 %black pepper. Data from this study showed usage of red and black pepper powder mixture on broilers diets had increased the total amount of the small intestine parts (p<0.05). Aderemi *et al* (2013)reported that feeding old layer with hot red pepper and garlic as natural feed additive resulted in improved of egg production, weight of egg and interior quality, no significant differences were seen in total protein and urea or enzyme activity. They also observed reduction in serum glucose and cholesterol. (Hermogenes, *et. al*. 2011) evaluated the effect of diets supplemented with *Cspsicium frutescens* on chicken laying performance and egg quality, at concentration levels of 0.5, 1.0, 1.5 and 2.0% .Their findings revealed that inclusion level of 1.5 and 2.0 percent of *Cspsicium frutescens powder* in the layer diets gave significant reduction significantly ($P < 0.05$) of layers feed consumption and feed conversion ratio. However, egg weight, yolk color intensity

and shell thickness did not affect ($P > 0.05$) by treated diets. All red pepper powder treatments were successfully in maintained a higher egg yolk color score than that observed for birds fed with the basal diet for at least eight days. Meanwhile, mortality rate was not affected an indication of less incidence of deaths among treatments during the period of the experiment.

CHAPTER THREE

MATERIALS AND METHODS

Four experiment testing four type of natural herbs as feed additive, Garlic (Allium satavium), Ginger (Zangabber Officinal),Spearmint(Mentha Spicata) and Hot pepper (Caspcicum Fruitcense) of different levels, in broiler rations.

3.1 Experiment (1) response of broiler chicks to different dietary levels of garlic:

This experiment was conducted during (5 of June to 7July 2012) the ambiented temperature was controlled as the housing system was the semi intensive system it was 20 – 26 c (appendix 1) during the experiment period (6 weeks).

3.1.1 Experiment chicks

A total number of 200 one day old commercial unsexed broilers of cob strain were obtain from (Enmaa Breeder Company – Sudan) and transported to student poultry premises, college of Agricultural Studies, Sudan University of Science and Technology, Shambat. All chicks were with an average initial weight (93g) five day old chicks. The chicks were adapted to the premises and feed over (5days) before the start of experimental period. The chicks were then allotted randomly to five groups A, B, C, D, and E of four replicates with ten chicks arrangement. Chicks were bought vaccinated against Mareks with on – farm vaccinated against Gumboro disease at (11) days of age and Newcastle at (22) days of age, soluble multivitamin compounds (pantominovite – pantex Holand and B.V. 5525 ZG Duizel Holand), given to the chicks before three days of the vaccination in order to guard stress.

3.1.2 Housing:

The experimental house in which the chicks were kept was semi closed with east – west direction. The housing dimensions were 25 m. length, 8.8 m. width and 3.05

m height. The roof ceiling was made of trapezoid corrugated aluminum sheet and was insulated of (100mm) glass wool with thermal conductivity of (0.04 w/m^2) The walls of the house on the northern and southern sides were built from red blocks raised high to the level of 0.69 m. the house was equipped with adjustable side wall curtains to control the flow of air into the house. The top and bottom of the curtain opening was equipped with a curtain rod to minimized draft when fully closed. The floor was concrete.

Mechanical ventilation system was used in the house to generate on one direction air flow to provide the required levels of uniformity of air distribution over wide range of climatic condition. Two exhaust fan (fan diameter 1.29 with air 44500 m^2 / h).The house have two exhaust fan, Positioned in the middle of the western side wall were to maintain negative pressure inside the house as a result of negative pressure outside air flows into the house through inlet opening with cellulose pad besides maintaining the desired temperature and ventilations inside also an outlet on the roof was required to exit surplus heat, gases, moisture and supply fresh air

Cooling system was evaporative cooling panel comportment , the cooling pad banks dimensions were (4 m. long × 1.4 m. length × 0.15 width) and that of air inlet valve was 0.45 m. the cooling pad was situated of the at two sides , north and south direction at the rear of the poultry house.

Cooling pad was made of specially impregnated cellulose paper of wait ability, arranged in self supporting structure that guaranteed long life without sagging or deterioration

The other integral components provided with each pad cooling bank were pump, polyester, water tank capacity (1000 liters). For storage of water which was continuously supplied from main tap water under control of flouter which was put

in the tank also there was one horse power electrical motor for pumping water from the tank to the top of pad cooling banks.

There was piping system for supply and return of water, the cooling and humidification of outside air is obtain by evaporation of very fine water particles.

Due to negative pressure maintained by the exhaust fans air flow through the pad and then through special air inlet to the house. Special geometry of the pads enables the air to pass through small opening or flutes in turbulent state .thus creating ideal condition for maximum evaporation and consequently maximum cooling to take place as a result of the layer contact area between water and air (excess water is returned to the bank where it is pumped to the top edge of the pad for r-circulation. The temperature inside the house was maintained at 27-30c throughout the experimental period.

Experiments 20 pens (1.5 × 1 m.) were prepared using wire mesh portioned and then were cleaned washed and disinfected by formalin and white phenol solution.

Before start the experiment allayer of wood shairy (5cm) thick was laid on the floor as littler material. Each pen was provided by (5 kg) rounded feeder and (2.5 lit.) baby drinker which were adjusted to the progressive growth of chicks.

The light program was 24 hours light from 1-3 days and 23 hours day for the rest period

3.1.3 Experiment ration:

Garlic used in this experiment was purchased from Baharri market Kartoum state the outer shell was removed and culves were dried under sun then grind, the chicks were fed 5 dietary treatments, the first group A, fed on based diet,(negative control) without antibiotic or any growth promoter, the second group B fed on basal diet containing an antibiotic as chemical growth promoter, Neomycine 16mg/kg (positive control). The other groups, C, D, and E were fed on the basal

diet supplemented with diatery garlic as a natural growth promoter, at levels of 1%, 2%, and 3% respectively. The basal diet was formulated to meet the nutrient requirements of broiler chicks according to Nutritional Research Council (NRC, 1994).

The ingredients percent composition and the calculated chemical analysis of the experiment diet were presented in table (1) and (2). Experiment diets were fed for 6 weeks.

Table (1) the ingredients percent composition and the calculated chemical analysis of the Garlic experimental diets.

Ingredient%	**A**	**B**	**C**	**D**	**E**
Sorghum fetarita	64	64	64	64	64
Ground nut cake	28.61	28.61	28.61	28.61	28.61
Wheat Brand	1	1	1	1	1
Concentrate*	5	5	5	5	5
Dicalcium phosphate.	0.5	0.5	0.5	0.5	0.5
Oyster shell	0.5	0.5	0.5	0.5	0.5
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.14	0.14	0.14	0.14	0.14
Total	100	100	100	100	100
Antibiotic (Neomycin) Mg/kg	-	16	-	-	-
Garlic	-	-	1	2	3

*crude protein 40; crud fiber; calcium; phosphorus (aval) lysine methionine met +sys 3.20 met energy 2100 kcal; Sodium2.60 product vit. A:200.000I.U/Kg; vit E :500Mg/Kg; vit B1: 15Mg/Kg; vitB2: 100 Mg/Kg; vit B620Mg/Kg ;vit B12 300Mg /Kg; Biotin:1.000mg/kg; Nicotinicacid: 600mg/kg; Folicacid : 10mg/kg; vit K30mg/kg ;pantothenic acid: 150mg/kg; choline chloride: 5.000mg/kg; copper 100mg/kg; iodine 15mg/kg Cobalt :3mg/kg; selenium: 2mg/kg; manganese: 1200mg; zine; 800mg/kg; iron1.000mg/kg; B.H.T.: 900MG/KG; Salinomycin-Na;1.200.

Table (2) Calculated chemical analysis of Garlic experimental Diet

Ingredient%	**A**	**B**	**C**	**D**	**E**
Dry matter	89.20	89.20	89.20	89.20	89.20
Crud protein	23.10	23.10	23.10	23.10	23.10
Crud fiber	4.44	4.44	4.44	4.44	4.44
Ether extract	3.9	3.9	3.9	3.9	3.9
Ash	4.60	4.60	4.60	4.60	4.60
Nitrogen free extract	63.96	63.96	63.96	63.96	63.96
Calcium	0.91	0.91	0.91	0.91	0.91
Total phosphorous	0.70	0.70	0.70	0.70	0.70
Available phosphous	0.50	0.50	0.50	0.50	0.50
M.E.Kcal/kg	3102.84	3102.84	3102.84	3102.84	3102.84

Calculated according to (ELLis, 1981;Kuku Bulletin)

3.1.4 Data collected

3.1.4.1 Performance data

Average body weight gain, feed consumption (g) and feed conversion ratio for each group were determined weekly throughout experimental period. Health of the experimental stock was closely observed.

3.1.4.2 Slaughter procedure and data:

At the end of the 6^{th} week birds were fasted overnight with only water allowed. Birds were weighed individually before slaughter by severing the right and left carotid and jugular vessels, trachea and esophagus. After bleeding they were scalded in hot water, hand plucked and washed. Head was removed closed to skull, feet and shanks were removed at the hock joint. Evisceration was accomplished by posterior ventral cut to completely remove the visceral organs. Hot carcass and each evisceration have the liver heart , gizzard abdominal fat and intestine was separately weighed.

3.1.4.2 Carcass data:

The hot carcass was prepared for analysis by removal of the skin and neck near to the body and each was weighed separately. The carcass was then divided in to wright and left sides by mid sawing along the vertebral column and each side was weighed. The left side was divided in to three commercial cuts, breast, drumstick and thigh each cuts was weighed separately, then they were deboned, the meat and bone were weighed separately. The meat was frozen and stored for further analysis.

3.1.4.3 Blood serum profile

Blood samples withdrawal from jugular veins. Serum prepared from the blood analyzed for concentration of metabolites total protein, cholesterol, glucose, urea, enzyme activities ALP, AST and mineral (Ca, P)

3.2 **Experiment (2) response of broiler chicks to different dietary level of ginger:**

This experiment was conducted during (5 of June to 7July 2012) the ambient temperature was controlled as the housing system was the semi intensive system it was 20 – 34 c (appendex 1) during the experiment period (6 weeks).

3.2.1Experiment chicks

A total number of 200 one day old commercial unsexed broilers of cob strain were obtain from (Enmaa Breeder Company – Sudan) and transported to student poultry premises, College of Agricultural Studies, Sudan University of science and Technology, Shambat. All chicks were with an average initial weight (93g) five day old chicks. The chicks were adapted to the premises and feed over (5days) before the start of experimental period. The chicks were then allotted randomly to five groups A, B, C, E, and E of four replicates with seven chicks arrangement. Chicks were bought vaccinated against Mareks with on – farm vaccinated against Gumboro disease at (11) days of age and Newcastle at (22) days of age, soluble multivitamin compounds (pantominovite – pantex Holand and B. V. 5525 ZG Duizel Holand), givento the chicks before three days of the vaccination in order to guard stress.

3.2.2Housing:

The house was in the as same as described in the first experiment

3.2.3 Experiment ration:

Ginger used in this experiment was purchased from Baharri market Kartoum state and grind, the chicks were fed 5 dietary treatments, the first group A, fed on based diet, (negative control) without antibiotic or any growth promoter ,the second group B fed on basal diet containing an antibiotic as chemical growth promoter, Neomycine 16mg/kg (positive control). The other groups, C, D, and E were fed on

the basal diet supplemented with with diatery ginger as a natural growth promoter, at levels of 0.25%, 0.5%, and 0.57% respectively. The basal diet was formulated to meet the nutrient requirements of broiler chicks according to Nutritonal Research Council (NRC, 1994).

The ingredients percent composition and the calculated chemical analysis of the experiment diet were presented in table (3) and (4). Experiment diet were fed for 6 weeks.

Table (3) The ingredients percent composition and the calculated chemical analysis of the experimental diets.

Ingredient%	**A**	**B**	**C**	**D**	**E**
Sorghum fetarita	64	64	64	64	64
Ground nut cake	28.61	28.61	28.61	28.61	28.61
Wheat Brand	1	1	1	1	1
Concentrate*	5	5	5	5	5
Dicalcium phosphate.	0.5	0.5	0.5	0.5	0.5
Oyster shell	0.5	0.5	0.5	0.5	0.5
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.14	0.14	0.14	0.14	0.14
Total	100	100	100	100	100
Antibiotic (Neomycin) Mg/kg	-	16	-	-	-
Ginger	-	-	0.25	0.5	0.75

*crude protein 40; crud fiber ; calcium ; phosphorus (aval) lysine methionine met +sys 3.20 met energy 2100 kcal; Sodium2.60 product vit. A:200.000I.U/Kg; vit E :500Mg/Kg; vit B1: 15Mg/Kg; vitB2: 100 Mg/Kg; vit B620Mg/Kg; vit B12 300Mg /Kg; Biotin:1.000mg/kg; Nicotinicacid:600mg/kg; Folicacid: 10mg/kg; vit K30mg/kg ;pantothenic acid: 150mg/kg; choline chloride: 5.000mg/kg; copper 100mg/kg; iodine 15mg/kg Cobalt: 3mg/kg;selenium: 2mg/kg; manganese:1200mg;zine; 800mg/kg; iron1.000mg/kg; B.H.T.: 900MG/KG; Salinomycin-Na;1.200.

Table (4) Calculated chemical analysis of experimental Diet

Ingredient%	**A**	**B**	**C**	**D**	**E**
Dry matter	89.20	89.20	89.20	89.20	89.20
Crud protein	23.10	23.10	23.10	23.10	23.10
Crud fiber	4.44	4.44	4.44	4.44	4.44
Ether extract	3.9	3.9	3.9	3.9	3.9
Ash	4.60	4.60	4.60	4.60	4.60
Nitrogen free extract	63.96	63.96	63.96	63.96	63.96
Calcium	0.91	0.91	0.91	0.91	0.91
Total phosphorous	0.70	0.70	0.70	0.70	0.70
Available phosphous	0.50	0.50	0.50	0.50	0.50
M.E.Kcal/kg	3102.84	3102.84	3102.84	3102.84	3102.84

Calculated according to (ELLis, 1981;Kuku Bulletin)

3.2.4 Data to be collect collected

Data collected were the same as described in the first experiment in aspects of chick performance, slaughter and carcass data, blood serum, enzyme activities, metabolic indicator, minerals,.

3.3 Experiment (3) response of broiler chicks to different dietary level of spearmint:

This experiment was conducted during (5 of June to 7July 2012) the ambient temperature was controlled as the housing system was the semi intensive system it was 20 – 26 c (appendex 1) during the experiment period (6 weeks).

3.3 .1 Experiment chicks

A total number of 200 one day old commercial unsexed broilers of cob strain were obtain from (Enmaa Breeder Company – Sudan) and transported to student poultry premises, College of Agricultural Studies, Sudan University of Science and Technology, Shambat. All chicks were with an average initial weight (93g) five day old chicks. The chicks were adapted to the premises and feed over (5days) before the start of experimental period. The chicks were then allotted randomly to five groups A, B, C, D, and E of four replicates with ten chicks arrangement. Chicks were bought vaccinated against Mareks with on – farm vaccinated against Gumboro disease at (11) days of age and Newcastle at (22) days of age, soluble multivitamin compounds (pantominovite – pantex Holand and B. V. 5525 ZG Duizel Holand), givento the chicks before three days of the vaccination in order to guard stress.

3.3 . 2 Housing:

The house was in the as same as described in the first experiment

3.3 3 Experiment ration:

Spearmint used in this experiment was purchased from Hillat Kuku farm Eastern Khartoum state, then dried under shades and grinded then added in powdered form, the chicks were fed 5 dietary treatments, the first group A, fed on based diet,(negative control) without antibiotic or any growth promoter, the second group B fed on basal diet containing an antibiotic as chemical growth promoter, Neomycine 16mg/kg (positive control). The other groups, C, D, and E were fed on the basal diet supplemented with dietary spearmint as a natural growth promoter, at levels of 1%,1.5%, and 2% respectively. The basal diet was formulated to meet the nutrient requirements of broiler chicks according to Nutritional Research Council (NRC, 1994).

The ingredients percent composition and the calculated chemical analysis of the experiment diet were presented in table (5) and (6). Experiment diet were fed for 6 weeks.

Table (5).The ingredients percent composition and the calculated chemical analysis of the experimental diets .

Ingredient%	**A**	**B**	**C**	**D**	**E**
Sorghum fetarita	64	64	64	64	64
Ground nut cake	28.61	28.61	28.61	28.61	28.61
Wheat Brand	1	1	1	1	1
Concentrate*	5	5	5	5	5
Dicalcium phosphate.	0.5	0.5	0.5	0.5	0.5
Oyster shell	0.5	0.5	0.5	0.5	0.5
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.14	0.14	0.14	0.14	0.14
Total	100	100	100	100	100
Antibiotic (Neomycin) Mg/kg	-	16	-	-	-
Spearmint	-	-	1	1.5	2

*crude protein 40; crud fiber ; calcium ; phosphorus (aval) lysine methionine met +sys 3.20 met energy 2100 kcal; Sodium2.60 product vit. A:200.000I.U/Kg; vit E :500Mg/Kg; vit B1: 15Mg/Kg; vitB2: 100 Mg/Kg; vit B620Mg/Kg ;vit B12 300Mg /Kg;Biotin:1.000mg/kg; Nicotinicacid:600mg/kg; Folicacid : 10mg/kg; vit K30mg/kg ;pantothenic acid: 150mg/kg; choline chloride: 5.000mg/kg; copper 100mg/kg; iodine 15mg/kg Cobalt :3mg/kg; selenium:2mg/kg; manganese:1200mg;zine; 800mg/kg; iron1.000mg/kg; B.H.T.:900MG/KG; Salinomycin-Na;1.200.

Table (6) Calculated chemical analysis of experimental Diet

Ingredient%	**A**	**B**	**C**	**D**	**E**
Dry matter	89.20	89.20	89.20	89.20	89.20
Crud protein	23.10	23.10	23.10	23.10	23.10
Crud fiber	4.44	4.44	4.44	4.44	4.44
Ether extract	3.9	3.9	3.9	3.9	3.9
Ash	4.60	4.60	4.60	4.60	4.60
Nitrogen free extract	63.96	63.96	63.96	63.96	63.96
Calcium	0.91	0.91	0.91	0.91	0.91
Total phosphorous	0.70	0.70	0.70	0.70	0.70
Available phosphous	0.50	0.50	0.50	0.50	0.50
M.E.Kcal/kg	3102.84	3102.84	3102.84	3102.84	3102.84

Calculated according to (ELLis, 1981;Kuku Bulletin)

3.3.4Data to be collected

Data collected were the same as described in the first experiment in aspects of chick' s performance, slaughter and carcass data, blood serum, enzyme activities, metabolic indicator, minerals.

3.4 Experiment (4) response of broiler chicks to different dietary level of hotpepper:

This experiment was conducted during (5 of June to 7July 2012) the ambient temperature was controlled as the housing system was the semi intensive system it was 20 – 34 c (appendix 1) during the experiment period (6 weeks).

