DIERTY EFFECT OF FENNEL SEEDS (*Foeniculum Vulgaris L.*) AS GROWTH PROMOTER ON THE PERFORMANCE OF BROILER

A THESIS

BY

MUKESH KUMAR YADAV

REGISTRATION NO. 1805384

SEMESTER: JULY-DECEMBER, 2019

SESSION: 2018

MASTER OF SCIENCE (MS)

IN

POULTRY SCIENCE

DEPARTMENT OF DAIRY AND POULTRY SCIENCE

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR-5200

DECEMBER, 2019

DIERTY EFFECT OF FENNEL SEEDS (*Foeniculum Vulgaris L.)* AS GROWTH PROMOTER ON THE PERFORMANCE OF BROILER

A THESIS

BY

MUKESH KUMAR YADAV

REGISTRATION NO. 1805384

SEMESTER: JULY-DECEMBER, 2019

SESSION: 2018

Submitted To

The Department of the dairy and Poultry science
Hajee Mohammad Danesh Science and Technology University, Dinajpur
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE (MS)
IN

POULTRY SCIENCE

DEPARTMENT OF DAIRY AND POULTRY SCIENCE

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR-5200

DECEMBER, 2019

DIERTY EFFECT OF FENNEL SEEDS (*Foeniculum Vulgaris L.)* AS GROWTH PROMOTER ON THE PERFORMANCE OF BROILER

A THESIS

BY

MUKESH KUMAR YADAV

REGISTRATION NO. 1805384

SEMESTER: JULY-DECEMBER, 2019

SESSION: 2018

Approved as to style and content by

Dr. Tahera Yeasmin	**Dr. Mst. Afroza Khatun**
Professor	**Professor**
Supervisor	**Co-Supervisor**

Professor Dr. Tahera Yeasmin

Chairman

Examination committee

Department of Dairy and Poultry Science

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR-5200

DECEMBER, 2019

DEDICATED

TO MY BELOVED

PARENTS

ACKNOWLEDGEMENTS

All praises are to the "Almighty" the supreme authority of the universe, who kindly enables the author to complete the present research work successfully and to submit the thesis leading to Master of Science (M S) degree in Animal Science and Nutrition, Hajee Mohammad Danesh Science and Technology University, Dinajpur.

The author expresses the deepest sense of gratitude and heartfelt indebtedness to her honorable and respected teacher and research supervisor, Prof. Dr. Tahera Yeasmin, Professor Dr. Mst. Afroza Khatun Chairman, Department of Dairy and Poultry Science. Hajee Mohammad Danesh Science and Technology University, Dinajpur for her scholastic guidance, cordial consistence, sympathetic supervision, valuable advice and radical investigation in all phases of research work and preparation of this thesis.

The author is ever grateful and immensely indebted to her respected teacher and research co-supervisor, Dr. Mst. Afroza Khatun, Department of Department of Dairy & Poultry Science, Hajee Mohammad Danesh Science and Technology University, Dinajpur for her sympathetic supervision, valuable advice and encouragement during the entire study period.

The author owes arrears of gratitude to Assistant Dr. Md. Kamruzzaman (Mitoo) Assistant Professor, and other teachers Department of Dairy & Poultry Science, Hajee Mohammad Danesh Science and Technology University, Dinajpur for their kind collaboration, encouragement and valuable suggestions to complete the thesis works.

The author would also like to thank to her friend, staff members for their encouraging attitude, kind help and all-out support during the entire period of the research work.

The author is ever indebted to her beloved parents, sisters, brothers for their endless sacrifices, heartiest blessings and dedicated efforts to educate the author to this level and support throughout his entire lift.

'The Author

ABSTRACT

To investigate the effects of feeding different level of Fennel *(Foeniculum vulgaris L.)* powder on the performance of broiler during summer (September-October), 2019. Four experimental diets designated as T_0, T_1, T_2 and T_3 having 0%, 0.5%, 1% and 2% dried Fennel *(Foeniculum vulgaris L.)* powder was fed to (96) vigorous day-old Broiler chicks. The chicks were, randomly and equally distributed to 4 treatments having 3 replicates of 8 birds each. The experiment was lasted for 35 days. Average weight gain, feed consumption, feed efficiency, dressing yield and survivability were used as the criteria of response to feeding the Fennel *(Foeniculum vulgaris L.)* powder. Organs weight including heart, liver and gizzard were also recorded. Results showed that addition of Fennel *(Foeniculum vulgaris L.)* powder increased the body weight ($P<0.05$) in broiler irrespective of doses and the mean body weight per broiler were 1298.69, 1416.58, 1463.59 and 1433.14g in the T_0, T_1, T_2, and T_3, respectively ($P<0.05$). The average feed consumption per broiler were 2455.82, 2244.08, 2235.62 and 2223.61g ($P<0.05$) in the T_0, T_1, T_2 and T_3, respectively. The feed conversion ratio (feed/gain) were 1.48, 1.20, 1.17 and 1.19 ($P<0.05$) in the T_0, T_1, T_2 and T_3, respectively. The mean dressing yield were 58.32%, 59.00%, 62.25% and 61.41% ($P<0.05$) for the groups of T_0, T_1, T_2 and T_3, respectively. The average weights of abdominal fat were 2.73, 1.73, 1.59 and 1.63g ($P<0.05$) and where the heart weights were 6.46, 7.30, 8.1 and 7.5g ($P<0.05$), in T_0, T_1, T_2 and T_3, respectively. The average weights of liver were 38.1, 38.52, 41.21 and 39.98g ($P>0.05$) in the T_0, T_1, T_2 and T_3, respectively. The mean gizzard weights were 37.47, 37.56, 38.77 and 37.8g ($P>0.05$) for the groups of T_0, T_1, T_2, and T_3, respectively. It was concluded that Fennel *(Foeniculum vulgaris L.)* powder at 1 to 28 days of age at the level of 0.5%, 1% and 2% be used as feed additive to enhance overall performance of broiler.

Key words: Fennel *(Foeniculum vulgaris L.)* powder, Broiler performance, Dressing Yield, Survivability, Carcass Characteristics.