3.4 .1Experiment chicks

A total number of 200 one day old commercial unsexed broilers of cob strain were obtain from (Enmaa Breeder Company – Sudan) and transported to student poultry premises, College of Agricultural Studies, Sudan University of science and Technology, Shambat. All chicks were with an average initial weight (93g) five day old chicks. The chicks were adapted to the premises and feed over (5days) before the start of experimental period. The chicks were then allotted randomly to five groups A, B, C, D, and E of four replicates with ten chicks arrangement. Chicks were bought vaccinated against Mareks with on – farm vaccinated against Gumboro disease at (11) days of age and Newcastle at (22) days of age, soluble multivitamin compounds (pantominovite – pantex Holand and B. V. 5525 ZG Duizel Holand), givento the chicks before three days of the vaccination in order to guard stress.

3.4.2 Housing:

The house was in the as same as described in the first experiment

3.4.3 Experiment ration:

Hot red pepper used int his experiment was purchased from Baharri market Kartoum state, the chicks were fed 5 dietary treatments, the first group A, fed on based diet,(negative control) without antibiotic or any growth promoter ,the second group B fed on basal diet containing an antibiotic as chemical growth promoter, Neomycine 16mg/kg (positive control). The other groups, C, D, and E were fed on the basal diet supplemented with dietary hot pepper as a natural growth promoter, at levels of 0.5%, 1%, and 1.5% respectively. The basal diet was formulated to meet the nutrient requirements of broiler chicks according to Nutritional Research Council (NRC, 1994).

The ingredients percent composition and the calculated chemical analysis of the experiment diets were presented in table (7) and (8). Experiment diets were fed for 6 weeks.

Table (7) The ingredients percent composition and the calculated chemical analysis of the experimental diets.

Ingredient%	**A**	**B**	**C**	**D**	**E**
Sorghum fetarita	64	64	64	64	64
Ground nut cake	28.61	28.61	28.61	28.61	28.61
Wheat Brand	1	1	1	1	1
Concentrate*	5	5	5	5	5
Dicalcium phosphate.	0.5	0.5	0.5	0.5	0.5
Oyster shell	0.5	0.5	0.5	0.5	0.5
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.14	0.14	0.14	0.14	0.14
Total	100	100	100	100	100
Antibiotic (Neomycin) Mg/kg	-	16	-	-	-
Hot pepper	-	-	0. 5	1	1.5

*crude protein 40; crud fiber; calcium; phosphorus (aval) lysine methionine met +sys 3.20 met energy 2100 kcal; Sodium2.60 product vit. A:200.000I.U/Kg; vit E :500Mg/Kg; vit B1: 15Mg/Kg; vitB2: 100 Mg/Kg; vit B620Mg/Kg ;vit B12 300Mg /Kg; Biotin:1.000mg/kg; Nicotinicacid:600mg/kg; Folicacid : 10mg/kg; vit K30mg/kg ;pantothenic acid: 150mg/kg; choline chloride: 5.000mg/kg; copper 100mg/kg; iodine 15mg/kg Cobalt :3mg/kg; selenium:2mg/kg; manganese:1200mg; zine;800mg/kg; iron1.000mg/kg;B.H.T.:900MG/KG; Salinomycin-Na;1.200.

Table (8) Calculated chemical analysis of experimental Diet

Ingredient%	**A**	**B**	**C**	**D**	**E**
Dry matter	89.20	89.20	89.20	89.20	89.20
Crud protein	23.10	23.10	23.10	23.10	23.10
Crud fiber	4.44	4.44	4.44	4.44	4.44
Ether extract	3.9	3.9	3.9	3.9	3.9
Ash	4.60	4.60	4.60	4.60	4.60
Nitrogen free extract	63.96	63.96	63.96	63.96	63.96
Calcium	0.91	0.91	0.91	0.91	0.91
Total phosphorous	0.70	0.70	0.70	0.70	0.70
Available phosphous	0.50	0.50	0.50	0.50	0.50
M.E.Kcal/kg	3102.84	3102.84	3102.84	3102.84	3102.84

Calculated according to (ELLis, 1981;Kuku Bulletin)

3.4.4Data to be collected

Data collected were the same as described in the first experiment in aspects of chick' s performance, slaughter and carcass data, blood serum, enzyme activities, metabolic indicator, minerals.

3.5 Methods:

3.5.1Chemical methods

3. 5.1.1 Serum determination

Venous unheparition blood samples obtained at the end of expermint from chicks were centerfuged at 3000 r. p. m. for 5 minutes and sera were stored at -20C until analyzed using spectrophotometer, Hitachi-902, Gemany.

3.5.1.1.1 Glutamyl oxaloacetic transaminase (Aspartate amino transferase, L. Aspartate; 2- oxoglutarate amino-transferase, E. C. 6.1.1.; G.O.T, A.S.T)

Serum AST activity was measured by a commercial kit (DIALAB Laboratories Ltd, Austria)

Test principal:

Aspartate aminotransferase catalyses the reversible transfer of an amino group from aspartate to α-ketoglutarate fonning glutamate and oxalacetate:

L-aspartate + α-ketoglutarate $\overset{GOT}{\longleftrightarrow}$ L-glutamate ± oxalacetate

The oxalacetate produced is reduced to maltate by maltate dehydrogenase (MDH) and NADH.

Oxalacetate + NADH + H^{+} $\overset{MDH}{\longleftrightarrow}$ Maltate + NAD

The rate of decrease in concentration of NADH is proportional to the catalytic concentration of GOT present in the serum sample.

Protocol:

Non-haemolysed serum was added to a buffered substrate mixture of L-aspartate and α-oxoglutarate. The absorbance at a wave length of 365 nm was reaclat one

minute intervals after mixing the serum with the buffered substrate solution. The mean absorbance change per minute (A_{365}/minute) was used for calculation of enzyme activity as follows:

I U = A_{365} nm/minute X 2059

3.5.1.1.2 Alkaline phosphatase (orthophasphoric mono-ester phosphoydrolase, E.C.3.1.3.l., ALP)

The serum ALP activity was measured photometricallyc using commercial kits (DIALAB Laboratories Ltd, Austria).

Test principal

ALP catalyses the hydrolysis of p-nitrophenyl phosphate liberating P-nitrophenol and inorganic phosphate. The rate of P-nitrophenol formation is proportional to the ALP activity present in the serum.

P-nitrophenyl phosphate + H_2O ALP P-nitropheyl + inorganic phosphate. The substrate (Nitro-4-phenylphosphate) was added to a buffered amino-2 methyl-2 propanol -1) and the serum was mixed with the buffered substrate.

The mean absorbance change per minute (A_{405} nm/minute) was detennined for calculation of enzyme activity as follows:

I U = A_{405}/minute X 2575

3.5.1.1.3 Total protein

Total serum protein was measured by a colorimetric method using a commercial kit (BioSystems S.A., Spain).

Test principle

Colorimetric determination of total protein in serum is based on the biuret reaction. The serum protein reacts with copper sulphate in the presence of sodium hydroxide. The Rochelle Salt (K-Na-tartarate) contained in the burette reagent is utilized to keep the formed cupric hydroxide in solution which gives the blue color.

The intensity of the color produced is proportional to the amount of protein in the sample. The absorbencies of the sample (A sample) and of the standard.

(A standard) were. read against the reagent blank ill the Colorimeter at a wavelength of 545 nm. The total serum protein concentration (C) was calculated as follows:

$$C\ (mg/dl) = \frac{A\ sample\ X\ concentration\ of\ the\ standard}{A\ Standard}$$

3.5.1.4 Cholesterol

Total serum cholesterol concentration was measured by an enzymatic colorimetric method using a kit (DIALAB Laboratories Ltd, Austria).

Test principle

Free cholesterol and cholesterol released from ester after enzymatic hydrolysis are oxidized enzymatically. The indicator quinoneimine is fonned from hydrogen peroxide and 4-amino anti-pyrine in the presence of phenol and peroxidase

Cholesterol ester $+H_2O$ Cholesterol Esterase cholestero1+ fatty acids

Cholesterol + O_2 Cholesterol Oxidase cholestenone $+H_2O_2$

$2H_2O_2$ + 4 amino antipyrine + phenol Peroxidase quinoncimine H_2O

The intensity of the colored quinoneinine formed is proportional to the amount of cholesterol present in the sample. The absorbance of the sample (A-sample) and of the standard (A-standard) was read against a blank in the Colorimeter at a wave length of 500 nm and cholesterol concentration C was estimated as follows:

$$C\ (mg/dl) = \frac{A\ sample\ X\ concentration\ of\ standard}{A\ standard}$$

3.2.1.1.5 Urea

Serum urea concentration was estimated by an enzymatic colorimetric method using a kit (Crescent Diagnostics, MUSLCO SJ, Saudi Arabia).

Test principle

Ammonia and carbon dioxide are produced when urea is hydrolysed by urease

Urea + H_2O urease Ammonium carbonate + CO_2

Ammonium ions react with phenol and hydrochlorite to give a coloured complex.

Protocol

The serum was mixed with a buffered urease solution and the mixture was incubated for 10 minutes at room temperature. The hydrochlorite solution was added and mixed and the contents were incubated at room temperature for 15 minutes. The absorbency of the sample (A sample) and of the standard (A standard) were read against the blank at a wave length of 546 nm and the concentration (C) of urea was calculated as follows:

$$C\ (mg/dl) = \frac{A\ sample\ X\ concentration\ of\ the\ standard}{A\ standard}$$

3.5.1.1.6 Glucose

Serum glucose values were determined using enzymatic kits provided by BioSystems S.A., Spain.

Test principle

Glucose level was measured according to the method described by Giterson et al. (I971).

Glucose + O_2 + H_2O $\longrightarrow$ Gluconate + H_2O

$_2H_2O_2$ + phenol + 4-amino-antipyrine $\longrightarrow$ red chinonimin + H_2O

Protocol

Dilute enzyme reagent (GOD + POD + 4-amino-autipyrine) was mixed with buffer (phosphate buffer, pH 7.5 + phenol). None-haemolytic serum was mixed with the reagent solution and the mixture was incubated at 37°C for 15 min. The

absorbance was read at wavelength 500 nm against the reagent blank and calculated as follows:

$$U/L \quad \frac{\Delta A \text{ sample}}{\Delta A \text{ standard} \times \text{standard concentration (100 ml/dl)}}$$

(Where A = absorbance)

3.5.1.1.6 Calcium

Serum calcium concentration was determined by a colorimetric method using a commercial kit (Spinreact, S.A.U., Spain).

Test principle

Calcium ions form a violet complex with chromogen (-O-cretholphthalein complex one-8- hydroxyquinoline hydrochloric acid) in an alkaline medium (2-amino-2-methyl-propan-l-01).

Serum was mixed with a buffered reagent and the absorbance of the sample (A sample) and of the standard (A standard) were measured against a reagent blank at a wave length of 578 nm and calcium concentration (C) was calculated as follows:

$$C \text{ (mg/d1)} = \frac{\text{A sample X concentration of the standard}}{\text{A standard}}$$

3.5.1.1.7 Phosphorus

Determined by a colorimetric method using a commercial kit (Spinreact, S.A.U., Spain).

Test principle

In nitric acid phosphate forms a coloured complex with molybdate and a reductant. Serum was added to trichloroacetic acid for deproteinization, then the supernatant was added to the reductant and molybdate and the absorbance of the sample was read against a blank at a wavelength of 405 nm. Inorganic phosphorus concentration (C) was calculated as follows:

C (mg/dl) = 42.2 X A sample.

Protocol:

Non-haemolysed serum was added to a buffered substrate mixture of L-aspartate and α-oxoglutarate. The absorbance at a wave length of 365 nm was read· at one minute intervals after mixing the serum with the buffered substrate solution. The mean absorbance change per minute (A36/minute) was used for calculation of enzyme activity as follows:

$$I\ U = A_{365}\ nm/minute\ X\ _{2059}$$

3.6 Method used for meat quality assessment:

3.6.1 Subjective meat quality attributes

3.6.1.1The taste panel

Frozen deboned breast drumstick and thigh cuts of the right side were thawed at 5-7 C before cooking for sensory evaluation. The meat was trapped in aluminum foil, placed in roast pan and cooked at 176.7C in the conventional preheated electrical oven to about 80 C internal muscle temperature. The cooked meat was allowed to cool to room temperature in about 10 minutes. The samples were kept warm until served. Trained panelists were instructed to eat crackers drink water between samples evaluated; following recommended procedure 9(Hawrysh et al., 1980). The sensory panel evaluated the chops for tenderness. Flavor, color and juiciness using an eight- point scale

3.7 Statistical analysis:

The experimental design was completely randomized. Data in performance, haemogram, serum metabolites and enzyme activities slaughter carcass yield and quality were all analyzed using One – way analysis of variance (ANOVA). Frequency distributions were set and treatment means were compared for significance at the level of probability (Obi,1990).

CHAPTER FOUR

RESULTS

4.1 Response of broiler chicks to dietary Garlic

4.1.1 Performance

The effect of feeding different levels of six weeks dietary Garlic on performance of broiler chicks is shown in Table (9). The result indicated that the chicks of groups B, C, D, and E obtained significantly ($P \leq 0.05$) higher weight gain than that of group A, where as no significant differences were observed between groups B, C, D, and E.

No significant differences were observed between groups A, B, C, D and E in feed consumption ($P \leq 0.05$). Groups B, D, C and E had significantly ($P \leq 0.05$) better feed conversion ratio than of group A.

4.1.2 Carcass measurement

4.1.2.1. Carcass and non carcass yield

As shown in Table (10), treatment effect on percent of carcass dressing and giblets gizzard, liver, heart and intestine percentage was not significant ($P > 0.05$). The significant difference ($P \leq 0.05$) was found in abdominal fat percent, the result indicated that the chicks of group B and A obtained significantly ($P < 0.05$) higher abdominal fat percent than that of group, C, D and E while no significant differences were observed between groups C, D and E.

Experiment (I): Garlic

Table (9): Effect of adding different levels of garlic on body weight gain (gm), feed intake (gm) and feed conversion ratio

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Body weight gain (gm)	1569.95^{b}	1649.93^{a}	1714.32^{a}	1716.24^{a}	1717.65^{a}	83.44^{*}	27.08
Feed intake (gm)	3269.73^{a}	3304.62^{a}	3394.27^{a}	3393.52^{a}	3423.24^{a}	$218.1^{n.s}$	70.79
Feed conversion ratio	2.09^{a}	2.00^{b}	1.99^{b}	1.99^{b}	1.99^{b}	0.04872^{*}	0.01581

Any two mean values having same superscript within rows are not significantly different (P≤0.05).

n.s = No significant difference (P≤0.05)

* Significant difference (P≥0.05).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Garlic 1%

D = Garlic 2%

E = Garlic 3%

Table (10): Effect of adding different levels of garlic on dressing (%), heart (%), liver (%), gizzard (%), abdominal fat (%) and intestine weight (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Dressing (%)	68.95^{a}	69.03^{a}	69.07^{a}	69.10^{a}	69.08^{a}	$1.055^{n.s}$	0.3235
Heart (%)	0.75^{a}	0.76^{a}	0.72^{a}	0.76^{a}	0.74^{a}	$0.05954^{n.s}$	0.01826
Liver (%)	2.79^{a}	2.83^{a}	2.82^{a}	2.81^{a}	2.83^{a}	$0.0842^{n.s}$	0.02582
Gizzard (%)	2.71^{a}	2.71^{a}	2.70^{a}	2.71^{a}	2.73^{a}	$0.05954^{n.s}$	0.01826
Abdominal fat (%)	2.73^{a}	3.53^{a}	2.25^{b}	2.15^{b}	2.12^{b}	0.4419^{*}	0.1357
Intestine weight (%)	5.58^{a}	5.51^{a}	5.60^{a}	5.71^{a}	5.58^{a}	$0.5258^{n.s}$	0.1612

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

* Significant difference ($P \geq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Garlic 1%

D = Garlic 2%

E = Garlic 3%

4.1.2.2 Commercial cuts

Commercial cuts drumstick, breast and thigh percentages are presented in Table (11), there was no significant (P≤0.05) treatments effect in drumstick, breast and thigh percentage values and all treatment groups mean values were similar.

The treatment group values of meat expressed as percentage from total weight of selected commercial cuts is given in Table (12), no significant (P≤0.05) effect was observed between the groups in the meat of breast, thigh and drumstick.

4.1.3 Meat quality parameters

4.1.3.1 Panel test (subjective meat attributes)

The effect treatment on subjective meat attributes is shown in Table (13). The average subjective meat quality score color, tenderness, juice and flavor and overall acceptability of leg cuts (thigh and drum stick) did not differ significantly (P≤0.05) among the dietary treatment and score given for all attributes are above moderate acceptability

Table (11): Effect of adding different levels of garlic on breast (%), thigh (%) and drumstick (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Breast (%)	24.43^{a}	24.46^{a}	24.43^{a}	24.45^{a}	24.44^{a}	$2.552^{n.s}$	0.7825
Thigh (%)	19.29^{a}	19.33^{a}	19.30^{a}	19.34^{a}	19.31^{a}	$0.3368^{n.s}$	0.1033
Drumstick(%)	19.10^{a}	19.11^{a}	19.11^{a}	19.12^{a}	19.14^{a}	$0.1331^{n.s}$	0.04082

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Garlic 1%

D = Garlic 2%

E = Garlic 3%.

Table (12): Effect of adding different levels of garlic on breast meat (%), thigh meat (%) and drumstick meat (%)

Parameter	**Samples**					**$Lsd_{0.05}$**	**SE±**
	A	**B**	**C**	**D**	**E**		
Breast meat (%)	81.79^{a}	81.83^{a}	81.49^{a}	81.84^{a}	81.85^{a}	$0.9527^{n.s}$	0.2921
Thigh meat (%)	83.23^{a}	83.25^{a}	83.10^{a}	83.24^{a}	83.27^{a}	$0.7243^{n.s}$	0.2221
Drumstick meat (%)	75.58^{a}	78.93^{a}	75.93^{a}	75.29^{a}	75.63^{a}	$4.622^{n.s}$	1.417

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Garlic 1%

D = Garlic 2%

C = Garlic 3%

Table (13): Effect of adding different levels of garlic on quality attributes

Quality attribute	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Tenderness	6.51^{a}	6.69^{a}	6.71^{a}	7.05^{a}	6.72^{a}	$0.6271^{n.s}$	0.1922
Flavor	6.17^{a}	6.21^{a}	6.19^{a}	6.20^{a}	6.18^{a}	$0.5680^{n.s}$	0.1742
Color	6.20^{a}	5.85^{a}	5.84^{a}	6.19^{a}	6.21^{a}	$0.7389^{n.s}$	0.2266
Juiciness	5.80^{a}	6.00^{a}	6.15^{a}	6.17^{a}	6.17^{a}	$0.6944^{n.s}$	0.2129

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Garlic 1%

D = Garlic 2%

C = Garlic 3%

4.1.4serum parameter

4.1.4.1: Serum metabolites

The serum metabolite value of broiler chicks fed different levels of garlic for 6 weeks were shown in Table (14) mean values of cholesterol were highest significantly ($p<0.05$) in group A, and B, compared to group C, D, and E, no significant difference is seen between ,C ,D, E. However, cholesterol decreased as the level of dietary garlic increased.

Treatments effect on total protein, urea and glucose were not significant ($p>0.05$).

4.1.4.2: Serum enzyme activity

Enzyme activities value of broiler chicks fed different levels of garlic for 6 weeks were shown in Table (15), The treatment had no significant ($p>0.05$) effect on ALP values, the AST values were significantly high ($p<0.05$) in group A and B, compared to other treatment groups, whereas no significant differences ($p>0.05$) were observed between groups C ,D , and E in AST.

4.1.4.Serum electrolytes

The serum electrolytes value of broiler chicks fed different levels of garlic for 6 weeks were shown in Table(16) no significant ($p>0.05$) differences in serum electrolytes values were observed between the dietary treatments.

Table (14): the effect of different levels of garlic on the serum metabolite of broiler chicks for (6) weeks.

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
Urea	5.33^{a}	5.00^{a}	4.33^{a}	4.67^{a}	4.67^{a}	1.087^{NS}	0.3332
Total protein	3.37^{a}	3.43^{a}	3.47^{a}	3.40^{a}	3.48^{a}	0.4763^{NS}	0.1461
Glucose	227.67^{a}	215.90^{a}	228.67^{a}	214.60^{a}	209.57^{a}	17.85^{NS}	5.475
Cholesterol	126.20^{a}	129.17^{a}	113.77^{b}	109.63^{b}	101.67^{b}	1.598*	0.4899

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Garlic 1%

D = Garlic 2%

E = Garlic 3%

Table (15): the effect of different levels of garlic on the Enzyme activity of broiler chicks for (6) weeks.

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
ALP	155.90^{a}	152.27^{a}	162.47^{a}	165.20^{a}	171.73^{a}	21.71^{ns}	21.71^{ns}
AST	37.77^{a}	34.65^{a}	32.05^{b}	27.55^{b}	26.44^{b}	9.456*	2.9

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Garlic 1%

D = Garlic 2%

E = Garlic 3%

Table (16): the effect of different levels of garlic on the serum minerals of broiler chicks for (6) weeks.

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
Ca	4.80^{a}	4.77^{a}	5.07^{a}	5.00^{a}	4.57^{a}	0.6522^{NS}	0.20
P	7.67^{a}	7.63^{a}	7.97^{a}	8.10^{a}	7.53^{a}	0.8891^{NS}	0.2726

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Garlic 1%

D = Garlic 2%

E = Garlic 3%

4.1.5 Economic appraisal:

The total costs, returns and profitability ratio per head of broiler chicks fed different levels of garlic and antibiotic for 6 weeks are shown in table (17)

Chicks purchase, feed, electricity, and labor cost values were the major in put considered. The total selling values of meat is the total revenues obtained. Profitability ratio (1.2) of tested group B, D, and E were the highest of the tested groups .

Table (17) Total cost ,returns and profitability ratio per head of broiler chicks fed different amounts of Garlic and anti - biotic for 6 weeks

Items	A	B	C	D	E
Cost					
Chicks purchase	2800	2800	2800	2800	2800
Feed Cost	2975.25	3006.77	3089.55	3089.44	3123.04
Electricity	1	1	1	1	1
Labor and mange	4	4	4	4	4
TOTAL	10775.25	10806.77	10889.55	10889.44	10923.04
Revenues					
Average live weight of bird	1662.95	1743.22	1807.32	1809.54	1810.71
Dressing%	68.59	69.03	69.07	69.10	69.08
Average weight of carcass	1140.61	1203.35	1248.32	1250.39	1250.84
Price/Kg of bird	17	17	17	17	17
TOTAL	19390.37	20456.96	21221.44	21256.63	21264.28
Profits					
Total revenues	10775.25	20456.96	21221.44	21256.63	21264.28
Total cost	19390.37	10806.77	10889.5	10889.44	10923.04
Profit/chick	8615.12	9650.19	10331.89	10367.19	10341.24
Profitability ratio	1	1.12	1.19	1.2	1.2

4.2 Response of broiler chicks to dietary Ginger

4.2.1 Performance

The effect of feeding different levels of six weeks dietary Ginger on performance of broiler chicks is shown in Table (18). The result indicated that the chicks of groups B, C, D, and E obtained significantly ($P < 0.05$) higher weight gain than that of group A where, was no significant differences were observed between groups B, C, D and E.

No significant differences were observed between groups A, B, C, D and E, in feed consumption ($P>0.05$). Groups B, C, D, and E had significantly ($P < 0.05$) better feed conversion ratio than of group A.

4.2.2. Carcass measurement

4.2.2.1. Carcass and non carcass yield

As shown in Table (19), treatment effect on percent of carcass dressing and giblets gizzard, liver, heart and intestine percentage and abdominal fat was not significant ($P>0.05$).

4.2.2.2 Commercial cuts

Commercial cuts drumstick, breast and thigh percentage are presented in Table (20), there was no significant ($P < 0.05$) treatments effect in drumstick, breast and thigh percentage values and all treatment groups mean values were similar.

The treatment group values of meat expressed as percentage from total weight of selected commercial cuts were given in Table (21), no significant ($P < 0.05$) effect was observed between the groups in the meat of breast, thigh and drumstick

Experiment (II): Ginger

Table (18): Effect of adding different levels of ginger on body weight gain (gm), feed intake (gm) and feed conversion ratio

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Body weight gain (gm)	1569.95^{b}	1649.93^{a}	1645.03^{a}	1652.84^{a}	1665.53^{a}	86.94^{*}	28.21
Feed intake (gm)	3269.73^{a}	3304.62^{a}	3257.16^{a}	3289.03^{a}	3311.37^{a}	$161.1^{n.s}$	52.29
Feed conversion ratio	2.09^{a}	2.00^{b}	1.98^{b}	1.99^{b}	1.99^{b}	0.04872^{*}	0.01581

Any two mean values having same superscript within rows are not significantly different (P≤0.05).

n.s = No significant difference (P≤0.05)

* Significant difference (P≥0.05).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Ginger 0.25%

D = Ginger 0.50%

E = Ginger 0.75%

Table (19): Effect of adding different levels of ginger on dressing (%), heart (%), liver (%), gizzard (%), abdominal fat (%) and intestine weight (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Dressing (%)	68.95^{a}	69.03^{a}	69.02^{a}	69.10^{a}	69.11^{a}	$0.491^{n.s}$	0.1506
Heart (%)	0.75^{a}	0.77^{a}	0.72^{a}	0.74^{a}	0.75^{a}	$0.05954^{n.s}$	0.01826
Liver (%)	2.80^{a}	2.83^{a}	2.78^{a}	2.81^{a}	2.87^{a}	$0.1786^{n.s}$	0.05477
Gizzard (%)	2.71^{a}	2.72^{a}	2.74^{a}	2.74^{a}	2.75^{a}	$0.0842^{n.s}$	0.02582
Abdominal fat (%)	2.73^{a}	3.53^{a}	2.64^{a}	2.47^{a}	2.38^{a}	$1.931^{n.s}$	0.5930
Intestine weight (%)	5.56^{a}	5.51^{a}	5.61^{a}	5.59^{a}	5.57^{a}	$0.5325^{n.s}$	0.1633

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Ginger 0.25%

D = Ginger 0.50%

E = Ginger 0.75%

Table (20): Effect of adding different levels of ginger on breast (%), thigh (%) and drumstick (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Breast (%)	24.41^{a}	24.46^{a}	24.47^{a}	24.61^{a}	24.48^{a}	$3.750^{n.s}$	1.153
Thigh (%)	19.29^{a}	19.33^{a}	19.35^{a}	19.33^{a}	19.31^{a}	$0.3946^{n.s}$	0.1211
Drumstick (%)	19.10^{a}	19.11^{a}	19.10^{a}	19.08^{a}	19.12^{a}	$0.05954^{n.s}$	0.01826

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Ginger 0.25%

D = Ginger 0.50%

E = Ginger 0.75%

Table (21): Effect of adding different levels of ginger on breast meat (%), thigh meat (%) and drumstick meat (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Breast meat (%)	81.79^{a}	81.83^{a}	81.79^{a}	81.80^{a}	81.83^{a}	$0.9301^{n.s}$	0.2852
Thigh meat (%)	83.23^{a}	83.25^{a}	83.22^{a}	83.20^{a}	83.20^{a}	$0.568^{n.s}$	0.1742
Drumstick meat (%)	75.58^{a}	75.60^{a}	75.60^{a}	75.62^{a}	75.62^{a}	$4.441^{n.s}$	1.362

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Ginger 0.25%

D = Ginger 0.50%

E = Ginger 0.75%

4.2.3 Meat quality parameters

4.2.3.1 Panel test (subjective meat attributes)

The effect treatment on subjective meat attributes is shown in Table (22). The average subjective meat quality score color, tenderness, juice and flavor and overall acceptability of leg cuts (thigh and drumstick) did not differ significantly ($P \leq 0.05$ among the dietary treatment and score given for all attributes are above moderate acceptability.

Table (22): Effect of adding different levels of ginger on quality attributes

Quality attribute	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Tenderness	6.67^{a}	6.69^{a}	6.71^{a}	6.70^{a}	6.71^{a}	$0.5394^{n.s}$	0.1653
Flavor	6.17^{a}	6.17^{a}	6.18^{a}	6.16^{a}	6.19^{a}	$0.7602^{n.s}$	0.2331
Color	6.20^{a}	5.18^{a}	6.10^{a}	6.21^{a}	6.22^{a}	$0.7091^{n.s}$	0.2174
Juiciness	6.13^{a}	6.00^{a}	6.03^{a}	6.07^{a}	6.07^{a}	$0.8526^{n.s}$	0.2610

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Ginger 0.25%

D = Ginger 0.50%

E = Ginger 0.75%

4.3 Serum parameters

4.3 .1 Serum metabolites

The serum metabolite value of broiler chicks fed different levels of ginger for 6 weeks were shown in Table (23) mean values of cholesterol were highest significantly ($p<0.05$) in group A ,and B, compared to group C, D, and E, no significant difference is seen between ,C,D,E. Treatments effect on total protein, urea and glucose was not significant ($p>0.05$).

4.3 .2 Serum enzyme activity

Enzyme activities value of broiler chicks fed different levels of ginger for 6 weeks are shown in table (24) the treatment group did not differ significantly ($p>0.05$) in ALP values. Significantly ($p<0.05$) AST high in group A and B compared to group C, D and E, although no significant differences is found between C, D, and D.

4.3.3 Serum electrolytes

The serum electrolytes values of broiler chicks fed different levels of ginger for 6 weeks were shown in table(25) Treatments effect on The serum electrolytes were not significant ($p>0.05$).

Table (23): the effect of different levels of ginger on the serum metabolite of broiler chicks for (6) weeks.

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
Urea	5.33^{a}	5.00^{a}	5.00^{a}	4.76^{a}	4.67^{a}	0.6867^{NS}	0.2106
Total protein	3.37^{a}	3.43^{a}	3.38^{a}	3.49^{a}	3.43^{a}	0.4038^{ns}	0.1238
Glucose	227.67^{a}	215.90^{a}	215.60^{a}	212.90^{a}	211.53^{a}	20.68^{NS}	6.341
Cholesterol	126.20^{a}	129.17^{a}	114.73^{b}	113.03^{b}	109.00^{b}	6.869^{*}	2.106

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Ginger 0.25%

D = Ginger 0.50%

E = Ginger 0.75%

Table (24): the effect of different levels of ginger on the Enzyme activity of broiler chicks for (6) weeks.

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
ALP	155.90^{a}	152.27^{a}	155.57^{a}	147.00^{a}	139.93^{a}	16.18^{NS}	4.961
AST	37.77^{a}	34.65^{a}	33.38^{b}	32.10^{b}	30.24^{b}	5.802*	1.779

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Ginger 0.25%

D = Ginger 0.50%

E = Ginger 0.75%

Table (25): the effect of different levels of ginger on the serum minerals of broiler chicks for (6) weeks.

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
Ca	4.80^{a}	4.77^{a}	4.70^{a}	4.65^{a}	4.63^{a}	0.3261^{NS}	0.10
P	7.67^{a}	7.63^{a}	7.63^{a}	7.80^{a}	7.10^{a}	0.9205^{NS}	0.2823

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Ginger 0.25%

D = Ginger 0.50%

E = Ginger 0.75%

4.4 Economic appraisal

The total costs, returns and profitability ratio per head of broiler chicks fed different levels of ginger and anti biotic for 6 weeks are shown in table (26)

Chicks purchase, feed, electricity, and labor cost values were the major in put considered. Te total selling values of meat is the total revenues obtained. Profitability ratio (1.13) of tested group E was the highest of the tested groups.

Table (26) Total cost ,returns and profitability ratio per head of broiler chicks fed different amounts of Ginger and anti biotic for 6 weeks

Items	**A**	**B**	**C**	**D**	**E**
Cost					
Chicks purchase	2800	2800	2800	2800	2800
Feed Cost	2975.25	3006.77	2912.58	2993.30	3013.40
Electricity	1	1	1	1	1
Labor and mange	4	4	4	4	4
TOTAL	10775.25	10806.77	10712.58	10793.30	10813.40
Revenues					
Average live weight of bird	1662.95	1743.22	1738.09	1745.90	1758.73
Dressing%	68.58	69.03	69.00	69.09	69.11
Average weight of carcass	1140.61	1203.35	1199.36	1206.20	1215.46
Price/Kg of bird	17	17	17	17	17
TOTAL	19390.37	20456.96	20393.71	20505.54	20662.79
Profits					
Total revenues	19390.37	20456.96	20393.71	20505.54	20662.79
Total cost	10775.25	10806.77	10712.58	10918.44	10923.04
Profit/chick	8615.12	9650.19	9680.86	97121.15	9739.75
Profitability ratio	1	1.12	1.12	1.12	1.13

4.3 Response of broiler chicks to dietary Spearmint

4.3.1 Performance

The effect of feeding different levels of six weeks dietary spearmint on performance of broiler chicks is shown in Table (27). The result indicated that the chicks of group E obtained significantly ($P < 0.05$) higher weight gain than that of group A where was no significant differences were observed between groups A, B , C, D and E .

No significant differences were observed between groups A, B, C, D and E, in feed consumption ($P > 0.05$). Groups B, C, D and E had significantly ($P < 0.05$) better feed conversion ratio than of group A.

4.3.2 Carcass measurement

4.3.2.1. Carcass and non carcass yield

As shown in Table (28) treatment effect on percent of carcass dressing and giblets gizzard, liver, heart and intestine weight was not significant ($P>0.05$),

The significant difference ($P\leq0.05$) was found in abdominal fat percent, the result indicated that the chicks of groups A and B obtained significantly ($P\leq0.05$) higher abdominal fat percent than that of groups C, D and E.

4.3.2.2 Commercial cuts

Commercial cuts drumstick, breast and thigh percentages are presented in Table (29), there was no significant ($P > 0.05$) treatments effect in drumstick, breast and thigh percentage values and all treatment groups mean values were similar. The treatment group values of meat expressed as percentage from total weight of selected commercial cuts is given in Table (30), no significant ($P > 0.05$) effect was observed between the groups in the meat of breast, thigh and drumstick.

Experiment (III): Spearmint

Table (27): Effect of adding different levels of spearmint on body weight gain (gm), feed intake (gm) and feed conversion ratio

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Body weight gain (gm)	1569.95^{b}	1649.93^{a}	1643.07^{a}	1648.56^{a}	1653.74^{a}	75.88^{*}	24.63
Feed intake (gm)	3269.73^{a}	3304.62^{a}	3275.75^{a}	3285.58^{a}	3280.38^{a}	$156.6^{n.s}$	50.82
Feed conversion ratio	2.09^{a}	2.00^{b}	1.99^{b}	1.99^{b}	1.98^{b}	0.04872^{*}	0.01581

Any two mean values having same superscript within rows are not significantly different (P≤0.05).

n.s = No significant difference (P≤0.05)

* Significant difference (P≥0.05).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Spearmint 1.0%

D = Spearmint 1.5%

E = Spearmint 2.0%

Table (28): Effect of adding different levels of spearmint on dressing (%), heart (%), liver (%), gizzard (%), abdominal fat (%) and intestine weight (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Dressing (%)	68.95^{a}	69.03^{a}	68.70^{a}	69.10^{a}	69.01^{a}	$1.010^{n.s}$	0.3098
Heart (%)	0.75^{a}	0.77^{a}	0.77^{a}	0.79^{a}	0.79^{a}	$0.05954^{n.s}$	0.01826
Liver (%)	2.80^{a}	2.83^{a}	2.82^{a}	2.82^{a}	2.84^{a}	$0.05954^{n.s}$	0.01826
Gizzard (%)	2.71^{a}	2.72^{a}	2.77^{a}	2.74^{a}	2.72^{a}	$0.0842^{n.s}$	0.02582
Abdominal fat (%)	2.73^{a}	3.53^{a}	2.45^{b}	2.43^{b}	2.40^{b}	0.4823^{*}	0.1475
Intestine weight (%)	5.58^{a}	5.51^{a}	5.63^{a}	5.56^{a}	5.60^{a}	$0.5522^{n.s}$	0.1693

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

* Significant difference ($P \geq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Spearmint 1.0%

D = Spearmint 1.5%

E = Spearmint 2.0%

Table (29): Effect of adding different levels of spearmint on breast (%), thigh (%) and drumstick (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Breast (%)	24.41^{a}	24.46^{a}	24.41^{a}	24.46^{a}	24.46^{a}	$2.768^{n.s}$	0.8489
Thigh (%)	19.29^{a}	19.33^{a}	19.29^{a}	19.30^{a}	19.35^{a}	$0.2228^{n.s}$	0.06831
Drumstick (%)	19.10^{a}	19.11^{a}	19.12^{a}	19.15^{a}	19.17^{a}	$0.1191^{n.s}$	0.03651

Any two mean values having same superscript within rows are not significantly different (P≤0.05).

n.s = No significant difference (P≤0.05)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Spearmint 1.0%

D = Spearmint 1.5%

E = Spearmint 2.0%

Table (30): Effect of adding different levels of spearmint on breast meat (%), thigh meat (%) and drumstick meat (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Breast meat (%)	81.79^{a}	81.83^{a}	81.80^{a}	81.83^{a}	81.85^{a}	$0.8831^{n.s}$	0.2708
Thigh neat (%)	83.23^{a}	83.25^{a}	83.22^{a}	83.25^{a}	83.29^{a}	$0.5951^{n.s}$	0.1823
Drumstick meat (%)	75.58^{a}	75.60^{a}	75.59^{a}	75.62^{a}	75.64^{a}	$4.669^{n.s}$	1.4293

Any two mean values having same superscript within rows are not significantly different (P≤0.05).

n.s = No significant difference (P≤0.05)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Spearmint 1.0%

D = Spearmint 1.5%

E = Spearmint 2.0%

4.3 Meat quality parameters

4.3.1 Panel test (subjective meat attributes)

The effect treatment on subjective meat attributes is shown in Table (31). The average subjective meat quality score color, tenderness, juice and flavor and overall acceptability of leg cuts (thigh and drumstick) did not differ significantly ($P>0.05$) among the dietary treatment and score given for all attributes are above moderate acceptability.