LIST OF CONTENTS

LIST OF TABLE

LIST OF FIGURE

LIST OF ABBREVIATIONS

ABBREVIATIONS	ELABORATIONS
FCR	Feed conversion ratio
MS	Master of Science
mg	Milligram
g	Gram
kg	Kilogram
lit	Liter
ME	Metabolizable energy
CP	Crude protein
CF	Crude fiber
ml	Milliliter
µg	Microgram
IU	International unit
USA	United States of America
AGP	Antibiotic growth promoter
K	Potassium
Mg	Magnesium
Mn	Manganese
Na	Sodium
Ca	Calcium
Fig	Figure
Prof.	Professor
NS	Non- significant

^{0}C	Degree Celsius
%	Percent
*	Significant at 5% level of probability
/	Per
NS	Non significant
@	at the rate of
<	Less than
>	Greater than
HSTU	Hajee Mohammad Danesh Science and Technology University

CHAPTER-I
INTRODUCTION

Bangladesh is an agricultural country and livestock is an important sector which plays a vital role in the agricultural production sphere. Statistics show that about 1.6 % of national GDP is covered by the poultry (Banglapedia, 2015). Livestock population in Bangladesh is currently estimated to comprise 118.7 million chickens (DLS, 2016-17). Livestock in Agricultural GDP Current prices (13.62%). Total Poultry current prices (3379.98) (BBS, 2017-18). The use of antibiotic as growth promoters in poultry nutrition has been associated with fast growing nature of broiler chickens and their short generation interval in order to improve the quality of the final product (Schwarz *et al.,* 2001). The subclinical application in feed has arisen into a controversial issue worldwide because of appearance of residue resistant strain of bacteria (Owens *et al.,* 2008; Toghyani *et al.,* 2011).

The main products form fennel seeds is the seed, seed oil, herb, herb oil and anethole, for all of which quality specifications exist. of the medicinal properties, it is recognized as antioxidant, hepatoprotective, anticancer, antimicrobial and as a treatment against nausea. Fennel seeds is one of the aromatic plants which is containing high percentage of the fatty acids linolenic and stearic. In addition fennel seeds has 16.81% trans -anethol plus 47.20% estragole with total sweating components of 64.01% in essential oil (Guifraz *et al.,* 2008). Limited research the addition of aromatic plants to the feeds and water improved feed intakes, feed conversion ratio and carcass yield (Hertrampt, 2001 and Alcicek *et al.,* 2003). Romila (2001) stated that fennel seeds (*Foeniculum vulgaris* L.) is one of these aromatic plants which is containing high percentage of the fatty acids linolenic and stearic. In addition fennel seeds has 16.81% trans- anethol pulse 47.20% estragole with total sweeting components of 64.01% in essential oil. El-Deek *et al.* (2003) indicated that body weight was increased and improvement feed conversion by using fennel seeds in the diets. Our aim to use the fennel seeds seeds in poultry nutrition as natural growth promoting substance. For this purpose, different levels of fennel seeds seeds were added to the traditional ration which had chick peas to determine their effect on broiler performance. Fennel seeds water has similar properties to those of anise and dill water: mixed with sodium bicararbonate and syrup, these waters constitute the domestic gripe water, used to correct flatulence of infants. Extracts of fennel seeds seeds

have been shown in animal studies to have a potential use in the treatment of glaucoma, as a diuretic and potential drug for the treatment of hypertension. It has been used as a glactaggue improving the milk supply of a breast feeding mother. This is suggested to be due to the presence of phytoestrogens present in fennel seeds which promote growth of breast tissues (Agarwal *et al.,* 2008). Fennel seeds is very popular as an anti flatulent, due to the carminative properties of the aspartic acid found in fennel seeds. Fennel seeds is a great source of fibre, in powder form it act as a laxative, it also helps to maintain healthy levels of chotesterol in the blood stream. This means that it can stimulate the elimination damaging LDL cholesterol, which is a major factor in heart disease, artherosderosis and strokes (Ostad *et al.,* 2001). Fennel seeds is a very rich source of potassium, which relaxes the tension of blood vessels, thereby reducing blood pressure .Fennel seeds is rich in vitamin C, which improves general immune system heath, produces and repairs skin tissue, helps it form collagen and also protects blood vessel walls as an antioxidant against the harmful effects of free radicals that can frequently lead it heart disease (Chainy *et al.,* 2000). The flavonoids present in fennel seeds seeds increase the amount of estrogen by acting as stimulant and tonic increase the size of breasts as- they increase the formation of new cells and tissues in the breast. Using fennel seeds in food helps protect the eyes from inflammation, this is due to high of antioxidants (vitamin C and amine acids like Arginine). Fennel seeds is useful in respiratory disorders such as congestion, bronchitis and cough due to the presence of, cineole and anetol. Fennel seeds is diuretic which means that it increases, thereby helping the removal of toxic substances from the body and helping in rheumatism and swelling (Ensminger *et al.*,1986). Fennel seeds (*Foeniculum vulgare* L.) was also recognized as a plant having medical properties (antispasmodic, carminative and diuretic). Nichita *et al.*, (1984) found that after extraction of fennel seeds seed, the residue contained 18.96% crude protein and 19.46% ether extract. This residue was given at 0.5, 1.0 and 2.0% in the diet for growing chickens and mean daily gain was 85.3, 80.8, and 85.9 g, respectively and feed conversion ratio (FCR) was lowest for chickens given 0.5% fennel seeds. Huang *et al.* (1992) concluded that the Chinese medicinal herbs have a stimulating effect on growth of broilers. Fritz *et al.* (1993) found that there were differences between the herbs, with A. millefolium giving best results, and herb supplemented diets resulted in a better FCR. Also, Abou-Egla (1995) found that peppermint improved FCR of broilers during the first four weeks of age. Fennel seeds seed essential oil can also be an alternative to commercial insecticides (Zoubiri *et al.,* 2014). Digilio *et al.,* (2008) notified that when compared with

the other Mediterranean essential oils produced from fennel seeds, anise and basil have strong insecticidal activity. In addition, Pavela *et al.,* (2016) declared that Czech fennel seeds provides high yield and is effective in the development of botanical insecticides. There are some rare studies about the use of fennel seeds seeds in poultry diets in recent years, which have focused on the performance of broilers (Mohammed and Abbas, 2009; Ragab *et al.,* 2013; Saki *et al.,* 2014), broiler breeders (Kazemi-Fard *et al.,* 2013), noted that using a mixture of essential oils, including fennel seeds essential oil.

The objective of the present work was to study the impacts of fennel seeds (*Foeniculum vulgare* L.) fed at growth performance of broilers of meat.

1. To investigate the effect of fennel seeds (*Foeniculum vulgare* L.) on the performance of commercial broiler.
2. To investigate the effect of fennel seeds (*Foeniculum vulgare* L.) on carcass characteristics of commercial broiler.

CHAPTER-II
REVIEW OF LITURATURE

Review of related literature is necessity in the sense that it provides scope for reviewing the stock of knowledge and information relevant to the proposed research. Despite the fact that a few numbers of works have been done in Bangladesh related to this research, there are some published reports and related activities. However, the limited numbers of works so far published are mentioned here along with other related works. A short description on the available literature relevant to the present investigation has been presented below:

Saleh Lemrabt *et al.,* (2018). Efficacy of *Foeniculum vulgare* seeds powder on growth performance in broilers. The experiment was laid out in Randomized Block Design (RBD). There were four treatments like T_0, T_1, T_2 and T_3 and 28 chicks in each treatment were distributed. Chicks of each treatment with variable proportions of (T0: (control) basal diet with no supplement, T_1: *Foeniculum vulgare* seeds powder 250 gm+50 kg basal diet, T_2: *Foeniculum vulgare* seeds powder 500 gm+50 kg basal diet and T_3: *Foeniculum vulgare* seeds powder 750 gm+50 kg basal diet). In the view of present investigation, the most effective combined supplements of T_3 (*Foeniculum vulgare* seeds powder 750 gm+50 kg basal diet) has proved best in respect of growth performance like body weight and gain in weight, followed by T_2, T_1 and T_0. These formulations improved growth performance in birds. It was concluded that *Foeniculum vulgare* seeds powder has positive effects on broilers.

Santi Devi Upadhaya *et al.,* (2017). The growing concerns of consumers on the use of antibiotic as a growth promoter in livestock feed have fueled the interest in alternative products. In the recent years a group of natural products known as phytogenics has been a focus of several studies. Phytogenics are a heterogeneous group of feed additives originating from plants and consist of herbs, spices, fruit, and other plant parts. These feed additives are reported to have a wide range of activities including antimicrobial, anthelminthic, antioxidant, growth enhancer, and immune modulator. Besides these properties they are also reported to stimulate feed intake and endogenous secretion and enhance production. They include many different bio-active ingredients such as alkaloids, bitters, flavonoids, glycosides, mucilage, saponins, tannins phenolics, polyphenols, terpenoids, polypeptide, thymol, cineole, linalool, anethole, allicin, capsaicin,

allylisothiocyanate, and piperine. These feed additives have been tested in the form of extracts, cold pressed oils, essential oils in a number of animals but the results are variable. Therefore, their application as feed additive has been limited, largely owing to their inconsistent efficacy and lack of full understanding of the modes of action. The future of these feed additives depend on the characteristics of herbs, the knowledge on their major and minor constituents, the in-depth knowledge on their mode of action and their value based on the safety to animal and their products. The aim of this review is to summarize on the current knowledge on the use of phytogenic as a feed additive in monogastric animals.

2.1 Composition of fennel seeds

Ayssiwede *et al.,* (2011). This study was carried out to assess the nutrient composition of some unconventional and local feed resources available in Senegal so as to use them as protein supplement sources in the diets of indigenous chickens to enhance their productivity. Ten (10) unconventional and local ingredients from Senegal including leguminous leaves (Leuceana leucocephala, Cassia tora, Moringa oleifera, Adansonia digitata, Sesbania rostrata), cucurbit (Citrullus vulgaris) and roselle (Hibiscus sabdariffa) seeds, red and white cowpea (Vigna unguiculata seeds) and cockroaches (Blatta orientalis) were collected, sun-dried, processed into meal and analyzed for their chemical and macro-mineral composition using internationally established procedures. The results showed that the samples Dry Matter (DM) percent ranged from 89.3% (red cowpea) to 94.9% (C. vulgaris). The Crude Protein (CP) content ranged from 24.7% (white cowpea) to 61.9% (cockroaches meal), with A. digitata leaves having the lowest value (12.9%). Citrullus and Hibiscus seeds meal recorded the highest (38.8% and 18.9%) Ether Extract (EE) values, followed respectively by cockroaches (11.1%), Moringa (9.8%), Leuceana (6.4%) and Sesbania leaves meal (5.1%), while the others were below 4.5%. The crude fiber (CF) content was globally high in the leaves, ranging from 11.7% (M. oleifera) to 16.8% (C. tora) while that of seeds and cockroaches ranged from 1.9% (white cowpea) to 19% (Citrullus seeds). A. digitata leaves gave the highest ash content (25.2%), followed by Cassia (15.2%), Moringa (13.6%), Leuceana (11.4%) and Sesbania leaves (7.1%), while the others were below 5.6%. The metabolizable energy (ME) value calculated for seeds and cockroaches meal ranged from 3161 kcal/kg DM (cockroaches) to 4270 kcal/kg DM (C. vulgaris) and that of leaves from 1873 (A. digitata) to 2888.9 kcal/kg DM (M.

oleifera). Cassia leaves contained the highest level of calcium (3.1%), followed by Adansonia and Leuceana (1.81%), Moringa and Sesbania leaves (1.41%), whilst cockroaches, Hibiscus and Citrullus seeds meal recorded respectively 0.93, 0.81 and 0.55% of phosphorus. These results showed that all the ingredients samples contained appreciable quantities of all dietary nutrients tested for which more or less make them partial or complete substitutes for the conventional feed sources.

2.2 Antioxidant properties of fennel seeds

Munir *et al.,* (2003). In this study, the antioxidant activity of water and ethanol extracts of fennel seeds (*Foeniculum vulgare*) seed (FS) was evaluated by various antioxidant assay, including total antioxidant, free radical scavenging, superoxide anion radical scavenging, hydrogen peroxide scavenging, metal chelating activities and reducing power. Those various antioxidant activities were compared to standard antioxidants such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), and α-tocopherol. The water and ethanol extracts of FS seeds showed strong antioxidant activity. 100 μg of water and ethanol extracts exhibited 99.1% and 77.5% inhibition of peroxidation in linoleic acid system, respectively, and greater than the same dose of α-tocopherol (36.1%). The both extracts of FS have effective reducing power, free radical scavenging, superoxide anion radical scavenging, hydrogen peroxide scavenging, and metal chelating activities. This antioxidant property depends on concentration and increasing with increased amount of sample. In addition, total phenolic compounds in the water and ethanol extracts of fennel seeds seeds were determined as gallic acid equivalents. The results obtained in the present study indicated that the fennel seeds (F. vulgare) seed is a potential source of natural antioxidant. Although, the tests presented here show the usefulness of FS extracts as in vitro antioxidants it still needs to be that this extracts show their activity in emulsions, biological systems, health implications or dry foods.

Fig. 1: Fennel seeds

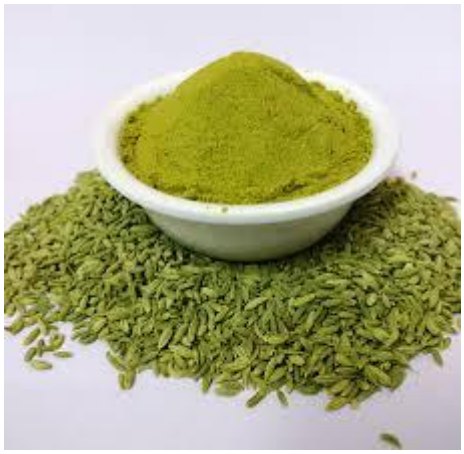

Fig. 2: Fennel seeds Powder

2.3 Anti-inflammatory properties of fennel seeds

Hanefi Ozbek, (2005). The aim of this study was to gas chromatographic analysis of extract of *Foeniculum vulgare* L. essential oil and to investigate its median lethal dose (LD₅₀) and possible anti-inflammatory effects. The composition of the essential oil was as follows: 74.8% (E)-anethole, 11.1% limonene, 4.7% methyl chavicol, 2.5% fenchone and 1.3% α-pinene. The LD₅₀ dose was found to be 1.038 mL kg⁻¹. The essential oil of *Foeniculum vulgare* L. was investigated the model of carrageenan induced rat paw edema and it had an anti-inflammatory effect matching to that of etodolac at 0.050 and 0.200 mL kg⁻¹ doses.