Table (31): Effect of adding different levels of spearmint on quality attributes

Quality attribute	Samples					$Lsd_{0.05}$	SE±
	A	**B**	**C**	**D**	**E**		
Tenderness	6.67^{a}	6.69^{a}	6.70^{a}	6.71^{a}	6.71^{a}	$0.5837^{n.s}$	0.1782
Flavor	6.17^{a}	6.17^{a}	6.19^{a}	6.19^{a}	6.21^{a}	$0.7294^{n.s}$	0.2238
Color	6.20^{a}	6.18^{a}	6.20^{a}	6.22^{a}	6.24^{a}	$0.5324^{n.s}$	0.1631
Juiciness	6.13^{a}	6.00^{a}	6.10^{a}	6.12^{a}	6.14^{a}	$1.575^{n.s}$	0.4833

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Spearmint 1.0%

D = Spearmint 1.5%

E = Spearmint 2.0%

4.4 serum parameter

4.4.1 Serum metabolites

The serum metabolite value of broiler chicks fed different levels of spearmint for 6 weeks were shown in Table (32). Mean values of cholesterol were higher significantly ($p < 0.05$) in group A, and B, compared to groups C, D, and E, no significant difference is seen between, C,D,E. However cholesterol decreased as the level of dietary spearmint increased.

Treatments effect on total protein, urea and glucose was not significant ($p>0.05$)

4.4.2 Serum enzyme activity

Enzyme activities value of broiler chicks fed different levels of spearmint for 6 weeks are shown in table (33)ALP values did not differ significantly ($p>0.05$) by the dietary tretment.AST values were Significantly ($p<0.05$) high in groups A and B compared to other groups, where as no significant differences is found between C, D, and E.

4.4.3 Serum electrolytes

The serum electrolytes values of broiler chicks fed different levels of spearmint for 6 weeks were shown in table(34) Treatments effect on The serum electrolytes were not significant ($p>0.05$).

Table (32): the effect of different levels of spearmint on the serum metabolite of broiler chicks for (6) weeks.

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
Urea	5.33^{a}	5.00^{a}	5.33^{a}	5.00^{a}	4.67^{a}	0.9089^{NS}	0.2787
Total protein	3.37^{a}	3.43^{a}	3.47^{a}	3.43^{a}	3.73^{a}	0.3949^{NS}	0.1211
Glucose	227.67^{a}	215.90^{a}	222.00^{a}	218.33^{a}	213.33^{a}	24.76^{NS}	7.592
Cholesterol	126.20^{a}	129.17^{a}	119.73^{b}	113.27^{b}	110.33^{b}	6.247*	1.916

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Spearmint 1.0%

D = Spearmint 1.5%

E = Spearmint 2.0%

Table (33): the effect of different levels of spearmint on Enzyme activity of broiler chicks for (6) weeks.

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
ALP	155.90^{a}	152.27^{a}	160.93^{a}	151.60^{a}	144.27^{a}	27.92^{NS}	8.561
AST	37.77^{a}	34.65^{a}	31.33^{b}	30.09^{b}	28.63^{b}	6.526*	2.001

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Spearmint 1.0%

D = Spearmint 1.5%

E = Spearmint 2.0%

Table (34): the effect of different levels of spearmint on the Minerals of spearmint of broiler chicks for (6) weeks.

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
Ca	4.80^{a}	4.77^{a}	4.80^{a}	4.50^{a}	4.50^{a}	0.8462^{NS}	0.2595
P	7.67^{a}	7.63^{a}	8.00^{a}	7.43^{a}	7.53^{a}	0.9747^{NS}	0.2989

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Spearmint 1.0%

D = Spearmint 1.5%

E = Spearmint 2.0%

4.5 Economic appresial

The total costs, returns and profitability ratio per head of broiler chicks fed different levels of Spearmint and anti biotic for 6 weeks are shown in table (35) Chicks purchase, feed electricity and labor cost values were the major in put considered. The total selling values of meat is the total revenues obtained. Profitability ratio (1.13) of tested groups B, C, and D were the highest of the tested groups .

Table (35) Total cost ,returns and profitability ratio per head of broiler chicks fed different amounts of spearmint and anti biotic for 6 weeks

Items	**A**	**B**	**C**	**D**	**E**
Cost					
Chicks purchase	2800	2800	2800	2800	2800
Feed Cost	2975.25	3006.77	2980.98	2913.29	2985.50
Electricity	1	1	1	1	1
Labor and mange	4	4	4	4	4
TOTAL	10775.25	10806.77	10780.89	10713.29	10785.50
Revenues					
Average live weight of bird	1662.95	1743.22	1736.30	1741.86	1747.07
Dressing%	68.58	69.03	69.00	69.10	69.01
Average weight of carcass	1140.61	1203.35	1198.05	1203.63	1205.65
Price/Kg of bird	17	17	17	17	17
TOTAL	19390.37	20456.96	20316.90	20461.71	20496.10
Profits					
Total revenues	19390.37	20456.96	20316.90	20461.71	20496.04
Total cost	10775.25	10806.77	10889.5	10918.44	10923.04
Profit/chick	8615.12	9650.19	9603.61	9680.82	9710
Profitability ratio	1	1.12	1.12	1.12	1.13

4.4 Response of broiler chicks to dietary Hot pepper

4.4.1 Performance

The effect of feeding different levels of six weeks dietary Hot pepper on performance of broiler chicks is shown in Table (36). The result indicated that the chicks of groups B, C, D, and E obtained significantly (P≤0.05) higher weight gain than that of group A, where as no significant differences were observed between groups B, C, D, and E.

No significant differences were observed between groups, A, B, C, D, and E, in feed consumption (P≤0.05). Groups B, C, D and E had significantly (P≤0.05) better feed conversion ratio than of group A.

4.4.2 Carcass measurement

4.4.2.1Carcass and non carcass yield

As shown in table (37) treatment effect on percent of carcass dressing significantly difference, higher dressing was obtained by groups D and E then followed by groups B and C, group A had the lowers dressing percentage value.

Treatment effect on percent of giblets gizzard, liver, heart and intestine weight was not significant (P>0.05), the significant difference (P≤0.05) was found in abdominal fat percent, the result indicated that the chicks of groups A and B obtained significantly (P≤0.05) higher abdominal fat percent than that of groups C, D and E.

Experiment (IV): Hot pepper

Table (36): Effect of adding different levels of hot pepper on body weight gain (gm), feed intake (gm) and feed conversion ratio

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Body weight gain (gm)	1559.95^{b}	1649.93^{a}	1657.19^{a}	1708.05^{a}	1718.19^{a}	80.06^{*}	32.11
Feed intake (gm)	3269.73^{a}	3304.62^{a}	3322.86^{a}	3363.89^{a}	3402.74^{a}	$227.9^{n.s}$	73.95
Feed conversion ratio	2.09^{a}	2.00^{b}	2.01^{b}	1.97^{b}	1.98^{b}	0.04872^{*}	0.01581

Any two mean values having same superscript within rows are not significantly different (P≤0.05).

n.s = No significant difference (P≤0.05)

* Significant difference (P≥0.05).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Hot pepper 0.5%

D = Hot pepper 1.0%

E = Hot pepper 1.5%

Table (37): Effect of adding different levels of hot red pepper on dressing (%), heart (%), liver (%), gizzard (%), abdominal fat (%) and intestine weight (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Dressing(%)	68.95^{c}	69.03^{b}	69.05^{b}	69.13^{a}	69.14^{a}	0.5435^{*}	0.1672
Heart (%)	0.75^{a}	0.77^{a}	0.75^{a}	0.78^{a}	0.73^{a}	$0.05954^{n.s}$	0.01826
Liver (%)	2.80^{a}	2.83^{a}	2.84^{a}	2.85^{a}	2.86^{a}	0.05954^{ns}	0.01826
Gizzard(%)	2.71^{a}	2.72^{a}	2.73^{a}	2.74^{a}	2.75^{a}	$0.05954^{n.s}$	0.01826
Abdominal fat (%)	2.73^{a}	3.53^{a}	2.54^{b}	2.43^{b}	2.39^{b}	0.4568^{*}	0.1439
Intestine weight (%)	5.58^{a}	5.51^{a}	5.52^{a}	5.56^{a}	5.59^{a}	$0.5225^{n.s}$	0.1602

Any two mean values having same superscript within rows are not significantly different (P≤0.05).

n.s = No significant difference (P≤0.05)

* Significant difference (P≥0.05).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Hot pepper 0.5%

D = Hot pepper 1.0%

E = Hot pepper 1.5%

4.4.2.2 Commercial cuts

Commercial cuts drumstick, breast and thigh percentages are presented in Table (38), there was no significant ($P \leq 0.05$) treatments effect in drumstick breast and thigh percentage values and all treatment groups mean values were similar. The treatment group values of meat expressed as percentage from total weight of selected commercial cuts is given in Table (39), no significant ($P \leq 0.05$) effect was observed between the groups in the meat of breast, thigh and drum stick.

Table (38): Effect of adding different levels of hot pepper on breast (%), thigh (%) and drumstick (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Breast (%)	24.41^{a}	24.46^{a}	24.46^{a}	24.47^{a}	24.49^{a}	$2.937^{n.s}$	0.9006
Thigh (%)	19.29^{a}	19.33^{a}	19.30^{a}	19.30^{a}	19.36^{a}	$0.2917^{n.s}$	0.08944
Drumstick(%)	19.10^{a}	19.11^{a}	19.11^{a}	19.12^{a}	19.13^{a}	$0.0842^{n.s}$	0.02582

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Hot pepper 0.5%

D = Hot pepper 1.0%

E = Hot pepper 1.5%

Table (39): Effect of adding different levels of hot pepper on breast meat (%), thigh meat (%) and drumstick meat (%)

Parameter	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Breast meat (%)	81.79^{a}	81.81^{a}	81.83^{a}	81.85^{a}	81.86^{a}	$1.0561^{n.s}$	0.3167
Thigh neat (%)	83.23^{a}	83.25^{a}	83.22^{a}	83.25^{a}	83.27^{a}	$0.5359^{n.s}$	0.1643
Drumstick meat(%)	75.58^{a}	75.60^{a}	75.95^{a}	75.64^{a}	75.66^{a}	$4.6^{n.s}$	1.411

Any two mean values having same superscript within rows are not significantly different (P≤0.05).
n.s = No significant difference (P≤0.05)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Hot pepper 0.5%

D = Hot pepper 1.0%

E = Hot pepper 1.5%

4.4.3 Meat quality parameters

4.3.1 Panel test (subjective meat attributes)

The effect treatment on subjective meat attributes is shown in Table (40). The average subjective meat quality score color, tenderness, juice and flavor and overall acceptability of leg cuts (thigh and drum stick) did not differ significantly ($P \leq 0.05$) among the dietary treatment and scores given for all attributes are above moderate acceptability

Table (40): Effect of adding different levels of hot pepper on quality attributes

Quality attribute	Samples					$Lsd_{0.05}$	SE±
	A	B	C	D	E		
Tenderness	6.67^{a}	6.69^{a}	6.70^{a}	6.72^{a}	6.73^{a}	$0.7142^{n.s}$	0.2195
Flavor	6.17^{a}	6.17^{a}	6.19^{a}	6.19^{a}	6.18^{a}	$0.8228^{n.s}$	0.2524
Color	6.20^{a}	6.18^{a}	6.20^{a}	6.20^{a}	6.16^{a}	$0.6761^{n.s}$	0.2076
Juiciness	6.13^{a}	6.00^{a}	6.09^{a}	6.10^{a}	6.12^{a}	$0.6044^{n.s}$	0.1850

Any two mean values having same superscript within rows are not significantly different ($P \leq 0.05$).

n.s = No significant difference ($P \leq 0.05$)

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Hot pepper 0.5%

D = Hot pepper 1.0%

E = Hot pepper 1.5%

4.4 serum parameter

4.4.1 Serum metabolites

The serum metabolite value of broiler chicks fed different levels of hot pepper for 6 weeks were shown in Table (41) mean values of cholesterol were higher significantly ($p<0.05$) in groups A, and B, compared to groups C, D, and E, no significant difference is seen between, C, D, E. however cholesterol decreased as the level of dietary hot pepper increased.

Treatments effect on total protein, urea and glucose was not significant ($p>0.05$).

4.4.2 Serum enzyme activity

Enzyme activities value of broiler chicks fed different levels of hot pepper for 6 weeks are shown in table (42) no significantly ($p>0.05$) differences were observed in ALP values between the various treatment groups. The AST values were significantly ($p<0.05$) higher in groups A and B in compared to groups C, D and E, although no significant differences is found between B, C, D, and D.

4.4.3 Serum electrolytes

The serum electrolytes value of broiler chicks fed different levels of hot pepper for 6 weeks were shown in table(43) Treatments effect on The serum electrolytes were not significant ($p>0.05$).

Table (41): the effect of different levels of hot pepper on the serum metabolites of broiler chicks for (6) weeks

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
Urea	5.33^{a}	5.00^{a}	5.00^{a}	4.33^{a}	4.00^{a}	0.5954^{NS}	0.1826
Total protein	3.37^{a}	3.43^{a}	3.40^{a}	3.43^{a}	3.47^{a}	0.3522^{NS}	0.108
Glucose	227.67^{a}	215.90^{a}	223.23^{a}	228.77^{a}	220.03^{a}	22.37^{NS}	6.86
Cholesterol	126.20^{a}	129.17^{a}	110.07^{b}	113.77^{b}	114.67^{b}	8.244^{*}	2.528

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Hot pepper 0.5%

D = Hot pepper 1.0%

E = Hot pepper 1.5%

Table (42): the effect of different levels of hotpepper on Enzyme activity of the broiler chicks for (6) weeks .

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
ALP	155.90^{a}	152.27^{a}	148.30^{a}	141.77^{a}	140.03^{a}	23.93^{NS}	7.339
AST	37.77^{a}	34.65^{a}	30.63^{b}	30.31^{b}	30.58^{b}	8.24*	2.527

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Hot pepper 0.5%

D = Hot pepper 1.0%

E = Hot pepper 1.5%

Table (43): the effect of different levels of hot pepper on the Minerals of broiler chicks for (6) weeks

Treatments	A	B	C	D	E	**$Lsd_{0.05}$**	**SE±**
Ca	4.80^{a}	4.77^{a}	4.10^{a}	4.83^{a}	4.30^{a}	0.3766^{NS}	0.1155
P	7.67^{a}	7.63^{a}	7.43^{a}	7.67^{a}	7.53^{a}	1.106^{NS}	0.3391

Any two mean values having same superscript in a column are not significantly different ($P \leq 0.05$).

Key:

A = Control without antibiotic

B = Control with antibiotic

C = Hot pepper 0.5%

D = Hot pepper 1.0%

E = Hot pepper 1.5%

4.5 Economic appraisal

The total costs, returns and profitability ratio per head of broiler chicks fed different levels of Hot pepper and anti biotic for 6 weeks are shown in table (44)

Chicks purchase, feed, electricity, and labor cost values were the major in put considered. Te total selling values of meat is the total revenues obtained. Profitability ratio (1.21) of tested group E were the highest of the tested groups

Table (44) Total cost ,returns and profitability ratio per head of broiler chicks fed different amounts of hot red pepper and anti biotic for 6 weeks

Items	**A**	**B**	**C**	**D**	**E**
Cost					
Chicks purchase	2800	2800	2800	2800	2800
Feed Cost	2975.25	3006.77	3023.10	3061.21	3097.03
Electricity	1	1	1	1	1
Labor and mange	4	4	4	4	4
TOTAL	10775.25	10806.77	10823.10	10861.21	10897.03
Revenues					
Average live weight of bird	1662.95	1743.22	1750.19	1801.12	1811.26
Dressing%	68.95	69.03	69.05	69.13	69.14
Average weight of carcass	1140.61	1203.35	1208.38	1245.16	1252.31
Price/Kg of bird	17	17	17	17	17
TOTAL	19390.37	20456.96	20542,46	21167.76	21289.19
Profits					
Total revenues	19390.37	20456.96	20542,46	21167.76	21289.19
Total cost	10775.25	10806.77	10823.10	10861.21	10897.03
Profit/chick	8615.12	9650.19	9719.36	10306.55	10392.16
Profitability ratio	1	1.12	1.13	1.20	1.21

CHAPTER FIVE

DISCUSSION

The objective of the present study is to investigate the effect of inclusion of dietary garlic, ginger, spearmint, and red hot pepper in form of powder in broiler chicks ration, 0 – 6 weeks, on feed intake, rate of growth, feed conversion efficiency, carcass characteristics, serum metabolites. Through out of the experimental period of the four experiments, the mortality rate was negligible with no differences among all treatment groups, the appearance health of stock was good throughout the experiment period these was agreed with Arkan, *et. al.*, (2012) they found all broiler appearance healthy and no mortality occurred throughout the entire experimental period when they use ginger as feed additive at the following concentrate (0.1, 0.2%),El Husseiny, (2002) found that hot pepper fed to broiler chicks at dietary doses of 1, 1.5 and 2% had no significant cumulative toxicity at doses administrated also Amal, (2012) did not found any health adverse condition when she used menthe essential oils and some other medicine plant essential oil's this may be as Delaquis and Mazza, (2008) explained that natural occurring biological active components from plants are genarly assumed to be more acceptable and a rich source of potential disease control agent.

The results of this study indicated that, addition of different level of garlic, ginger, spearmint and hot red pepper powder as a natural feed additives, had no significant effects on feed consumption. ($p>0.05$). The absence of significantly effects of these additives on feed intake was probably due to the intense smell of these natural additives, which required a period of adaption for chicks to this type of feeds. These results were agreed with several researchers, Jafindal, *et al* . (2008); Ashayerizadeh, *et al*. (2009); Dieumou, *et al*. (2012) ; Issa, *et al*. (2012); Amouzmerha, *et al* ., (2013); Zolika, (2014) for garlic; Doley, *et al*. ,(2009);

Zang, *et al*.,(2009)and Fahkime, *et al*.,(2014) for ginger; Howida, (2009) and Bushra,(2011) for spearmint and Awad Elkareem, (2007) for hot red pepper . All these workers reported that, feed intake of broiler chicks was not affected significantly by the addition of these herbs and their extracts to the diets. These results were disagreed with finding of (Racesi, *et al*., 2010; Dieumou, *et al* .,2012 ; and Eltazi, *et al*., 2014) ;(Rafiee, et al., 2014 and Ademola, et al., 2009);(Galib, *et al*., 2012, Ocake, et al., 2008 and Amal, 2012) and (AL.Kassie, *et al*., 2012) who found that ,the addition of garlic, ginger, spearmint and hot red pepper , respectively to the diet increased significantly the feed intake of broiler chicks . In contrast the chicks fed on garlic (Arkan, *et al*., 2012); ginger(Zomrawi 2013, Hertwi ,2010 and safa 2014); hot red pepper (El-Hussiny, *et al*., 2002 and ALtazi, 2014)were consumed significantly less feed compared to those of control group. This may be attributed to the strong bitter test of these herbs when used at high doses. (AL-Harthi, 2002; Outonola, *et al*., 2010; ALtazi, 2014;and Hossini, 2011).

Concerning body weight gain in the present study , results showed a significant ($P<0.05$) improvement in body weight gain recorded from chicks fed the diets supplemented with garlic, ginger, spearmint and hot red pepper at various levels impaired with those negative control (NC) while the different was not significant when compared with antibiotic (PC) group . The improvement of body weight gain achieved by these natural feed additives may related to their content of active components such as allicin in garlic, gingrole and gingerdoine in ginger , p-cymene, carvone and thymol in spearmint and capsaicin in hot red pepper which posses pharmacological properties act as anti bacterial (Konjufca, *et al*,1997, Jimoh *et al* 2013; Moorthy, *et al*., 2009; Chie, 1984; Jafari, *et al*., 2011 and ALnakri, *et al*., 2004); anti oxidiant (Borck, 2001,Koch and Lawson, 1996, Ali ,*et al*, 2008, Zang ,*et al* , 2009, Abdulahdi and Ismail, 2012,Mimica Dukic, *et al*. ,

1999), antiviral (Weber, *et al*., 1992) and anti fungal(Ankari and Mirelman, 1999,Rafiee, *et al*., 2014, Jafari, *et al*., 2011). The active components in these natural additives also may be act as stimulant digestive enzymes in the intestinal mucosa and pancreas and feed efficiency subsequently increasing growth rate (Platel and Srinvason, 2000; Demir *et al*., 2005, Iqpal, *et al*., 2011and Amal, 2012). The results of this study are in line with the finding of several researchers. Safa, (2014) found a significant increased in body weight gain of broiler fed 1% and 1.5% ginger powder , also Garcia, *et al*., (2007) and AL-Homidan,(2005) stated that, the body weight gain was increased significantly when the broiler chicks fed 2.5 % and 6% ginger powder . EL-Tazi, *et al* .,(2014) found that, broiler chicks fed on garlic powder at level of 2, 3and 4% were gained significantly higher weight than those of control group. Similarly, Fayed, *et al*. (2011) and Ziton,(2009) Ahmed,(2005) , found that, dietary garlic powder improved significantly the weight gain of broiler. Galib, *et al*. (2010) reported that, the addition peppermint at levels of 0,25, 0,5,1 and 1,5 % improved significantly the body weight gain of broiler .Also the results of present study were consist with finding of AL-Hussini, et al. (2002) who found that, the addition of hot red pepper to the diet at levels of 1, 1.5, and 2% improved significantly the body weight gain of broiler chicks . Similar results were obtained by ELdeek and ALharthi (2005b) and ALkassi, *et al*.,(2011) . On the other hand, many researches stated that, the body weight gain of broiler was not affected significantly by the dietary garlic powder (Issa ,et al .,2012 and Bostagilo, 2005); ginger (Zange, *et al* 2009 EL-Deek, *et al* 2002 Ghzaiah, *et al* 2007) spearmint(Howida, 2009 and Bushra, 2013) or hot red pepper(Awad ALkareem, 2007, and Tollba et al 2007). In contrast several studied showed that, the use of these natural feed additives were depressed the body weight gain of broilers. Najafi and Taherpour (2012) reported that addition of ginger powder at levels 0.4 and 0, 8% in the diet was significantly decreased the body weight gain of

broilers, also Safa (2014); Herati and Marjuki (2011) and Zomrawi, (2013) , mentioned that, increased ginger powder in the ration up to level 2% showed significantly lower body weight gain of broilers. Similarly, Pourali , et al 2010 stated that , broiler chicks fed garlic powder at levels more than 0.6 decreased the body weight gain .They attributed that to the repulsive Oder and the test of diet with level of garlic more than 0.6% probable decrease feed intake and consequently body weight gain . Williams and Kienholz, (1974) found that, addition of hot red pepper at level of 12% in the diet significantly reduced growth to 84% of the control broiler checks weight. however, many significant evidence demonstrated that many of herbal and spices have medicinal properties that alleviated symptom and may prevent diseases, but high use of them may cause toxicity due to the strong bitter taste and reduced the feed intake which could be led to reduction body weight gain. (Safa, 2014 ;Hossini, 2011and Fiicker, et al 2003).

Respect to the feed conversion ratio (FCR) in this study, results indicated that, supplementation of different type of natural feed additives at various levels into diets improved significantly ($P<0.05$) the feed conversion ratio of broiler chicks comparative to NC diet. There were no differences between these additives and PC diet at different inclusion levels in term of FCR. Better feed conversion ratio of broilers fed these natural feed additives in the present study, may be due to the antibacterial properties of these supplements , which can lead to decrease the harmful microbes in digestive system resulted in better digestion and absorption of the nutrient and finally leading to improvement in FCR (Teleki, 2007; Chevallier , 1999;Lowies, et al, 2011; Zomrawi ,2013; ELtazi, et al 2014).The reduction of the inflammatory ration at the intestinal mucosa due to anti inflammatory properties these natural additives , leads also to increased the villous area and of the functions of recreation , digestion and absorption of nutrient by mucosa thereby , improve

the feed efficiency utilization (Iqbal, et al 2011; Chiej,1984;Gracia, et al 2007) Moreover, the antioxidant properties of these natural feed additives may stimulated protein synthasis by bired enzymatic system and improved the FCR (Jaafri , 2011) . Similar results were recorded by Altazi et al (2014) ; Raecesi, et al (2011) ; Ziton, (2009);and Fayed, et al (2011), for garlic, Safa (2014), Hertwi, (2010);Najafi and Faherpour (2014) and Arkan, et al (2012) for ginger ; Alkasi, et al (2011), El deek and AL-Harthi (2005b) , ALharthi (2005b) ;and ELHussini et al (2002) for hot red pepper and Galib (2010) and Amal (2012) for spearmint .These results inconsistent with the findings of (Awad Elkareem, 2007 and Williamsi and KLenholz 1974), (Botsglu, 2004, Bolukashi, et al 2006 ,Essa, et al 2012) ; (Zomrawi, 2013) and (Hawida, 2009 and Busra , 2013) who found that , addition of hot red pepper, garlic, ginger and spearmint had no significant effect on FRC of broiler respectively.

The results of the present study showed that, dietary garlic, ginger, spearmint and hot red pepper powder at different levels of inclusion , performed similar to antibiotic growth promoter on body weight gain, feed intake and FCR of broiler chicks . The similar trends of these four natural additives as antibiotic growth promoter in improving performance of broiler may attributed to their mode of action to decrease the number of pathogenic Bactria and formation of a more stable intestine flora (Telkeli, 2007 and Amal, 2012) and improve the efficiency of utilization feed in consequence of a better digestion and absorption of nutrient due to active ingredients in this additives. Similarly, Fotea, et al (2009); Diumou, et al (2012); Amal, (2012); Zolikha, (2014); Abzaz, (2008) and Teliki, et al (2011) stated that, the dietary herbal extracts as a natural feed additive may have similar effect as that of antibiotic growth promoter in broilers.

The effect of garlic, ginger and spearmint at all inclusion levels on dressing percentage was not significant in this study. Similar effect was recorded in garlic

by Ziton, (2009), and Fayed, et al (2011); and Ahmed, (2005)and Dimou, et al (2009), on ginger by ELDeek, *et al* (2002) and Moorthy, *et al* (2009) and on spearmint by Howida (2009) and Bousra (2013). These results are contradictory with finding of EL-Tazi, *et al* (2014)who found that, the hot and could dressing percentage were increased significantly for birds fed on garlic powder at levels 2,3and 4% as compared with control group . likewise, Safa, (2014) reported that diet supplemented with 1% and 2% ginger powder produced significantly higher dressing percentage, while the lower dressing percentage was significantly obtained by the diet 2% ginger powder as compare with the control diet.

The results of this study showed that , inclusion of hot red pepper at levels 1% and 1.5% in the diet produced significantly ($p>0.05$) high dressing percentage as compared to NC and PC . This results is equally in harmony with the finding of El-Hossini et al ,(2002) who stated that, the addition of hot red pepper at level of 1% and 1.5% in the diet improved significantly the dressing percentage. Similarly EL-tazi (2014) found that, birds fed on the highest level of red hot pepper 1% significantly the highest dressing percentage compared with control group.

The results of this study showed non- significant differences among all treatments groups in the percentages of liver, heart and gizzard this results is supported by the findings of EL-Tazy (2014) for the hot red pepper, Barazeh et al (2013) in ginger, Fyed et al ,(2011) garlic , Dahal and Farran (2011) for spearmint . These results are inconsistent with finding of Safa (2014) who reported that, birds fed up to 2% ginger powder decreased significantly liver and gizzard percentages of broilers. The relative weight of intestine also was not affected significantly by the treatment in this study and this are agrees with finding of Al-Harthi (2002) who reported that , the cecium length did not affected significantly by the addition of garlic and hot red pepper at levels of 0.5, 1, 1.5% in the broiler diet. Similarly, Javandel, et. al.(2008) detected no significant effect on intestine percentage of broilers fed garlic

powder at level up to 2%. In contrast, Ademola, et al (2009) reported that, addition of garlic and ginger powder at level of inclusion 2% increased significantly intestine tract weight. Similarly, Teleki et al (2011) stated that, ileum and small intestine showed significantly increased in ginger and proppoils extraction and cecium increased significantly in antibiotic supplemented group.

with respect to the effect of dietary inclusion of garlic, spearmint and hot red pepper in the diet on the abdominal percentage, significantly (P>0.05) lower abdominal fat percentage were recorded for broiler chicks fed on these natural feed additives at all level of inclusion as opposite to those of (NC) and antibiotic (PC) group which recorded the highest abdominal fat percentages. The reduction of abdominal fat for the diets that supplement with these natural feed additives may attributed to possess lipids lowering effects (Arwal,1999 and Kawda, et al , 1988) however, the mechanism of reducing abdominal fat by herbs feed additive may be through increasing the secretion of lipase and secondary bile acids. At the result, lower amounts of fatty acids are accumulate in abdominal cavity because of high lipid metabolism due to lipase secretion , this results are in line with finding of EL-Hossini (2002) and EL-Tazi et al (2014) who found addition of hot red pepper and garlic powder in the diet significantly decreases the abdominal fat in broilers . the highest abdominal fat values produced by antibiotic diet in this study is supported by the finding of Ashayerzadeh et al (2009) who found that , Flavomycine antibiotic significantly increased the amount of abdominal fat in broiler. In contrast, Mokhtari, et al (2010) stated that, the lowest abdominal fat in chicks received antibiotic diets. The results of this study showed that the abdominal fat values were not affected significantly by the dietary ginger at all levels of inclusion. This results are consistent with the finding of Barazeesh, et al (2013) and Fakhim, et al (2013). In contrast, several studies showed that, the addition of ginger and it is essential oil s to broiler diet reduced significantly the

abdominal fat percentage of the broiler (Rafee *et al* 2013; Voliollahi *et al* , 2014 and safa , 2014).

Treatment effect in the four experiments describe in this study was not significant on commercial cuts (thigh, breast, and drum stick) percentage and their separable tissues. These results were agreed with finding EL-Deek, *et al* (2002) and Moorthy, *et al* (2009) who observed no significant effects on carcass yield of broiler fed different levels of powder and extract of ginger . Amouzmerhr, *et al* (2013) found inclusion of garlic extracts at levels of 0.3% and 0.6% did not affected breast and thigh percentages of broilers. Similarly Amal, (2012) stated that addition of spearmint essential oil in the diet at levels of 50 , 100 and 150ppm /ton had no significant effect on thigh ,breast and drumstick of broilers. These results are inconsistent of the finding of Safa (2014) who stated that, thigh ,breast and drumstick percentages were increased significantly in broiler fed with 1% mixture of hot red pepper and black pepper compared to control group. EL-Tazi, *et al* (2014) reported that,addition of garlic powder at levels of 2, 3, and 4% in the diet significantly increased the breast percentage and decreased the thigh and drum stick of the broilers . Alcicek, *et al* (2004);Tollba, *et al* (2007); Ademola, *et al* (2009);and Javed, *et al* (2009) stated that, carcass characteristics were improved significantly in broiler fed different levels of powder or aqueous extracted of ginger.The results of the present study showed that, the subjective meat quality values of broiler (color, juiciness, tenderness and flavor) were not affected significantly by the dietary garlic, ginger, spearmint and hot red pepper at all various inclusion levels. These results are confirmed by several studies. EL-Tazi, et al (2014) detected no significant effect on subjective meat quality parameter (color , juiciness, tenderness and flavor) of broilers fed on different levels (2 , 3 and 4%) of garlic powder . Amal, (2012) reported that, addition of spearmint essential oil at levels of 50, 100 and 150ppm /ton did not have any significant

effect on subjective meat quality of broilers. Safa (2014) stated that, the subjective meat quality parameters were not affected significantly by ginger powder at levels o,1, 1.5, and 2% in the broiler diet and all scores being at above moderate values. These results are inconsistent with those obtained by many researches. Zomrawi (2013) found that, the high percentage value of sensory evaluation for(color, texture, and flavor) were obtained by the broiler fed on 0.5% ginger powder, wereas, more tenderness and juiciness by bird fed 1.5% of ginger . Eugèiuszr and Edayat (2007) stated that, diet containing 5mg/kg dried garlic powder contribute to increase sensory assessment of chicks meat. Khalfalla, *et al* (2011) foud that, the hot red pepper at level of 10g/kg in the diet increased tenderness scores of broilers meat. Dahal and farran (2011) reported that, tested meat sample at three groups of broiler chicks fed on mint, thyme or cardamom dried medicinal plants gave highly significant of flavor scores compared with control groups.

The results of serum metabolites showed that, cholesterol values were significantly ($P>0.05$) lower in groups fed on garlic, ginger ,spearmint and hot red pepper compared to NC and PC groups. The reduction of serum cholesterol in the diets supplemented by these natural feed additives could be due to the active ingredient of medicine herbs such as borneol, allcin,citral, geraniol , methone , menthol, tenenold, tremolo, carvacrol and ionone, which inhibit the activity of 3- hydroxyl-3- methylglutaryl co-enzyme A reductase (HMG- CO A) in the liver Crowell, (1999) Elson, et al, (1989) this enzymes is a key regulation in cholesterol enzyme synthesis. according to Case, et al (1995) , 5% inhabitation of H M G- CoA reductase will lower serum cholesterol in poultry up to 2%. In addition the reduction in blood cholesterol could be attributed the reduction in some hormones secreted by corter of adrenal glands , which in turn causes the reduction in. The secration of fatty acids frome adipose tissue or a reduction of fat oxidation that lead to reduction of level of fatty acids inclusion cholesterol and triglyceride (Aami

– Azghadi et al 2010, Khaeajli et al 2012 and Rafiee et al 2014). This results were agreed with those of Alkasi (2009) and Ologhobo et al (2008) who reported that addition of garlic in broiler diet caused a reduction in serum cholesterol levels, due to the garlic can facilitate the activity of enzymes which are involved in the conversion of cholesterol to bilious acids and subsequently, there by less cholesterol levels . also the results of the present study were agree with Alkassi, et al (2011) who state that, the addition of red pepper in the broiler diet to level up to 1% depressed the serum cholesterol concentration . likewise, the result of this study were similar to finding Zomrawi (2013) who pointed that, feeding broiler chicks ginger powder at level of 0.5 and 1% decreased serum cholesterol levels. Also, the results of this study are consistent with those of Amal (2012) who mentioned the addition of spearmint essential oils at levels of 50, 100, 150 ppm /ton of broiler diet caused significant reduction in the level of serum cholesterol due to the active ingredient menthol and methone in spearmint oil which are responsible of the decreasing serum cholesterol in broiler.

The serum total protein level was not influenced by the dietary treatment in this study. This results could be supported by the finding of AL-Homidan, et al (2005) who reported that, serum total protein was not affected significantly when broiler chicks fed on 2% garlic or 2% ginger. Similar results also obtained by Amal (2012) who found the addition of spearmint essential oils at various levels had no significant effects in total serum protein. Contradict to the results of this study , Fadallah ,et al (2010) reported that, serum total protein level was higher when chicks fed 0.3 , 0,45, 0.6% garlic powder compared to control. Zomrawi (2013) found lower value of serum total protein for broiler fed in 2% ginger powder. The results of the present study recorded no significant differences among the experimental groups in serum glucose. Similar results, were obtained by Barazesh, et al (2013) for ginger; Mansoub, et al.,(2011) garlic ; and Jafari, et al.,(2012) for

spearmint, contrary to this results there are reports on blood glucose reduction using either dietary garlic(Ernst,1987) or ginger (Akhani, *et al* 2004; Jamel, *et al* 2010). This description may be justified as follows : the blood glucose level are maintained by critical homeostatic mechanism depending on the stage of growth and maturity , feed consumption productivity and environmental change (Platel, *et al*.,2004) . The result of the present study showed that, dietary effect was not significant on serum urea level , this is in the same line with Onyimony ,*et al*(2012) who found no significant differences in serum urea level between chicks fed on 0.25, 0.5,and 0.75% garlic powder and control group . Similarly, An, *et al* (2007) reported that level of the serum urea was not affected by the addition of hot red pepper in broiler diets.

Use of garlic , ginger ,spearmint and hot red pepper powder of different levels in broiler diets caused significant $p>0.05$ reduction in the activity of aspartic amino transferas (AST) enzyme compared to PC and NC groups within the normal range , wereas the treatment effect was not significant on alkaline phosyphotase (ALP) enzyme and all values being in the normal range. The reduction of AST enzyme activity related to the dietary natural growth promoter in this study may be due to their protective action in the liver. Vital organs lesion , especially the liver were believed source of enzyme linkage to blood, hence normal peripheral enzyme reflect the integrity of most vital organs (Kaneko *et al* , 1997). This was confirmed by the absence of liver diseases in the experimental birds in the present study , this was also explained by Liu and Ng (2000) who reported that, the tested ingredient possess anti-oxidant properties, thereby preventing un healthy reaction of free radicals with lipid protein and other molecule causing them to lose their structure and functions . This properties are attributed to various active phytochmical compounds including vitamins, carotinoid , terpenoids , alkaloids, simple phenols acids .These results were similar to the finding of (Moure *et al* 2001) who reported

that hot red pepper was found to have high level of antioxidants like phenolics and flavonoid content, this have modulating role on physiologicale function and biotranformation reaction involved in detoxification process there thereby providing protection from cytotoxic , genotoxic and metabolic effect of environment toxicants.The result on ALP enzyme activity in this study could be supported by the finding of Zomrawi (2013) who found that, addition of ginger at level up to 1.5 % did not have any significant effect on ALP activity. The effect of experimental natural feed additives of various levels of inclusion in the diet, on serum biochemical parameters serum electrolytes (Ca nd P) was not significant, this results could be supported by the finding of Seyed et al (2012), Amal (2012) and Malekizadeh, *et al.*, (2012) . These results inconsistent with those of the Zomrawi *et al.* (2013) who showed that the Ca level decreases and P level increased by the addition of ginger to broiler diets.

However results cited in literature are highly variable about the degree of improvement in productive performance, carcass characteristic and serum biochemical content of broiler achieved by herbal and spices and their extracts as growth promoter. This may be attributed to the variation in efficiency of this natural feed additives which depend on several factors such as, variety of herbs, methods of cultivation and environmental condition (climate, soil, etc) age at harvest, storage condition, preparation and processed methods, beside the bird melerials, type of strain and age of bird, management condition and hygienic situation, form and doses of herb or spices used (Mohan, 2004) Barreto, et al.,2008) Pourali, et al.,2010 and Gorinstein, *et al*., (2010) . Farhad *et al*., (2013) Cross, *et al*., (2007).

The results of economically evaluation of experimental diets, showed that the addition of garlic , ginger spearmint hot red pepper at various levels to the diet of broiler was economically more profitable compared to NC . This may be due to the

highest return of the weight gains recorded by chicks fed these feed additives without affected feed intake significantly. This results could be supported by the finding of several researchers Ziton, (2009) found that net profit was increased in linearly trends as the level of dietary garlic increased in the diet . Similarly ,Awad Elkareem, (2007) and EL- Tazi ,(2014) reported that, the broiler fed 1% of hot red pepper obtained ahigher net profit compared with control group . Also Altazi, et al (2014) and Zomrawi (2013) stated that the highest economic value recorded by the diet supplemented with ginger powder at level 1% .