2.4 Fennel seeds's anti-cholesteremic effect

Ntchapda *et al.,* (2017). Hyperlipidemia and oxidative stress are major risk factors for atherosclerosis, and all three are among the most important risk factors for cardiovascular diseases. Cassia occidentalis aqueous extract has been used in African traditional medicine for the treatment of hypertension and associated cardiovascular diseases. This study was undertaken to evaluate the hypolipidemic and anti-atherosclerotic properties of the aqueous extract of the leaves of C. occidentalis in rats with hypercholesterolemia (HC). Sixty Normocholesterolemic (NC) male rats were divided into six groups ($n = 10$) and fed a high-cholesterol (HC) diet for 30 days (5 groups), or normal rat chow (normal control group). The plant extract was administered to animals at the increasing dose of 240, 320 and 400 mg/kg. After 4 weeks of treatment 5 rats out of 10 were sacrificed, blood samples, aorta, liver, and fresh faecal were collected and processed for biochemical tests. The experiments were conducted under the same conditions with a group of rat treated with Atorvastatin (1 mg/kg), used positive control. The effects of C. occidentalis on weight gain, water and food consumptions, levels of serum lipids and lipoprotein lipid oxidation and stress markers in blood and liver were also examined. A significant body weight gain was observed in general in all the group of animals without any treatment after 4 weeks. During the treatment period, the C. occidentalis extract induced a significant increase ($P < 0.01$) in water consumption and food intakes. After 4 weeks of treatment with hypercholesterolemia, the body temperature and organ weights including the liver, kidney, heart and the testis did not present any significant change. The administration of C. occidentalis extract significantly ($p < 0.05$) prevented the elevation in TC, LDL-C, VLDL-C, hepatic and aortic TG and TC. The atherogenic, triglycerides, and lipid peroxidation (TBARS) index were also decreased in the rats treated with the plant extract. C. occidentalis favoured the performance of faecal cholesterol. It also significantly inhibited the changes and the formation of aortic atherosclerotic plaques. This study provides evidence of hypolipidemic and antiatherosclerotic effects of C. occidentalis extract. C. occidenntalis aqueous extract reduced bad cholesterols, triglycerides and increasing good cholesterols in rats subjected to a feeding regime enriched with cholesterol. The results support the traditional use of the extract of this plant in the treatment of hypertension and diabetes.

2.5 Effect of fennel seeds as poultry feed

Arif *et al.,* (2019). The present study aimed at evaluating the effect of a phytogenic mixture in the diet on broiler production. A total of 400 day-old unsexed Cobb broiler chicks were randomly allotted to four treatment groups of 10 replications in a randomised design experiment. The phytogenic feed mixture (BMC) contained equal ratios of black cumin, Moringa oleifera and chicory seeds. The treatment groups were as follows: T_1 was fed the basal diet, while T_2, T_3 and T_4 were fed the basal diet supplemented with 0.2%, 0.4% or 0.6% of three BMC mixture, respectively. Results showed that increasing the dietary BMC level could be associated with a gradual but significant increase in body weight and improvement in the feed conversion ratio when compared with the control group. Broiler diets enriched with 0.4% to 0.6% of the BMC mixture reduced gut microbial count of coliforms, *E. coli* and *C. perfringens* as well as gut pH, compared to the control group. Increasing the dietary BMC mixture level was associated with gradual but significant decrease in serum total cholesterol, low density lipoprotein concentrations and liver enzymes concentrations. However, there was an increase in the high density lipoprotein concentration, and glutathione peroxidase and superoxide dismutase activity in serum. In conclusion, the BMC mixture could be deemed an effective growth promoter, but further research is needed to evaluate it as a viable alternative to antibiotics.

Abd El-Latif *et al.,* (2019). Four hundred fifty one day old, unsexed growing Japanese quail were distributed into 6 treatment groups to evaluate the effect of adding some additions at different levels, 0.5 or 0.1% of fenugreek seeds (FS), 0.5 or 1% of yeast culture (YC) and 0.5 plus 0.5% mixture of FS plus YC to Japanese quail diet, on digestibility and economical efficiency responses. Each treatment group contained 3 replicates, of 25 birds. The control diet had no additions. At the end of 6 weeks of age, a digestion trial was done to calculate the digestibility of nutrients. The economical efficiency was calculated by Egyptian pound (L.E) according to the prices of year 2015. The data revealed that, birds fed dietary 1% YC recorded the best ($P \leq 0.05$) value of dry matter digestibility followed by birds fed dietary 0.5% YC compared with other dietary treatments. Moreover, birds fed either YC at all levels or mixture of YC and FS in their diets recorded the greatest ($P \leq 0.01$) crude fiber and crude protein digestibility compared with other dietary treatments. The greatest ($P \leq 0.01$) values of ether extract digestibility were recorded for birds fed diets contain 0.1% YC or 0.5% FS. Economical efficiency,

relative economical efficiency percent and net revenue items, recorded the highest values when birds fed dietary 0.5% FS followed by chicks fed control diet compared with other dietary treatments.

Gaikwad *et al.*, (2019). The 140 day old „Vencob-400" chicks, which were divided into seven treatment groups with four replicates per group (Five chicks per replicate) i.e. 20 chicks per treatment groups. Dietary treatments consisted of basal diet T_0 (Control), T_1, T_2 and T_3 with T_4, T_5 and T6consist of 1, 2 and 3 per cent cinnamon while 1, 2 and 3 per cent ginger, respectively. Body weight and feed consumption were recorded at weekly interval. Feed conversion ratio, dressing percentage, economics of broiler production were calculated. Cinnamon and ginger feeding were done separately and compared by completely randomized design (CRD). The body weight of the 2.0% (T_2) cinnamon and 1% ginger (T_4) group was significantly ($P \leq 0.05$) higher than the other groups. The average feed consumption was significantly highest (3966.85 g/b) in control group and lowest (3793.30 ± 05.94 g/b) in 2.0% cinnamon (T_2) supplemented group. No mortality was observed entire experiment. Highest profit per bird was observed in T_4 (Rs. 24.17) followed by T_2 (21.15), T_1 (18.27) and other treatments while lowest in T_3 (8.47).Similarly highest cost benefit ratio was found in T_4 supplemented with 1% ginger powder followed by T_2, T_1, T_5, T_0, T_3 and T_6. From the result of present study it was concluded that dietary inclusion of 2.0 % cinnamon and 1.0 % ginger can be used as growth promoters for more profit per bird.

Mohammed, (2019). The present study was conducted to evaluate growth promoting effect of anise seed Pimpinella anisum L. in broiler chickens in terms of live body weight, carcass characteristics (traits), organ weights, production traits and mortality percentage. For this purpose, four levels with 0, 0.3, 0.6 and 0.9% of aniseed powder were administered in feed from day 0 till the end of experiment (42 days of age). Positive results were obtained specially in body weight and carcass traits like dressing percentage, when aniseed was fed by broiler chicken. This study showed a significant at $P<0.05$ effect of different treatments on live body weight and dressing percentage, but there was no significant at $P<0.05$ effects of different treatments on mortality percentage. Also, there was a significant at $P<0.05$ effect of different treatments on Carcass cuts: breast, thigh and back percentage, but there was no significant at $P<0.05$ effects of different treatments on wings, heart, liver and gall bladder percentage. According to the results obtained of this study, it can be concluded from this study that additive dietary broiler chicken with

anise seed improve production traits like live body weight, body weight gain, dressing percentage, FCR and production index. However, there were not significant effect on mortality and some internal body organ percentage.

Miroslava Kacaniova *et al.,* (2019). The aim of the present work was to evaluate the microbiological quality of chicken thighs after treatment by fennel seeds (*Foeniculum vulgare*) and savory (Satureja hortensis) essential oil, stored under vacuum packaging (VP) at 4 0.5 C for a period of 16 days. The following treatments of chicken thighs were used: Air-packaging control samples (APCS), vacuum-packaging control samples (VPC), vacuum-packaging (VP) control samples with rapeseed oil (VPRO), VP (vacuum-packaging) with fennel seeds essential oil at concentrations 0.2% v/w (VP + F), and VP with savory essential oil at concentration 0.2% v/w (VP + S). The quality assessment of APCS, VPC, VPRO, VP + F and VP + S products was established by microbiological analysis. The microbiological parameters as the total viable counts of bacteria of the Enterobacteriaceae family, lactic acid bacteria (LAB), and Pseudomonas spp. were detected. Bacterial species were identified with the MALDI-TOF MS Biotyper. The combination of essential oils and vacuum packaging had a significant eect ($p < 0.05$) on the reduction of total viable counts (TVC) compared with control group without vacuum packaging and the untreated control group. Though 15 genera and 46 species were isolated with scores higher than 2.3 from the chicken samples.

Ulsagheer Mohanad *et al.,* (2019). The experiment was designed to study the effect of adding natural apple vinegar adding to water and garlic powder and black bean adding to the feed on the immune system and some blood characteristics of broilers Ross 308. A total of 256 chicks were randomly divided in eight group, (16 bird in each replicate) for 35 days. The first group was fed without additives (control) (T_1). Second group was added apple vinegar to water 1 ml/l (T_2). Third group was added garlic powder 0.3g/kg (T_3). Fourth group was added black bean 4 g / kg (T_4). Fifth group was added apple vinegar 1 ml/l water and garlic powder 0.3g/kg (T_5). Sixth group was added apple vinegar 1 ml/l water and black bean powder 4g/ kg in the feed (T_6). Seventh group was added garlic powder 0.3 g/kg and black bean 4 g/kg in diet (T_7). Eighth group was added 1 ml/l water, garlic powder 0.3 g/kg and black bean 4 g/kg in diet (T_8). At the end of experiment 4 birds were chosen randomly from each group (2 birds / replicate) for anatomy and calculating the weight of some organs to evaluate the effectiveness of the immune system. Blood extraction was carried out to measure the level of immunity in birds against

Newcastle disease and the study of some blood characteristics. Results showed significant differences ($p \leq 0.05$) in thymus gland weight in favor of (T_7) compared with (T_1, T_2, T_3 and T_4) while not significant with (T_5, T_6 and T_8). Results showed no significant differences in the weight of spleen between all groups ($p \leq 0.05$) and showed a significant increase ($p \leq 0.05$) in the level of immunity against Newcastle disease and infectious bursal disease with the highest levels of (T_5 and T_7), while the lowest level of immunity against these diseases it was in (T_6 and T_8). The results showed a significant decrease in the level of cholesterol in (T_2 and T_6) compared with the other experimental groups. There was a significant increase in the level of protein in the blood in favor of (T_7 and T_8) compared with the other experimental groups. The blood glucose level was significantly lower in favor of the (T_6) compared to the other experimental groups.

Majid Hemati *et al.,* (2019). Poultry meat has high contents of polyunsaturated fatty acids that can cause off-flavors, off-odors, and reduce meat quality and shelf life. Replacement of phytogenic feed additives (PFAs) with chemical additives are highly considered, which reduces the potential risk of using poultry meat. The current study aimed at determining the effects of hydroalcoholic extract of hogweed (*Heracleum persicum*) and anise (*Pimpinella anisum* L.) on broiler meat quality, immune responses, and intestinal microflora and morphology. The current study was conducted on 400 male Ross 308 chickens divided into five treatment groups, based on a completely randomized design with four replicates of 20 broilers. The control group was not fed any feed additives, whereas the other groups received 100 mg/kg of probiotics (Primalac®), 200 mg/kg of hogweed extract, 200 mg/kg of anise extract, and 200 mg/kg of oxytetracycline, respectively. On day 35 of chicken breeding, the immune responses were investigated. At the end of chicken breeding, meat quality was analyzed. Also, the jejunal and ileal contents were investigated in terms of intestinal morphology and microflora. quality belonged to treatments with hogweed and anise extracts ($P < 0.05$). Also, the lowest number of harmful intestinal bacteria belonged to hogweed extract treatment ($P < 0.05$). Morphological characteristics of the intestine improved under the effects of hogweed and anise extract treatments ($P < 0.05$). Therefore, inclusion of 200 mg/kg of hogweed and anise extracts in broiler diet is suggested to improve meat quality, immune responses, and intestinal morphology as well as reduce the number of harmful bacteria in the ileum.