CONCLUSION AND RECOMMENDATION

Conclusion:

Incorporation of garlic, ginger, spearmint and hot red pepper powder at all levels in the diet as natural feed additives significantly enhanced the body weight gain and feed conversion ratio of the broiler similar to that achived by the antibiotic growth promoter group.

All levels of garlic, ginger, spearmint and hot red pepper powder added to the diet made no change in carcass characteristic of broiler.

Supplementing garlic, ginger, spearmint and hot red pepper powder at different level resulted in lower level of serum cholesterol and AST enzyme activity compared to either antibiotic PC or negative control NC , whareas the level of serum total protein , glucose , urea ALP enzyme activity, calcium and phosphorus were remained un changed .

Adding garlic, ginger, spearmint and hot red pepper to broiler diet economically is profitable.

Recommendation :

Practicale implications

Based on the results of this study , powder of garlic ginger spearmint and hot red pepper could be considered as potential growth promoters that may replace the antibiotic in broiler diets without any adverse effect

All levels of different natural feed additives added to broiler diet in this study were recommended economic – wise

Suggestion for future research:

More trials are needed to clarify the effect of different herbs and spices and their extracts as natural growth promotes on, performance, carcasses yield and meat quality, digestive system development, immune system , intestinal micro flora and blood constituent of poultry with regard to various management condition ,

including different stress factors, herbs and their extracts and the optimal dietary herbs application level, active substances, dietary ingredient and nutrients contents.

Further experiments are needed to test the synergistic effect of these herbs and spices and their extracts to prove additive or other wise

Finding of this study point on the possibility of using those natural feed additives in layer as well as testing for egg production and quality

The future research also should be focus on the use of other natural feed additive such as, enzymes,prebiotic, probiotic, synbiotic and organic acids in poultry production.

REFERENCE

Aami-Azghadi, M., Golian, A., Kermanshahi, H. and Sedghi, M. (2010). Comparison of dietary supplementation with cumin essential oil and prebiotic fermacto on humoral immune response, blood metabolites and performance of broiler chickens. *Global Veterinaria*, 4: 380-387.

Abaza, I.M., M.A. Shehata, M.S. Shoieb and I.I. Hassan, (2008). Evaluation of some natural feed additive in growing chicks diets. Int. J. Poult. Sci., 7(9):872-879.

Abdul Ghani, (2003) Medicinal Plants of Bangladesh with chemical constituents and uses; Asiatic Society of Bangladesh, Second Edition, 300.

Abdulahad D. and Ismail. C (2012) Hepatoprotective and antioxidant activities ofgrapeseeds against ethanol induced oxidative stress in rats. British Journal of Nutrition 107: 45- 51.

Abouelfetouh AY, Moussa NK (2012). Enhancement of Antimicrobial Activity of Four Classes of Antibiotics Combined with Garlic. Asian Journal of Plant Sciences, 11: 148-152. http://scialert.net/abstract/?doi=ajps.2012.148.152

Ackermann RT, Mulrow CD, Ramirez G, Gardner CD, Morbidoni L, Lawrence, VA (2001). Garlic shows promise for improving some cardiovascular risk factors. Arch. Int. Med., 161: 813-824.

Ademola SG, Farinu GO, Ajayi Obe AO, Babutunde GM. (2004). Growth, hematological and biochemical studies on garlic- and ginger-fed broiler chicken . Moor J. Agric. Res., 5(2): 122-128.

Ademola, S.G., G. Farinu and G.M. Babatunde, (2009).Serum lipid, growth and haematological parameters of broilers fed garlic, ginger and their mixtures. World J. Agric. Sci., 5: 99-104.

Aderemi ,f. Olufemi Alabi and Oluseyi Ayoola **(**2013) Evaluating Pepper (Capsicum annuum) and Garlic(*Alliumsativum)* on Performance Egg Trait and Serum Parameters of Old Layers Journal of Biology, Agriculture and Healthcare www.iiste.org ISSN 2224-3208 (Paper) ISSN 2225-093X (Online) Vol.3, No.7, 2013.

Afzal, M., D. Al-Hadidi, M. Menon, J. Pesek, and M. S. Dhami. (2001). Ginger: An ethnomedical, chemical and pharmacologicalreview. Drug Metabol. Drug Interact. 18:159–190.

Agarwal, K.C., (1996). Therapeutic action of garlic constituents. Med. Res., 16: 111-124.

Ahmed, S . (2005): Comparative Eveciancey of garlic, tumaric kalongias growth promoter in broiler. M.Sc. Thesis, Department of poultry Science, University of Agriculture, Faisalabad, Pakistan.

Akhani SP, Vishwakarma SL, Goyal RK (2004). Anti-diabetic activity of Zingiber officinale in Streptozotocin-induced type I diabetic rats. J. Pha. Phar., 56: 101-105.

AKhtar M.S., Afzal h., CHaudry F. (1984): Preliminary *in vitro* antibacterial screening of Bakain, and Zarisk against Salmonella. Medicose, 9, 6-7.

Akoachere, J. F. T. K., R. N. Ndip, E. B. Chenwi, L. M. Ndip, T.E. Njock, and D. N. Anong. (2002). Antibacterial effect of *Zingiberofficinale* and *Garcinia kola* on respiratory tract pathogens. EastAfr. Med. J. 79:588–592.

AL- Harthi, Al. M. A. (2002).Performance and carcass characterestics of broiler chicks as affected by different dietary types and levels of herbs, and spices as non classical growth promoters. Egypt. Poult. Sci. 22(1): (325-343).

Al-Ankari A.S., Zaki M.M. and Al-Sultan S.I. (2004) Use of Habek Mint(Mentha Longifolia) in broiler checken dies. *International Journal of Poultry Science*, 3(10), 629-634.

Alçiçek A, Bozkurt M. Çabuk M. (2004). The effect of mixture of herbal essential oils, an organic acid or a probiotic on broiler performance. South Afr. J. Anim. Sci., 34(4): 217-222.

AL-Homidan, A.A. (2005). Efficiency of using different sources and levels of Allium cepa, Allium sativum and Zingiber officinale on broiler chicks performance. Saudi Journal of Biological Sciences.12(2):96-102.

Ali, B.H., G. Blunden, M.O. Tanira, and A. Nemmar. (2008). Some phytochemical, pharmacological and toxicological properties of ginger (*Zingiber officinale* Roscoe): A review of recent research.Food Chem. Toxicol. 46:409–420.

Al-Kassie1, A.M Galib., Mamdooh A.M. Al-Nasrawi and Saba J. Ajeena(2011). The Effects of Using Hot Red Pepper as a Diet Supplement on Some Performance Traits in Broiler*Pak. J. Nutr., 10 (9): 842-845*Pakistan Journal of Nutrition 10 (9): 842-845, ISSN 1680-5194.

AL-Kassi A.M Galib; Ghassan Y.Butris bSaba J. Ajeena (2012) the potency of feed supplemented mixture of hot red pepper and black pepper on the performance and some hematological blood traits in broiler dietI.J.A.B.R., VOL. 2(1):53-57ISSN 2250 – 3579.

Al-Kassie, G.A.M.; Mamdooh, A.M.; Al-Nasraw, Saba and Ajeena, J. (2011). Use of black pepper (Piper nigrum) as feed additive in broiler diet. Research Opinions in Animal and Veterinary Science, 1(3): 169-173.

Al-Kassie, GAM, Jameel YJ (2009). The effect of adding Thyme vulgaris and Cinnamomuim zeylanicum on productive performance in broilers.

Proceeding of 9th Veterinary Scientific Conference, College Vet. Med., Univ. Baghdad, Iraq.

Amagase, H., Petesch, B.L., Matsuura, H., Kasuga, S., Itakura, Y.,(2001).Intake of garlic and its bioactive components. J. Nutr. 131 (S3), 955S– 962S.

Amal ,O.A. (2012) Use of oils in broiler Nutrition ,thesis submitted in Accodanace with the requerment s of the Sudan University of science and technology for the degree of Doctor of philosophy.

Amouzmehr, A.; Daster, B.; Nejad, J.G.; Sung, K.;Lohakare, J. and Forghani, F. (2013). Effect of garlic and thyme extracts on growth performance and carcass characteristics of broiler chicks. Poultry Industry Technical articles. Nutrition. Article. (170).

An, B. K. Im, H. J. and C. W. Kang (2007) Nutritional Values of Red Pepper Seed Oil Meal and Effects of Its Supplementation on Performances and Physiological Responses of Broiler Chicks Asian-Aust. J. Anim. Sci.Vol. 20, No. 6 : 971 – 975.

Angel, R., Dalloul, R.A. and Doerr, J., (2005). Performance of broiler chickens fed diets supplemented with a Direct-Fed Microbial. Poult. Sci. 84, 1222-1231.

Ankri, S. and Mirelman, D. (1999): Antimicrobial properties of allicin from garlic. Microbes infect.Feb.,1(2): 125-129.

Aporn, S. A.S.; Reawadee, U.S.A.O.; Penpak p. S.; Sawanit ,C.; Wunchai, P. (2008): Effect of Garlic (Allium sativum) Supplementation in Diets of Broilers on Productive Performance, Meat Cholesterol and Sensory Quality**.** Tropentag 2008, University of Hohenheim, October 7-9.Conference on International Research on Food Security, Natural Resource Management and Rural Development.

Arkan B. Mohamed,M. A.M.Al-Rubaee and Ali Q.Jalil. (2012) Effect of Ginger on performanceand Blood Serum Parameters of Broiler.International Journal of poultry Science 11(2):143-146.

Ashayerizadeh, O. B. Daster, M. Shams SHarph, E. Ashayerizadeh, E, Rahmatnejad and S. M. R. Hossaini, (2009), Use of Garlic (Allium sativum), Black Cumin Seeds (Nigella satival) and Wild Mint (Menthe longifolia) In Broiler chicken Diets. Journal of animal and veterinary 8(9): 1860-1863.

Association of Analytical Chemists. (1990). Official Methods of Analysis (A.O.A.C.) 15th Ed. Washington D.C.

Awad ELkareem, M. E.(2007) Response.of chicks to diets containing hot pepper as natural feed additive . Thesis submitted in partial fulfillment for the requirements of the degree of master of science (animal production), collage of agriculture studies, sudan university of and technology.

Azaz, D., Demirci, F., Satil, F., Kürkcüog, ?lu. and Baser, K.H.C. (2002). Antimicobial activity of some Satureja oils. Z. Naturforsch. 57:817-821.

Barazesh, H.;M.B.Pour, S.Salari and, T. Mohammad Abadi (2013)The effect of ginger powder on performance, carcass characteristics and blood parameters of broilers, International journal of Advanced Biological and Biomedical ResearchVolume 1, Issue 12, 2013: 1645-1651.

Barbero, G.F., Palma, M. and Barroso, C.G. (2006)a. Pressurized liquid extraction of capsaicinoids from peppers. Journal of Agricultural and Food Chemistry 54:3231-3236.

Barrarto, m. s.r., Menten j,f. m. Racaniccia , a.m.c., Pereira, p.wz., and rizzo , p. (2008) plant extract used as growth promoters in broilers. Rev. Bras. Cienc. Avic. (Brazilin Journal of poultry science), 2: 109-115.

Bashir, S. M. (2000) Effect of irrigation and fertilization on herbage Yield and oil content of two spearmint species. M. Sc. Thesis, Faculty of Agriculture, University of Khartoum, Sudan.

Bassett, R. (2000). Oreganos positive impact on poultry production. World Poultry-Elsevier 16:31-34.

Bedford, M.R. (2000).Removal of antibiotic growth promoters from poultry diets. World Poultry Science. 34:507-514.

Bent Borg and Jesen (2004). Cereal micro flora as affected by dietary fibre of cereals and enzyme supplementation 69 zjad Naukowy OTZ Stri. 60.

Berghmann, L.R.; Abi-Ghanem, D.; Wagnela, S.D. & Ricke, S.C. (2005). Antibodies: an alternative for antibiotics? *Poultry Science*, Vol. 84, No. 4, pp. 660-666, ISSN 0032-5791.

Bianchini,F.,Vainoh.H(2001):Alliumvegetablesand organousluphur compounds:do they help prevent cancer Environ.Health prespect, 109(9)893.

Biovet S. A. Laboratories. (2005). The intensive Production and the Spreading of high productivity genetic stock have conditional common use of chemical substances known as Growth Promoter www. Thepigsite.com/articles.

Blamey, M. and Grey-Wilson, C. (1989). Flora of Britain and Northern Europe. ISBN 0-340-40170-2.

Blumenthal ,M. Goldberg,A. and Brinckmann J.(2000) Herbal medicine : expanded Commission E monographs (pp. 139-148). TX American Botonical Coucil.

Bolukbasi S, Erhan M (2007). Effect of dietary Thyme (Thymus vulgaris) on laying hens performance and *Escherichia coli* (E. coli) concentration in feces. Atatürk University, the Faculty of Agriculture,Department of Animal Science, 25240, Erzurum, Turkey.

Bolukbasi, S. and M. Erhan, (2007). Effect of dietary thyme (thymus Vulgaris) on lagging hensperformance and Escherichia coli (E. coli)concentration in feces. Ataturk university, the faculty of agriculture, Department of Animal Science,Erzurum, turkey.

Borck , C.(2001). Antioxidant health effect of aged garlic extract. J. Nutr. (Suppl.3): 1010- 1015.

Botsoglou, N. A., E. Christaki, P. Florou-Paneri, I. Giannenas, G.Papageorgiou, and A. B. Spais. (2004)a. The effect of a mixture of herbal essential oils or alpha-tocopheryl acetate on performance parameters and oxidation of body lipid in broilers. S. Afr. J.Anim. Sci. 34:52–61.

Botsoglou, N. A., P. Florou-Paneri, E. Botsoglou, V. Datos, I. Giannenas, A. Koidis, and P. Mitrakos. (2005). The effect of feeding rosemary, oregano, saffron and α-tocopheryl acetate on hen performance and oxidative stability of eggs. S. Afr. J. Anim. Sci.35:143–151.

Boyunaga, H. and Celik (1995). Kirmiziaci biber (capsaicin)bitkiselilac kaynagi mi. Billi Teknik Tubitak (6): 331.

Branter, A., Males, Z. &Antolic, A. (1996). Antimicrobial activity of paliurus spina-christi Mill.(christis thorn). . *J. Ethnopharmaco* 52: 119-122.

Buchman, N.P. J.M. HOT, S.E. Cutlip,AL, Rack, .Asamer, and j.s. Moritz .(2008) :The effect of anaturale antibiotic and anatural growth promoter feed addititive on broiler performance and carcass quality.j appl. Poult. Res.17: 202-210.

Bushra H, A, (2011). Effect of dietary levels of Spearmint (Mentha spicata) On Broiler chicks Performance .Thesis submitted in partial fulfillment for the requirement of master of science in animal production, department of animal nutrition faculty of animal production university of Khartoum.

Case, G.L., L., He H, Mo and C.E. Elson, (1995). Induction of geranyl pyrophosphate pyrophosphatease activity by cholestrol – supportive isoprenoids. Lipids. 30: 357- 359.

Casewell, M.; Friis, C. & Marco, E. (2003). The European ban on growth promotingantibiotics and emerging consequences for human and animal health. *Journal of Antimicrobial Chemotherapy*, Vol. 52, No. 2, pp. 159-161, ISSN 0305-7453.

Chang J (2000) Medicinal herbs: drugs or dietary supplements? Biochem. Pharmacol. 59:211–219.

Chevaller, A. (1996). The Encyclopedia of Medicin plant . published by DK publishing Inc, USK.

Chiej. R. *Encyclopaedia of Medicinal Plants.* (1984). MacDonald. ISBN 0-356-10541-5.

Chopra, R., S. Nayar and I Chopra, (1992). Second Glossary of Indian Medicinal Plants. Publications and information Directorate . New Delhi, India, P: 414.

Chrubasik, S., M.H. Pittler and B.D. Roufogalis, (2005).*Zingiberis rhizoma*: A comprehensive review on the ginger effect and efficacy profiles. Phytomedicine, 12: 684-701.

Coates, M.E., R.Fuller, G.F.Harrison, M.Lev, and S.F.Suffolk, (1963). A comparison of the growth of chicks in the Gustafson germ –free apparatus and in a conventional environment, with and without dietary supplements of Penicillin. Br. J. Nutr. 17: 141-150.

Colby, S.M, Alonso, W.R., Katahire, E.J., McGarrey, D.J.,and Groteau.R. (1993). 45.Limonene synthase from the glands of spearmint (Mentha spicata): cDNA isolation, characterization, and bacterial expression of the catalytically active monoterpene cyclase. J. Biol Chem. 268: 23016-23024.

Cormic, W.I.(2006). Using chilli pepper to burn drug abusers. Havard University Gazette, U.S.A.

Cross, D.E., McDevitt, R.M., Hillman K, Acamovic, T.(2007) The effect of herbs and their associated essential oils on performance, dietary digestibility and gut micro flora in chickens from 7 to 28 days of age. .Poultry Sci. 48:496-506.

Crowell PL (1999). Prevention and therapy of cancer by dietary monoterpenes. J. Nut., 129: 775-778.

Curtis, H., Noll, U., Stormann, J. and Slusarenko, A.J. (2004). Broad spectrum activity of the volatile phytoanticipin allicin in extracts of garlic (*Allium sativum* L.) against plant pathogenic bacteria, fungi and Oomycetes. Physiological and Molecular Plant Pathology 65: 79-89.

Dahal I.M. and Farran (2011). Effect of dried medicinal crops on the performance and carcass Flavor of broiler . International journal of poultry science 10(2):152- 156.

Dalkiliç B, Güler T (2009) The Effects of clove extract supplementation on performance and digestibility of Nutrients in broilers. F.Ü.Sağ. Bil. Vet. Derg., 23: 161–166.

Das, S. N.(2006).Medical Plants For Health And Wealth .Agrotech Publishing Acadmy Udaipur-313002, Saha P. and Das S (2003) Regulation of hazardous exposure by protective exposure modulation of Phase II detoxification and lipid peroxidation by *Camellia sinensis* and *swertia chirata*.Teratog Carcinog Mutagen Suppl. 1: 313 -322.

De Lucca, A.J., Boue, S., Palmgren, M.S., Maskos, K. and Cleveland, T.E. (2006). Fungicidal properties of two saponins from *Capsicum frutescens* and the relationship of structure.Canadian Journal of Microbiology 52(4), 336-342.

Delaquis PJ. Mazza G (2008). Antimicrobial properties of isothiocyanates in food preservation . Food Technol. 49:73.84.

Deman, J.C.(1975). The probability of most probable numbers. Eur. J. App. Microbiol. 1: 6778.

Demir E, Kilinc K, Yildirim Y. (2005) use of antibiotic growth promoter and two herbal natural feed additives with and without exogenous enzymes in weat base broiler diet.South Africa Anim.Sci., 35: 61-72.

Demir, E., Sarica, S., Ozcan, M.A., and Suicmez, M. (2003). The use of natural feed additives as alternatives for an antibiotic growth promoter in broiler diets. Br. J. Poultry Sci. 44:S44- S45.

Devegowda G. (1996): Herbal medicines, an untapped treasure in poultry production. In: Proc. 20th World Poult. Congr. New Delhi, India.