Kadir Emre Bugdaycı *et al.,* (2018). The objective of this research was to evaluate the effects of fennel seeds seed (*Foeniculum vulgare* Mill.) supplementation of ration on

performance, egg quality, and serum cholesterol of laying quails during an eight-week period. For this purpose, 96 quail (Coturnix coturnix japonica) of 16 weeks of age were evenly separated into one control group and three treatment groups. Each group was divided into four replicates, each containing six quail. The fennel seeds seeds (*Foeniculum vulgare*) were added to the diets of the first, second, and third treatment groups at levels of 0.3, 0.6, and 0.9%, respectively. No significant effect of dietary fennel seeds seed supplementation was recorded on body weight, feed intake, egg production, and egg weight. Feed efficiency (kg feed per kg egg) of the 0.6% treatment group was negatively affected by fennel seeds seed supplementation; however, kilogram of feed:dozen egg ratio was not affected when compared with the control group. The effects of dietary treatments on shape index, albumen height, albumen index, Haugh unit, yolk index, yolk colour, blood cholesterol level, and total phenol content of egg yolk had no significance. Dietary fennel seeds seed do not affect the egg quality and blood cholesterol level of laying quail. The amount of 0.3, 0.6, and 0.9% dietary fennel seeds seed supplementation do not have any adverse effect on performance and egg quality of laying quail.

Ebile Dayan *et al.,* (2018). The ban of antibiotics growth promoters due to bacteria resistance and the presence of chemical residues in animal products have stimulated research for alternative feeding supplements in poultry production. This study was designed to assess the production performance of quails under two D. glomerata feeding regimes. A total of 160 two weeks old Japanese quail chicks were assigned to four experimental treatments in a completely randomised design with 4 replicates of 10 chicks (5 males and 5 females) in each treatment. The two feeding regimes consisted of 5 g/kg of feed (T_1) and cold water inclusion of 5 g/l (T_2) of D. glomerata. Data were recorded on feed intake, weight gain, feed onversion ratio, haematological and serum biochemical parameters, and intestinal microbial count. Findings: Quails fed on the two feeding regimes were compared to quails fed with diet without any supplement (T_0) and an antibiotic (1 g/kg) medicated diet. The results showed no significant difference ($p>0.05$) in feed intake and weight gain, however the feed conversion ratio was significantly lower ($p<0.05$) with antibiotic compared to the two feeding regimes. The feeding regimes did not have any significant ($p>0.05$) effect on carcass yield and relative weight of organs. Triglycerides concentration was significantly higher in quails fed on cold water administration of D. glomerata as compared to the control diet. Aspartate

aminotransferase (ASAT), alanine aminotransferase (ALAT), creatinine, total protein, albumin, urea, total cholesterol, HDL-cholesterol and LDL-cholesterol were not significantly affected by the feeding regimes. Except for the concentration of pack cell volume (PCV) that was significantly high ($p<0.05$) with cold water administration (41.5%) as compared to the negative control ration (35.25%), haematological blood components were not significantly affected by the feeding regimes. Feeding quails with D. glomerata powder whatever the regime significantly ($p<0.05$) increased lactic bacteria count compared to *E. coli*, Salmonella and Staphylococci. Conclusions: The feeding of D. glomerata powder to quails through feed or drinking water can be used as an alternative to antibiotics to balance gut microbiota in Japanese quails.

Syed Muddassar *et al.,* (2018). To investigate the efficacy of promising alternatives to antibiotic growth promoters (organic acids, phytobiotics, and their combinations) as feed additives in poultry feed. Different feed treatments were formulated with organic acids, phytobiotics and their combinations, and their effects on blood profile, serum enzymes and immunity parameters were evaluated in broilers at 21 and 42 days of age. Cholesterol, triglyceride and HDL levels of the 21- and 42-day old broilers were significantly ($p < 0.05$) affected by the feed additives. The effect of albumin and albumin/globulin ratios varied significantly ($p < 0.05$) from that of the control group at 42 days of age. Haematological analysis did not show significant changes ($p > 0.05$) in parameters except hematocrit, RBC, MCH, MCHC, WBC at age 21 days. However, among the serum enzymes assayed, only gamma-glutamyl transferase activity was altered for the modified feed group. These results suggest that supplementation with organic acids and phytobiotics can be used as alternatives to antibiotic growth promoters without interfering with the overall health and performance of broilers.

Ribadiya *et al.,* (2017). Present study was undertaken to evaluate ground nut haulms as alternate feed resource by its incorporation in the diets of broiler birds. A total 240 one-day-old Cobb-400 broiler chicks were randomly assigned into four dietary treatments each with three replicates ($n = 60$). Experimental Birds in group T_1 were fed with conventional concentrate mixture while birds in T_2, T_3, T_4 were fed with feed containing 2%, 4% and 6% of ground nut haulms (GNH) replacing maize and soya bean on iso-nitrogenous basis. Feed intake increases significantly ($P > 0.05$) with increasing level of GNH in the diets of experimental birds. Highest feed intake was recorded in T_4 (6% GNH) followed by T_3 (4% GNH) than T_2 (2% GNH) and T_1 (control). Birds fed

groundnut haulms gained significantly ($P < 0.05$) higher body weight than birds fed the control diet. Birds in T_4 (6% GNH) gained highest body weight followed by T_3 (4% GNH) than T_2 (2% GNH) and T_1 (control). However, feed conversion ratio remained non-significant for all treatment groups. Regarding blood biochemical parameters, values of TEC and TLC showed non-significant difference. However values of Hb, PCV, AST and ALT were significant ($P<0.05$) among experimental groups but they were in normal range suggesting that groundnut haulms do not have any adverse effect on overall health and liver function in groundnut haulms fed birds. Based on results of the study it is concluded that supplementation of GNH can successfully replace costly ingredients like maize and soy bean meal in the diets of broiler birds up to the level of 6 % without any harmful effects on feed intake, growth and feed conversion ratio and Haemato biochemical profile. Keywords: body weight, feed intake, groundnut haulms, Haemato-biochemical profile.

Muhammad Arif1 *et al.,* (2017). A trial was conducted to evaluate the effect of different processing methods of pigeon pea (Pp; Cajanus cajan) on fattening performance and carcass traits as well as blood biochemical and hematological parameters of broiler chickens. For this purpose, 300 dayold chicks were assigned to 5 treatments. Each treatment had 5 replicates and contained 12 birds each under a completely randomized design. Five isonitrogenous and isocaloric diets were formulated with the inclusion of pigeon pea crushed (control, PPC), boiled with potash (PPP), boiled (PPB), soaked (PPS), or roasted (PPR) at the rate of 20% of the basal diet. The highest values of weight gain were observed in chicks fed the PPP diet through the starter and overall periods. Throughout the starter phase, the feed conversion ratio was significantly affected by dietary treatments. Highest values for carcass and breast weight were observed in birds fed the PPP diet as compared to the control diet. Blood biochemical parameters were not statistically influenced by Pp treatments. Hematology was also similar in all the diets. In conclusion, PPP can be used as a protein source in broiler diets and it can improve the growth performance of broilers.