Diepvens, K., (2007). Regulatory intergrative andcomparative physiology. Am. J. Physio., 292: 77-85.

Dieumou, F. E., Dieumou, A., Teguia, Kuiate, J. R., Tamokou, J. D.,Fonge, N. B., and Dongmo, M. C, (2009). Effects of ginger (*Zingiber officinal*) and garlic (*Allium sativum*) essential oils on growth performance and gut microbial population of broiler chickens. Livestock Research for Rural Development 21 (8): 21-33.

Dieumou**,** F.E.; Teguia, A.; Kuiate, J.R.; Tamokou,J.D.; Doma, U.D.; Abdullahi, U.S. and Chiroma, A.E.(2012). Effect of diets fortified with garlic extract and streptomycin sulphate on growth performance and carcass characteristics of broilers. International Journal of Livestock & Production. 3(4):36-42.

Doley, S., J.J. Gupta and P.B. Reddy, (2009). Effect ofsupplementation of ginger, garlic and turmeric in broiler chicken. In. Vet. J., 86: 644-645.

Dorman, H.J.D. and S.G. Deans, (2000). Antimicrobial agents from plants: Antibacterial activity of plant volatile oils. J. Appl. Microbial., 88: 308-316.

Duncans, D.B., (1955). Multiple range and multiple F test. Biometrics, 11: 1-42.

Durrani F.R., Chand N., Zaka K., Sultan A., Khattak F.M., Durrani Z., **2007**. *Pakistan. J.Biol. Sci.* 10, 4164-4167.

Earss, (2005). (European Antimicrobial Resistance Surveillance System). Annual Report. Available from: URL:http://www.rivm.nl/earss/ (accessed 25 February 2009).

EL Deek, A. A. and AL Harthi, M. A. (2005a) Responses of laying hens to different levels of Amoxicillin, hot pepper and green tea as non-conventional feed additives on productive performance, egg quality, chemical composition and cholesterol of yolk and plasma constituent. Research Article. Abstract No. 332-Faculty of Meteorology, Environmental and Arid Land Agriculture. KING Abdulaziz University, KAS.

EL Deek, A. A. and AL Harthi, M. A. (2005b). Performance and carcass characteristics of broiler chicks as affected by different dietary types and levels of herbs and spices as non-classical growth Meteorology Environment and arid lan Agriculture. King Abdlaziz University KAS.

El Tazi1,S.M., Zolikha M. A; K.A Mohamed; Mukhtar A. (2014): Effect of using garlic powder as a natural feed additive on performance and carcass quality of broiler chicks.

El-Tazi, S . M.A., (2014) . Response of broiler chicken to diets containing red pepper as natural feed additive. Omdurman Islamic University. Journal of Science and Technology; 4 (5).

EL-Aidy, N.A.E.(1981). Chemical and technological studies on red pepper M.sc thesis, Faculty of agric. Kefre. EL Sheik, Tanta University Egypt.

El-Deek, A. A., Y. A. Attia, M. Maysa, and M. Hannfy. (2002). Effect of anise (*Pimpinella anisum*), ginger(*Zingiber officinale* Roscoe) and fennel (*Foeniculum vulgare*) and their mixture on performance of broilers. Arch. Geflugelkd. 67:92–96.

Elgayyar, M., F.A. Draughon, D.A. Golden, and J.R. Mount (2001). Antimicrobial activity ofessential oils from plants against selected pathogenic and saprophytic microorganisms. Journal of Food Protection 64:1019-1024

ELHusseiny, O.; Shalash, S. M and Azouz, H.M.(2002). Response of broiler performance to diets containing hot pepper, and/or fenugreek at different metabizable energy level . Egypt Poul. Sci. (11) : 387 – 406.

Ellis, N. (1981). The nutrients composition of Sudanese animal feeds. Bulletin (1): Northern and Central Sudan.Central Animal Nutrition Research Laboratory. Kuku Research Centre, Khartoum-North, Sudan.

Elson, C. E, G. I. Underbakke, P . Hanson, E. Shrago, R. H. Wainbeng. And A.A. Qureshi, (1989). Impact of lemograss oil an essential oil. On serum cholestrol lipids, 24: 677-679.

Ensminger, A.H. (1994). Foods and nutrition encyclopedia. Volume 1. CRC. Press. 1994. ISBN 0-8493-8980-1.p750.

Eugeiuszr, R. and Edyta, K. (2007). Herbs in animal feeding. Herba Polonica. 53(3):360-365.

Fadlalla IMT, Mohammed BH, Bakhiet AO (2010). Effect of feeding garlic on the performance and immunity of broilers. Asian J. Poult. Sci., 4: 182-189.

Fakhim, R., Y. Ebrahimnezhad, H. R. Seyedbadi, and T. Vahdatpour. (2013). Effect of different concentrations of aqueous extract of ginger (Zingiber officinale) on performance and carcass characteristics of male broiler chickens in wheat-soybean meal based diets. *Journal of Bioscience and Biotechnology*. 2(2):95-99.

Faleiro L., Miguel G., Gomes S., Costa L., Venancio Teixeira F., Figueiredo A., Barroso A.C., PedroJ.G., (2005). Antibacterial and antioxidant activities of essential oils isolated from Thymbracapitata L. (Cav.) and Origanum vulgare L. J. Agr. Food Chem. 53, 8162-8168.

Fallah ,R., Ali Kiani and Arash Azarfar (2013) Effect of Artichoke Leaves Meal and Mentha Extract (menthe pipreita) on Immune Cells And Blood Biochemical Parameters of Broilers on Immune Cells And Blood Biochemical Parameters of Broilers Global Veterinaria 10 (1): 99-102, 201.

Farad Samadian Saeed Zeinoaldini Armin Mohammed Amir Kaimi Torshizi,Zarbakhat Ansari Pirasaraei, Pedram Gholamzadeh (2013).Evaluation of some photogenic feed additives in growth performance chicks diets international journal of agriculture research and reviewIssn 2228-7973 Vol.3(1).35-43.

Fayed, R.H.; Razik, A.A. and Ouf, G. (2011). Effect of dietary garlic supplementation on performance, carcass traits and meat quality in broiler chicken. XVISAH Congress, Viena.

Ficker, C.F., Smith, M.L; Leaman, D.L., Irawati;C.and Amason, J.T. (2003): Inhibtion of humin pathogenic fungi by member of zingiberaceae used by Kenyah Indonesian porneo .J.Ethnopermacol., 85:289-293.

Galib, A. M. AL-Kassie and A. Noor, (2010). The role of peppermint (Mentha pipermint) on performance in broilers diets . Agriculture and biological journal of NORTH America. 1009-1013

Garcia, V.P.; Catala-gresgoria, P.;Hernandez, F,; Megias, M. D. and Marid, J (2007): Effect formic acid formic acid and plant extracts on growth, nutrient digestability, intestine mucosa morphology and meat yield of broiler.J. App. Poult. Res., 16: 555-562.

Ghazaiah AA, El-Hakim ASA. Refaie AM. (2007). Response of broiler chicks to some dietary growth promoters throughout different growth periods. Egyptian Poult. Sci. J., 27: 53-57.

Giannenas I, Florou Paneri P, Papazahariadou M, Christaki E, Botsoglou NA, Spais AB(2003) Effect of dietary supplementationwith oregano essential oil on performance of broilers after experimental infection with *Eimeria tenella*. Arch. Tierernahr. 57:99-106.

Gill, C. (2001). Safe and sustainable feed ingredients. Feed Int. 22:40–45.

Gorinstein. S., H. Leontowicz, M. Leontowicz, Z., Jastrzebski, K. Najman, Z. Tashma, E. Katrich, B. Heo, J.Cho, Y. Park and S. Trakhtenbeng. (2010): the enflunce of raw and processed garlic and onions on plasma and classical and non – classical Atherosclerosis Indices: Investegations invitro and in vivo phytother, Ress., 24: 706- 714.

Grieve, M., (1981). A Modern Herbal .Penguin., UK, P:902.

Griggs, J.P. and J .P . Jacob, 2005. Alternatives to antibiotics in organic poultry production . J . Appl. Poultry Res., 14: 750-756.

Guenther, E. (1949) The essential oil, 5th ed ., D.van Nostard company, Inc . (printing New Jersey, 50-77,- 83(vol.1), 676-683 vol 111.

Habiba et al (2011) Chemical composition and antibacterial activity of *Mentha pulegium* L.and *Mentha spicata* L. essential oils Der Pharmacia Lettre, 2011: 3 (4) 267-275 ISSN 0975-5071 USA CODEN: DPLEB4

Hadjlaoui, H. Najla, T. Emira, N. Mejdi, S. Hanen, F. Riadh, K. Amina, B. (2009) *World J.Biotechnol. Microbiol*.**,** 25: 2227–2238.

Hanczakowska, E. and Swiatkiewic, (2007) Application of herbs and herbal preparations in pig feeding. Ann. Anim. Sci., 7: 13-22

Harbarth S, Samore MH. (2005) Antimicrobial resistance determinants and future control. Emerg Infect Dis; 11:794-801.

Hashemi SR, Zulkifli I, Hair Bejo M, Farida A, Somchit MN (2008) Acute toxicity study and phytochemical screening of selected herbal aqueous extract in broiler chickens. Int J Pharmacol 4:352–360

Hawrysh, Z. J., Steedman- Douglas, C, D., Robblee, A.R., Harding, R.T and Sam , (1980). Influence of low glucosinolate (cv.Tower) rapessed meal on the eating quality of broiler chickeness.Poult. Sci. 59:550-557.

Herawati (2010). The Effect of Red Ginger as Phytobiotic on Body Weight Gain, Feed Conversion and Internal Organs Condition of Broiler. Intern. J. Poul. Sci. 9(10): 963-967.

Herawati and Marjuki. (2011). The Effect of Feeding Red Ginger (Zingiber officinale Rosc) as Phytobiotic on broiler Slaughter weight and meat Quality. *International Journal of Poultry Science*.10(12):983-985.

Herawati, (2006). Effect of red ginger (*Zingiber officinale*Rosc) phytobiotic addition to the broiler performance and blood profile. Pengaruh Penambahan Fitobiotik Jahe Merah., 14: 173-142.

Herbs Hand Healing Ltd (2011). Traditional Western Herbal Product. Giner extracts from in a Nutshell Gjnger by jill Rosemary Davies. Htt/www.herbs-hnds-healing.co.uk/. Rertrieved July 12, 2011.

Hermogenes, M.Paguia, [2]Delfin O. Magpantay and [3]Rina Q.Paguia. (2011) LAYING performance of chicken (Gallus domesticus L.) fed diets supplemented with capsicum frutescens2011 international conference on asia Agriculture and Animal IPCBEE vol.13 P:44-49.

Hernandez, F., Madrid, J., Garcia, V.,Orengo, J. and Megias, M. D. (2004).Influence of Tow Plant Extracts on Broiler Performance, Digestibility, and Digestive Organ Size. *Poult. Sci.*, **83**: 169-174.

Hosseini, N.M. (2011). Comparison of using different levels of black pepper with probiotic on performance and serum composition on broilers chickens. J. Basic Appli. Sci. Res., 1(11): 2425-2428.

Howida, A.H., (2009) . Influence of Dietary Spearmint (*Mentha Spicata*) Supplementation on Broiler Chics Performance. A thesis submitted in partial fulfillment for the requirement of the degree of Master of Science In Nutritional Science, Dep. Anim. Nutri. Faculty of Animal Production , University of Khartoum.

Huxley, A., ed. (1992). *New RHS Dictionary of Gardening*. Macmillan ISBN 0-333-47494-5.

Imai J, Ide S, Moriguchi T, Matsuura H, Itakura Y. (1994). Antioxidant and radical scavenging effects of aged garlic extract and its constituents. Planta Med.;60:417–20.

Iqbal, Z.; Nadeem, Q.K.; Khan, M.N. Akhtar, M.S. and Waraich, F.N. (2011). In vitro anthelmintic activity of Allium sativum, Zingiber officinale, Curcurbita Mexicana and Ficus religiosa. Int. J. Agric. Bio., (3): 454-457.

Issa K. J. J. M. Abo Omar, (2012). Effect of garlic powder on performance and lipid profile of broilers Open Journal of Animal Sciences Vol.2, No.2, 62-68.

Jafari ,B. Kamerani M. and 2 Rezazadehreyhani Z. (2011*)* Influenceof different level of Spearmint*(Menthaspicata)* extract ondifferent parameters of Laying Hens *Annals of Biological Research, , 2 (6):517-521.*

Jamel M, Saeid AB, Mohamed M, AL-Baddy A (2010). Effect of Aqueous Extract of Ginger (Zingiber officinale) on Blood Biochemistry Parameters of Broiler. Int. J. Poult. Sci., 9 (10): 944-947.

Javed, M.; Durrani, F. R; Hafeez, A., Khan , R. U. and Ahmed ,I (2009) . Effect of aqueous extract of plant mixture on carcass quality of broiler chicks. Journal of agricultural and biological science.4(1):37-40.

Javandel, F., B. Navidshad, J. Seifavati, G.H. Pourrahimi and Banyaghoub, (2008) The favorite dosage of garlic meal as afeed additive in broiler chickens rations ratios. Pak . J.Biol. Sci., 11(13): 1746-1749.

Jimoh, A. A.; Ibitoye, E. B; Dabai, Y. U. Garba, S.(2013). In vivo Antimicrobial potential of garlic against Clostridium perfringens and its promotant effect in performance of broiler chickens. Pakistan Journal of Biological Sciences .16(25):1978-1984.

Jones, F.T and S.C. Ricket. (2003). Observations on the history of the development of antimicrobials and their use in poultry feeds. Poultry Science. 82:613-617.

Kaale, E., Schepdael, A. V., Roets, E. and Hoogmartens, J. (2002). Determination of capsaicinoids in topical cream by liquid-liquid extraction and liquid chromatography. Journal of Pharmaceutical and Biomedical Analysis 30:1331-1337.

Kamel, C. (2001) Tracing modes of action and the roles of plant extracts in non-ruminants . Pages 135-150 In: Recent advances in animal nutrition . Garnsowothy, P.C., Wiseman , J. eds, Nottingham University Press, Nottingham.

Kaneko, J.J., Haervery J.w., and BRUS,M.L.(1997): Clinical biochemistry of domestic animals,5th ed., Acadmic press, san Diego, usa.

Kawada, T; Sakabe,s.;Watanbe, T.,Yamamoto, M.; and Iwai, K.1988 some pungent principle of spices caused the adrenal medulla to secret catecholamine in one shetize rate proc soc exp boil med 188-229-233.

Kehinde, A. S., Obun C. O., Inuwa, M. and Bobadoye, O. (2011), Growth performance, haematological and serum biochemical indices of cockerel chicks fed ginger (zingiber officinale) additive in diets Animal Research International 8(2): 1398 – 1404.

Khajeali.Y, Kheiri, F., Rahimian, Y., Faghani, M. andNamjo, A. (2012). Effect of use different levels ofCaraway (*Carum carvi L.*) Powder on performance, some blood parameters and intestinal morphology on broiler chickens. *World Applied Sciences Journal*,19: 1202-1207.

Khalafalla F.A., Fatma,H.M Ali.,Dalia A. Zahran and A.M.M.A. Mosa (2011). Influence of Feed Additives in Quality of Broiler Carcasses. *J. World's Poult. Res.* 2(3): 40-47. Journal homepage: http://jwpr.science-line.com

Kochh HP, Lawson LD(1996). Garlic: the scince and therapeutic Application of Allium satvium and related species . Williams and Wilkins. Amazon p. 329.

Konjufca, V.H., Pesti, G.M., Bakalli, R.I., (1997). Modulation of cholesterol levels in broiler meat by dietary garlic and copper. Poult. Sci. 76, 1264–1271.

Kuhn, Merrily. and David, Winston. (2007) Winston & Kuhn's Herbal Therapy & Supplements. A Scientific Traditional Approach., Lippincott Williams and Wilkins. P. 260.

Langhout, P., (2000). New additives for broiler chickens.Feed Mix Special: Alternatives to antibiotics. pp: 24-27

Larsen, K., H. Ibrahim, S. H. Khaw, and L. G. Saw. (1999). Gingers ofPeninsular Malaysia and Singapore. Natural History Publications (Borneo), Kota Kinabalu, Malaysia.

Latham, Elizabeth (2013). "Capsicums at your table". *Nelson Mail*. Retrieved 19 April 2013. Wikipedia, the free encyclopedia. Lawson LD. The composition and chemistry of garlic cloves and processed garlic. In: Koch HP, Lawson LD, eds. *Garlic: the science and therapeutic application of* Allium sativum *L and related species* (2nd edn). Baltimore: Williams and Wilkins, 1996: 37–107.

Lee KW, Everts H, Kappert HJ, Frehner M, Losa R, Beynen AC (2004). Effects of dietary essential oil components on growth performance, digestive enzymes and lipid metabolism in female broiler chickens. Br.. J. Poult. Sci., 3: 738-752.

Lee, K.W., Everts, H. and Beyen, A.C. (2003).*Journal of Applied Poultry Research*. 12:394-399.

Lewis, M.R., Rose, S.P., Mackenzie, A.M., Tucker, L.A.,(2003). Effects of dietary inclusion of plant extracts on the growth performance of male broiler chickens. Brit. Poult. Sci. 44 (Suppl. 1), S43–S44.

Liu F and Ng T.B. (2000) Antioxidative and free radical scavenging activities of selected medicinalherbs. Life Science 66:291-299

Lovland, A., M. Kaldhusdal, K. Redhead, E. Skjerve, and A. Lillehaug. (2004). Maternalvaccination against subclinical NCrotic enteritis in broilers. Avian Pathol. 33:83-92.

M. Malekizadeh1, M. M. Moeini1, Sh. (2012) Ghazi The Effects of Different Levels of Ginger (*Zingiber officinale* Rosc) and Turmeric (*Curcuma longa* Linn) Rhizomes Powder on Some Blood Metabolites and Production

Performance Characteristics of Laying Hens J. Agr. Sci. Tech. Vol. 14: 127-134.

Mansoub HN, Nezhad MAM (2011). The effects of using Thyme , Garlic and Nettle on performance, carcass quality and blood parameters, Annals of biological Research, 2 (4):315-320.

Martins, A.P., L. Salgueiro, M.J. Goncalves, A.P. daCunha, R. Vila, S. Canigueral, V. Mazzoni, F. Tomi and A. Casanova,(2001). Essential oil composition and antimicrobial activity of three Zingiberaceae from S. Tome e Principe. Planta Med., 67: 580-584.

Masaadeh, H. A., W. A. Hayajneh and N.M. Momani,(2006). Microbial ecology of dental plaques of Jordanian patient and inhibitory effects of Allium sativum cepa L.extracts J. Medical Sci., 650-653.

Mathivana R, Kalaiarasi K (2007) Panchagavya and andrographis panculata as Alternatives to antibiotic on hematological, serum biochemical parameters and immune statues of broiler . J. POULT. Sci. 44:198-204

McEwen, S. A., and P. J. Fedorka-Cray.(2002). Antimicrobial use and resistance in animals.Clin. Infect. Dis.34:S93-S106.

Menten, J.F.M., (2001): Aditivos alternatives na nutricao de aves: probiotics e probiotics. Sociedade Brasileira de zootecnia-A producao animal na visao dos brasileiros, piracicaba:Fealq, pp: 141-157.

Mikulski D., Zduńczyk Z., Jankowski J. and Juśkiewicz J. (2008), Effects of organic acids or natural plant extractsadded to diets for turkeys on growth performance,gastrointestinal tract metabolism and carcasscharacteristics Journal of Animal and Feed Sciences, 17, 233–246

Mimica – Dukic, N., M. Popvic. Jakovljevic, A. Szabo, and O. Gasic, 1999. Pharmacological studies of Mentha Iongifolia phenolic extracts. II Hepatoprotective activity . Pharm. Biol., 37: 221-224.

Mohan, T.(2004).Pharmacological screenings of some medicinal plants as antimicrobial and feed additives. M.Sc. Thesis Vergina Polytechnic Institute and State University. Blacksburg. Vergina. USA.

Mohd-Yusof, Y. A., S. Sieh, N. A. Murad, and W. Z. Wan-Ngah.2002. Anticancer effect of ginger extract (*Zingiber officinale*) onliver cancer cell lines. Malays. J. Biochem. Mol. Biol. 7:38–42.

Mokhtari R, Yazdani AR, Rezaei M, and Ghorbani B (2010). The Effects of different growth promoters on performance and carcass characteristics of broiler chickens. J. Anim. Vet. Adv., 9(20): 2633-2639.

Monfared, A., Rustaiyan, A. and Nabid, M. (2002). Composition of carvone chemotype of Mentha Longifolia Phenolic (L.) Huds. From Iran J. Essent oil ., 14: 51-52.

Moorthy, M., Ravikumar, S. Viswanathan, K. and Edwin,S.C. (2009) Ginger ,Pepper and Curry Leaf Powder as Feed additives in Broiler diet .*Int.J.of Poult.Sci*.8:779-782.

Moure A, Cruz JM, Franco D, Dominguez JM, Sineiro J, Dominguez H, Nunez J, Parajo JC. (2001) Natural antioxidants from residual sources. Food Chemistry 72:145-171.

N.R.C. National Research Council (1994) Nutrent requirement of poultry(9^{th} rev , ED) National Academy press . Washinton, D. C., USA.

Najafi S. and Taherpour K. 2014 Effects of Dietary Ginger (Zingiber Ofjicinale), Cinnamon (Cinnamomum), Synbiotic and Antibiotic Supplementation on Performance of BroilersJ. Anim. Sci. Adv., 2014, 4(1): 658-667.

NOAH, 2001. National Office of Animal Health.Antibiotics for animals http:///www.noah.co.uk/ issues/antibiotics.htm.

Nori – Sharph, D.M, Jaimand, K., Norouzi – Arasi, H. and Mohammeddi, S. (200). Volatile oil component of Mentha Longifolia (L.) Huds. From Iran J. Essent oil Res., 12: 111- 120.

Obi, I. U. (1990) Statistical methods of detecting differences between treatments means, 2nd Edn. Snaap Press, Enugu, Nigeria, PP: 25-85.

OCAK N., ERENER G., BURAK A.K.F., SUNGU M., ALTOP A., OZMEN A.(2008): Performance of broilers fed diets supplemented with dry peppermint (*Mentha piperita* L.) or thyme (*Thymus vulgaris* L.) leaves as growth promoter source. Czech Journal of Animal Science, 53, 4, 169-175.

Ohaeri OC, Adoga GI (2006). Anticoagulant modulation of blood cells and platelet reactivity by garlic oil in experimental diabetes mellitus. Biosci. Rep., 26: 1-6.

Olemedo, J.A., Sanchez, A., Curiel, F and Orozco Hernandez, J.R (2009). The effect of a health growth promoter feed additive on shrimp performance, Research J. of Bio. Sci., 4(9): 1022-1024.

Ologhobo A.D, Adebiyi QA(2008).Effect of long term feeding long and sun dried garlic (Allium sativium) on performance and lipid metabolism of broiler chicks. In: Proceeding of the conference on international Research on food security . National Ress. Mange.Rural Dev. Univ. Hohenhim. Pp. 7-9.

Oluyemi J.A. and Roberts F.A. (2007) Poultry production in warm wet climates.Macmillan press Ltd London,PP 118-120

Onibi EG, Adebisi EO, Fajemisin NA, Adetunji VA (2009).Response of broiler chickens in terms of performance and meat quality to garlic (Allium sativum) supplementation. African Journal of Agricultural Research 4(5):511-517.

Onyimonyi,A.E., Chukwuma, P.C, Igbokwe, Chinenye, (2012): growth and hyocholestoesterolemic properties of dry garlic powder (Allium Sativum) on broiler African journal of biotechnology, issn 1684-5315Vol. 11(11).pp 2666-2671.

Otunola, G. A., Oloyede, O. B., Oladiji, A. T. and Afolayan, A. J. (2010): Comparative analysis of the chemical composition of three spices – *Allium sativum* L. *Zingiber officinale* Rosc. and *Capsicum frutescens* L. commonly consumed in Nigeria. African Journal of Biotechnology Vol. 9(41), pp. 6927-6931.

Ozer, A.; Berrin, Z.; Hatice, E and Neroin, O.(2006) Histlogical investigation on the effect of feeding diet containing red hot pepper on the reproductive system organs of the cock. . Turk. J. Vet Anim . Sci.(30): 7-15.

Padmini, E. Valarmathi, A. Usha Rani M. (2010) Comparative analysis of chemical composition and antibacterial activitiesof *Mentha spicata* and *Camellia sinensis* Asian j. exp. biol. sci. vol 1 (4)

Padmini, E., Prema, K.,Vijaya Geetha, B.&Usha Rani, M. (2008). Comparative study on composition and antioxidant properties of mint and tea extract. Intl.J.Food Sc.Tech 43: 1887-1895.

Park JM, Lee SH, Kim JO, Park HJ, Park JB and Sin JI, (2004). *In vitro* and *in vivo* effects of extracts of *Lentinus edodes* on tumor growth in a human papilloma virus 16 oncogenes-transformed animal tumor model - Apoptosis-mediated tumor cell growth inhibition. Korean Journal of Food Science and Technology, 36:141-146.

Patterson, J.A. and K.M. Burkholder, (2003). Application of Prebiotics and Probiotics in Poultry Production. Poult. Sci., 82: 627-631

Perić, L. D. Žikić, M. Lukić(2009) Application of alternative growthpromoters in broiler production, ISSN 1450-9156UDC 636.087.8 Publisher: Institute for Animal Husbandry, Belgrade-Zemun Biotechnology in Animal Husbandry 25 (5-6), p 387-397.

Pirgozliev, V., Murphy, T.C., Owens, B., George, J. & McCannin, M.E.E., (2008). Fumaric and sorbic acid as additives in broiler feed. Res. Vet. Sci. 84, 387-394.

Platel, K., and K. Srinivasan. (2000). Influence of dietary spices and their active principles on pancreatic digestive enzymes in albino rats. Nahrung 44:42–46.

Platel, K., and K. Srinivasan. (2004). Digestive stimulant action of spices: A myth or reality? Indian J. Med. Res. 119:167–179.

Pourali, M.; Mirghelenj, S.A. and Kermanshahi, H.(2010). Effects of garlic powder on productive performance and immune response of broiler chickens challenge with Newcastle disease virus. Global Veterinaria. 4(6):616-621.

Prasad, R., Rose, M.K., Vermani, M., Garg, S.L. and Puri, J.P. (2009) Lipid profile of chicken (*Gallus domesticus*) in response to dietary supplementation of garlic (*Allium sativum*). *International Journal of Poultry Science*, **8**, 270-276. doi:10.3923/ijps.2009.270.276.

Pruthi, J. S. (1976). Spices and Condiments. National Book Trust, New Delhi, India. pp.269.

Racesi,M. S. A. Hoseini- Aliabad, A. Roofchaee, A. Zare Shahneh and S.,(2010) Effect of Periodically Use of Garlic (*Allium sativum*) Powder on Performance and Carcass Characteristics in Broiler Chickens. World Academy of Science, Engineering and Technology 68:1213-1219.

Rafiee A, F Kheiri, Y Rahimian, M Faghani, MR Valiollahi and Y Miri, (2014). The effect of ginger root (*Zingiber officinale*) and cumin *(Cuminum cyminum)* powder on performance, some haematological traits and intestinal morphology of broiler chicks. Res. Opin. Anim. Vet. Sci., 4(2), 96-100.

Rahimi**,** S.; Zadeh, Z.; Torshizi, M.A.; Omidbagi, R. and Rokin, H. (2011). Effect of the three Herbal extracts on growth performance, Immune system, blood factors and intestinal selected bacterial population in broiler chickens. J. Agric. Sci. Tech. 13:527-539.

Rahman, M. M., 2Fazlic, V. and 2Saad, N. W. (2012) Antioxidant properties of raw garlic *(Allium sativum)* International Islamic University Malaysia, Kuantan, 25200 Pahang, Malaysia International Food Research Journal 19(2): 589-591.

Rasooli, I and Rezaei, M.(2002) Bioactivity and chemical properties of essential oils from Zataria multiflora Bio and Menta longifolia (L) Hubs. J.Essent. Oil Res . 14: 141–146.

Rastogi, R.P.&Mehrotra, B.N. (1998). Compendium of Indian medicinal plants, Central Drug Research Institute, Lucknow and National Institute of Science Communication, NewDelhi. 5: 1060.

Rivlin, R.S., (2001). Historical perspective on the use of garlic. J. Nutr.131 (3S), 951S–954S.

Rodríguez-Burruezo A, Kollmannsberger H, González-Mas MC, Nitz S, Fernando N; HS-SPME (2010),Comparative analysis of genotypic diversity in the volatile fraction and aroma-contributing compounds of Capsicum fruits

from the annuum-chinense-frutescens complex; Journal of Agricultural Food Chemistry, 58(7):4388-400.

Safa, M.A, (2014). Effect of using ginger powder as natural feed additive on performance and carcass quality of broiler chicks. Assiut Vet. Med.J. Vol. 60 No. 141 April.

Samarasinghe, K., Wenk, C., Silva, K.F.S.T. & Gunasekera, J.M.D.M., (2003). Turmeric (*Curcuma longa*) root powder and mannan oligosaccharides as alternatives to antibiotics in broiler chicken diets. Asian-Austr. J.Anim. Sci. 16, 1495-1500.

Sarica, S., Ciftci, A., Demir, E., Kilinc, K. and Yildirim, Y. (2005). Use of antibiotic growth promoter and two herbal natural feed additives with and without exogenous enzymes in wheat based broiler diets. S. Afr. Anim. Sci. 35:61-72.

Savithri Bhat, Priti Maheshwari, Sushil Kumar and Anil Kumar, (2002). Mentha species: In vitro Regeneration and Genetic Transformation Molecular Biology Today, 3 (1): 11-23.

Schwarz, S., Kehrenberg, C. and Walsh, T. R. (2001). Use of antimicrobial agents in veterinary medicine and food animal production. Int. J. Antimicrob. Agents. 17:431-437.

Scott, M.L.; Nesheim, M.C. and Young, R. J, (1982) Nutrition of chicken . Scott and associated, eds., W. F Humphrey Press.Inc., Ithacia,N. Y.

Sendl,(1995). A. Allium satavium and Allium ursinmon :Part 1. Chemistry, analysis, history, phytomedicine 4:323- 339.

Shahram Nanekarani a,∗, Majid Goodarzi a and Mohammad Heidari 2012 The Effect of Different Levels of Spearmint (Mentha Spicata) Extract on Immune System and Blood Parameters of Broiler Chickens *APCBEE* Procedia 4 (2012) 135 – 139.

Shahverdi A .F. Kheiri, Mostafa Faghani, Yaser Rahimian and Ali Rafiee, (2013), The effect of use red pepper (*Capsicum annum L*) and black pepper (*Piper nigrum L*) on performance and hematological parameters of broiler chicks European Journal of Zoological Research, 2 (6):44-48

Shim, L., Pelly, H. P. & Kripke, M. L. (1995). Use of Aloe vera yoghurt for acid production, viscosity, sensory properties and quality retention. J. Invest. Dermat. 102(2):197-204.

Simonetti , G. (1990). Schuler, S., ed. Simon and Scuster's Guide to herbs and speices. Simon and Scuter, Inc. ISBN 0-671-73489-x.

Singh S, Jarret R, Russo V, Majetich G, Shimkus J, Bushway R, Perkins B; (2009). Determination of capsinoids by HPLC-DAD in capsicum species; Journal of Agricultural Food Chemistry; 57(9):3452-7.

Singh, G.I.P. and Panda, H. (2005) .Medicinal herbs with their formulation. Volume 1-Allium sativum-Daya pupllshing House-Delhi-110035.

Spirling, L.I., and Daneils, I.R. (2001). Botanical perspectives on health peppermint: more than just an after – dinner mint. JR Soc Health. 121: 62 - 63.

Srinivasan, D., S. Nathan, T. Suresh, and P. Lakshmana Perumalsamy. (2001). Antimicrobialactivity of certain Indian medicinal plants used in folkloric medicine. J. Ethnopharmacol.74:217-220.

Steel, R and J. Torrie, (1980). Principles and procedures of statistics: A biomedical Approach. 2nd ed. McGraw –Hill Bock Company, Inc. New York.

Suk-Hyun Choi, Suh, Bong-Soon, E. Kozukue, N. Kozukue, C.E. Levin and Friedman, (2006). Analysis of the contents of punget compounds in fresh Korean red peppers and in contaning food. J. Agric. Food Chem., 54: 9024-9031.

Sultan MA, Shewita RS, El-Katcha MI (2008). Effect of dietary anise seeds supplementation on growth performance, immune response,carcass traits and some blood parameters of broiler chickens. Int. J.Poult. Sci., 7: 1078-1088.

Tapia, J. C., Garcia, R., Eleazar, M., Calva, G. and Rocha, J. A.(1993). Capsaicin recovery from a cell culture broth. Indian Engineering and Chemical, Research 32: 2242-2246.

Tapsell, L. C., I. Hemphill, L. Cobiac, C. S. Patch, D. R. Sullivan,M. Fenech, S. Roodenrys, J. B. Keogh, P. M. Clifton, P. G. Williams,V. A. Fazio, and K. E. Inge. 2006. Health benefits of herbsand spices: The past, the present, the future. Med. J. Aust.185:4–24.

Tekeli A, Kutlu HR. Celik L. (2011). Effect of *Z. officinale* and propolis extracts on the performance, carcass and some blood parameters of broiler chicks. Current Research in Poultry Science, 1(1): 12-23.

Tekeli A. (2007). Potential use of plant extracts and propolis to be natural growth promoter in broiler chick's diets. Ph.D. Thesis, University of Cukurova Institute of Natural and Applied, Department of Animal Science Adana.

Tekeli A., L. Celik, H.R., Kutlu, Gorgulu M (2006). Effect of dietary supplemental plant extracts on performance, carcass characteristics, digestive system development, intestinal microflora and some blood parameters of broiler chicks. Abstract Book of 12th European Poultry Conference, Verona- Italy 10-14th Sept.

Tollpa,A.A.; Azouz, H. M . M .and Abd-samad,M.H.(2007): Off Egyptian chicken under different environmental conditions. 2.the growth during cold winter stress. Egyptian poultry science J., 27:727-748.

Valiollahi MR, Y Rahimian, Y Miri, F Asgarian and A Rafiee, (2014). Effect of ginger (*Zingiber officinale*) and black pepper (*Piper nigrum L.*) powder on

performance, haematological parameters and antibody titre in broiler chicks. Res. Opin. Anim. Vet. Sci., 4(3), 128-132.

Weber, N. D.,D.O. Anderson, J.A. (1992). North, virucidal effects of Allium satavium (garlic) extract and component . Planta Med., 58:417-423.

WHO, the world health report 2007 - A safer future: global public health security in the 21st century; available at URL: http: // www .who .int / whr / 2007/en/index.html (accessed 25 February 2009).

William, M. and Klenholz, W. (1974). The effect of chilli curry and black pepper powder in diet for broiler chicks. Poultry Science, 53:2232-2234.

Windisch W, Schedle K, Plitzner C, Kroismayr A(2008) Use of phytogenic products as feedadditives for swine and poultry. J. Anim.Sci. 86:140-148.

Witte, W. (2000). Ecological impact of antibiotic use in animals on different complex microflora: environment. International Journal of Antimicrobial Agents, Vol. 14, No. 4,pp. 321-325, ISSN 0924-8579.

Yang, Y., Iji, P.A., Kocher, A., Thomson, E., Mikkelsen, L.L. & Choct, M., (2008). Effects of mannanoligo saccharide in broiler chicken diets on growth performance, net energy utilization, nutrient digestibility, and intestinal microflora. Br. Poult. Sci. 49, 186-194.

Yoshimura, H., M., Ishimaru, Y. S. Endoh, and A. Kojima.(2000). Antimicrobial susceptibilities of *enterococci* isolated from faeces of broiler and layer chickens. Lett.Appl. Microbiol. 31:427-432.

Zhang, G.F., Z.B. Yang, Y. Wang, W.R. Yang, S.Z. Jiang and G.S. Gai, (2009). Effects of ginger root (*zingiber officinale*) processed to different particle sizes on growth performance, antioxidant status and serum metabolites of broiler chickens. J. Poult. Sci., 88:2159-2166.

Ziton, A.A. (2009): Response of broler chicks to diet containing garlic as natural feed additive M.Sc. Thesis, College of Sudan Agricultural Studies and technology.

Zoliikha, M.A., (2014). Response of broiler chicks dietary garlic essential oil as natural growth promoters Altrnative promoter. M.Sc. Athesis submibmited, sudan university of science and technology dep. Of animal production.

Zomrawi, W. B., (2013). Respons of broiler chicks and laying hens to dieatery ginger (ziangbir officinal) root powder. Thesis submitted to university of Khartoum in fulfillment of requirements for the degree of doctor of philosophy in poultry production

APPENDIX

Appendix 1

1/ weekly maximum and minimum experimental temperature during the 5th June to 17th July. Temperature c° 2012

Week	Maximum	Minimum
1	33	24
2	30	23
3	28	23
4	25	18
5	22	16
6	18	16
Average temperature	26	20

Source: Shambat Station.

Appendex 2/ Card caused four judgments of subjected meat quality attributes

Sensory evaluation card

Evaluation these samples for color, flavor, justness and tenderness. For each sample , use appropriate scale to show your attribute by checking at the point that best describes your feeling about the samples. Pleases. Ask. .Thanks for your cooperation.

Name……

Date…….

Tenderness	Flavor	color	juiciness
8/Extremely tender	8/Extremely intense	8/Extremely desirable	8/Extremely juicy
7/Very tender	7/Very intense	7/Very desirable	7/Very juicy
6/Moderately Tender	6/Moderately intense	9/Moderately desirable	8/Moderately juicy
5/Slightly tender	5/ Slightly intense	5/ Slightly desirable	5/Slightly juicy
4/slightly tough	4/ slightly bland	4/ slightly un desirable	4/slightly dry
3/Moderatly tough	3/ Moderately bland	3/ Moderately un desirable	3/moderately dry
2/Very tough	2/Very bland	2/Very un desirable	2/Very dry
1/Extremely tough	1/ Extremely bland	1/ Extremely un desirable	1/ Extremely dry

Serial Sample Code:

1						
2						
3						
4						
5						