Chang-Song Ria *et al.,* (2017). A 6-week experiment was conducted to evaluate the effects of dietary oregano powder (OP) supplementation on the growth performance, antioxidant status and meat quality of broiler chicks. A total of 180 one day-old Arbour Acres broilers were randomly divided into 3 treatments with 6 replicates and 10 chicks per replicate. The chicks were fed with basal diet without (CTR), or with 20mg/kg of

virginiamycin (ATB), or with 150 mg/kg of OP. At 21 and 42 days of age, two birds from each cage were selected for sampling. Compared to the CTR group, the OP supplementation increased average daily gain and average daily feed intake during the grower period (p¼.047 and .03, respectively) and the whole period (p¼.04 and .02, respectively). The supplementation of ATB and OP did not affect the immune organ index of chicks. In addition, dietary OP reduced malondialdehyde content and increased total antioxidant activity (T-AOC) in the serum of chicks at 21 (p<.01) and 42 (p<.01) days of age, and chicks fed OP had higher T-AOC than the ATB chicks at 21 days of age (p<.01). However, no dietary effect was observed on carcase yield, cooking loss, dripping loss, shear force, pH value and meat colour. The results of the present study indicate that dietary OP supplementation could positively improve the growth and systemic antioxidative defence property of broiler chicks, which had potential to act as a growth promoter comparable to antibiotic in broiler chicks.

Pimpinella Anisum, (2017). The objective of the study was to investigate the influence of anise seed (*Pimpinella anisum L.*) powder supplemented to the drinking water on selected blood parameters of broilers. In total, 360 one-dayold Hubbard Classic chicks were randomly divided into four groups with three replicates of 30 birds each. Anise seed powder was added at 0, 500, 750, and 1000mg/L to the drinking water offered to the C (control), T_1, T_2, and T_3 groups respectively. The supplement was supplied for 56 days. When broilers were 28 and 56 days old, blood samples were collected (30 birds per group) by brachial vein puncture to evaluate the cellular components of blood (RBC, WBC, Hgb, HCT, H/L). The following serum biochemical parameters were evaluated: CHOL, GLU, TP, albumin, globulins, Ca, P, TG, total lipids, UA, and creatinine, as well as AST and ALT enzyme activities. The statistical analysis indicated that the anise supplement significantly improved blood RBC, WBC, Hgb, HCT, TP, albumin, globulin, GLU, P, and Ca levels of broilers in groups T_4, T_3, and T_2 compared with the control group on days 28 and 56, and on average. Also, T_3, T_2 and T_1 presented lower H/L ratios and CHOL, TG, total lipids, creatinine, UA, AST and ALT serum levels compared with the control group. The highest inclusion levels of anise seed powder, i.e., 1000 and 750mg/L, had a stimulating effect on the physiological traits of the birds.

Kumar *et al.,* (2017). Nigella sativa L. (black cumin), an aromatic plant, is used as a natural remedy due to the presence of antimicrobial, antioxidant and other pharmacological properties. The presence of large number of essential nutrients and a

variety of pharmacologically active compounds make black cumin seeds (BCS) potentially suitable for the use in poultry diets as a feed ingredient. Many studies have been conducted to investigate the possibility of introducing BCS as a natural feed additive for better productive performance under normal or stress conditions in birds. Supplementation of BCS in poultry diets increased growth performance, daily feed intake and feed efficiency in several studies. Nutrient utilisation also increased as a result of BCS inclusion in the diets. The population of some pathogenic bacteria were decreased by BCS. Antibody titres against viral diseases after vaccination increased owing to supplementation of BCS in the diets. The inclusion of BCS in poultry diets showed pronounced cholesterol lowering effect in blood. There is limited information on the chemical composition and antioxidant properties in meat and eggs from chickens fed with BCS diet. However, few studies reported that BCS may increase polyunsaturated fatty acid content and antioxidant properties in meat. The present paper reviews the effect of BCS as an alternative to growth promoters in poultry nutrition.

Serhat Akyildiz *et al.,* (2016). Various kinds of antibiotics have been used extensively as growth promoters in animal feeds for a large number of years, especially in the fields of poultry production. As a result of the decision to ban of the antibiotics in livestock production researches on plant extracts as alternatives to the use of growth promoters (antibiotics) has significantly increased. Many novel natural candidate replacements including probiotics, prebiotics, organic acids and plant extracts and essential oils have been applied to maintain good production. Recently, herb and plant extracts have been received a great attention to be fed to poultry as feed additives to improve and increase production. The most commonly studied plants to be used in animal nutrition are cinnamon, oregano, cumin, garlic, sumac, cloves, anise, mint, coriander and ginger. Researchers have shown that these extracts are the powerful stimulators of the immune and animal digestive systems as well as highly beneficial effects in poultry nutrition due to their antioxidant, antimicrobial, antiviral, anticoccidial and anthelmintic properties. The aim of this review is to provide an overview of the recent knowledge on the use of plant extracts in poultry feeds as feed additives and their effects on the poultry performance.

Okoro *et al.,* (2016). Medicinal spices like ginger contain chemical substances that could be used to enhance the value of food of animal origin and these substances are responsible for some other health benefits. This study investigated the effect of ginger on

the performance, carcass yield, organoleptic quality, egg quality, muscle ether extract content, yolk cholesterol and serum lipid profile of broilers and layers using one hundred and eight (108) day old broilers and seventy two (72) laying hens in a 56 and 49 day feeding trials, respectively. Three experimental diets for starting, finishing broilers and laying chickens were formulated such that the diets contained 0%, 0.5% and 1% of air dry and milled ginger. The diets were randomly assigned to three groups of 36 and 24 birds each replicated 3 times to give 12 broilers and 8 layers respectively, in a complete randomized design. Result showed no significant differences in feed intake and FCR among the treatment groups ($P > 0.05$) in both broiler and layer studies. There were significant reductions in final live weights of starter broilers and layers ($P < 0.05$). Diet related differences in final live weight of finisher broilers were not significant ($P > 0.05$). Dietary treatments had no effect ($P > 0.05$) on meat organoleptic quality, carcass and organ weights with the exception of the neck and heart. Result showed that dietary inclusion of ginger led to significant decrease in serum high density lipoprotein (HDL) in layers, but increased percentage albumen content in eggs ($P < 0.05$). Generally egg weight slightly increased with dietary ginger inclusion, whereas egg laying rate was similar across the various dietary treatments. Results indicated that inclusion of air-dried ginger at 0.5% and 1.0% levels depressed live weight gain in starter broilers and layers, but not in finisher broilers. Inclusion of ginger in layer diets apparently resulted to increased egg size and percentage albumen content, but reduced yolk size.

Maha Hady *et al.*, (2016). The objectives of the current study were to evaluate the performance responses, guts healthiness, and carcass characteristics of broiler chickens fed on formulated diets included dried coriander, turmeric and thyme. Unsexed commercially available chicks were enrolled into five experimental treatments each of eighty birds with four replicates per treatment. The birds were housed in deep litter clean pens. The experimental groups were as follow: Control; coriander; thyme; turmeric, and mixed. Two formulated diets (starter and finisher) to which all the dietary additives were added in a dried powdered form and at the level of 0.75% expect for the mixed group as each additive was used at level 0.25%. Performance parameters including weekly body development, body weights gain, feed intake, and feed conversion ratio were recorded during the 35-d experimental period. Also, representative samples from each replicate were gathered for the detection of carcass traits, consumer acceptability, and the gut morphometric changes. The data revealed that coriander, and turmeric significantly

($p<0.05$) increased the villus heights and crypt depths as compared to control which is concomitant with the improvement of performance results when incorporated solely in broilers diet at 0.75% level , but consumer acceptability was lowered specifically for the turmeric –fed group.

Mohamed Hassaan *et al.*, (2016). A total of six treatments, i.e., negative control group (D_1), B. licheniformis 7×107 CFU g−1 diet (D_2); 1ml essential fennel seeds oil (EFO) kg-1 diet (D_3); 1 ml essential garlic oil (EGO) kg-1 diet (D4); B. licheniformis 7×107 CFU g−1 +1 ml EFO kg-1 diet (D_5) and B. licheniformis 7×107 CFU g−1 +1 ml EGO kg-1 diet (D_6) were added to the diets of Nile tilapia, Oreochromis niloticus to investigate the effects of the respective treatments on the growth, feeding behaviour, hematological and biochemical indices. Fish (1.88 ± 0.12 g) were distributed at a rate of 20 fish per 100-L aquarium and three aquaria have been assigned for each treatment. At the end of the experiment (84-day), results indicated that the highest survival, weight gain and specific growth rate were recorded by fish fed D5 and D6 being statistically different ($P<0.05$) from other treatment groups. Whereas, the best feed conversion ratio and protein efficiency ratio were observed in D3, D4, D5 and D6 compared with other treatment groups. Fish feed D6 were higher in mouth wrestling and chasing behavior. Fish fed D5 and D6 significantly higher ($P<0.05$) hematocrit and hemoglobin values also, was effectively enhanced aspartate aminotransferase, alanine aminotransferase, total protein and globulin in comparison to the other treatments. No significant differences were found in the chemical composition of whole body of fish fed different tested diets.

Vakili *et al.*, (2016). In this experiment, the effects of fennel seeds and thyme extracts with and without flaxseed were investigated on performance and egg quality of Leghorn-type laying hens (Hy-Line W-36). 200 laying hens from 26 to 38 weeks of age were assigned to five dietary treatments with five replications. The treatment groups were: 1) Control (a diet without any additives); 2) control diet plus fennel seeds (40 mg/kg feed); 3) control diet plus thyme (40 mg/kg feed); 4) a diet containing flaxseed and fennel seeds; and 5) a diet containing flaxseed plus thyme. There were significant differences in feed intake and egg weight between the treatments ($P < 0.05$). The egg yolk color index in hens that received thyme extract and flaxseed treatment was significantly higher than other treatments ($P < 0.05$). Hens fed control diet had lower Haugh unit compared to other treatments that contained herbal extracts. The eggshell strength was significantly higher in hens that received thyme extract and flaxseed treatments than control ($P < 0.05$).

The eggshell weight in treatments containing flaxseed was significantly higher compared to the other treatments ($P < 0.05$). The lowest egg yolk cholesterol concentration was found in hens fed thyme and flaxseed treatment. The hens fed plant extracts and flaxseed diets had eggs with low palmitic and stearic acids and high α-linolenic acid. It is concluded that thyme and fennel seeds extracts, as well as flaxseed, improved the performance and egg quality of laying hens. The use of flaxseed and thyme extract improved egg yolk omega-3 fatty acids and decreased yolk cholesterol content.

Gharaghani *et al.,* (2015). In this study, one hundred and twenty 40-wk-old White Leghorn laying hens were submitted to two different thermal conditions (24° C vs. 34° C) and were fed three levels (0, 10, or and 20 g/kg of diet) of fennel seeds fruits (*Foeniculum vulgare Mill.)* as a feed additive in. This study was carried out according to a factorial design consisting of two temperatures and three fennel seeds levels with five 5 replicates each ($n = 2 \times 3 \times 5$). Performance, egg production, egg quality, and oxidative product levels (malondialdehyde, MDA, and carbonyl) in the eggs were measured before and after heat exposure. The results showed that the tested temperatures did not affect egg production ($p>0.05$), but the production of eggs with broken shell and feed intake were affected by heat stress ($p<0.05$). The different temperatures also affected egg quality ($p<0.05$), reducing egg weight (EW), eggshell thickness (EST), eggshell strength (ESS), Haugh units (HU), albumen height (AH), and albumen weight (AW). At the high environmental temperature, MDA and carbonyl egg contents increased ($p<0.05$), while fennel seeds consumption reduced the values of both parameters. Heat stress had no effect on yolk cholesterol levels ($p>0.05$), but increased yolk triglyceride levels. Hens that consumed fennel seeds presented lower yolk cholesterol and triglyceride levels ($p<0.05$). In general, fennel seeds fruit influenced egg yolk cholesterol and triglyceride contents, and because of its antioxidant properties, it may alleviate the adverse effects of heat stress on laying hens.

Sahar Abdalwahab *et al.*, (2015). This experiment was conducted to evaluate the response of broiler chicks fed on graded levels of Shamar seed (*Foeniculum vulgare* mill) as natural growth promoter alternative to antibiotic. Experimental parameters covered growth performance, carcass dressing percentage, subjective and objective meat quality and economical appraisal. The experimental design used was complete randomize design (CRD). A total number of (84), 8 days-old, 140 gm initial weight unsexed(Abar Acer) strain of broiler chicks randomly divided into four experimental groups with three

replicates, each of seven chicks. The first group (A) fed on basal diet without feed additives (control group), the other groups B, C and D were fed basal diet supplemented with different levels of (*Foeniculum vulgare* mill) 1,2,3,%. The basal diet was formulated to meet the nutrients requirements of broiler chicks according to (NRC, 1994). Experimental diets fed for 6 weeks. The results indicated that there were no significant differences ($P > 0.05$) among all treatment groups in the values of body weight gain, feed intake, feed conversion ratio, carcass dressing percentages and subjective and objective meat quality attributes. No mortality recorded throughout the experimental period. The economical evaluation showed that levels of dietary (*Foeniculum vulgare* mill) were economical feasible compared to control group, but the values of profitability ratio (1, 14) (1.08) of group B, C, were the highest of the tested groups.

Ali Asghar Saki *et al.,* (2014). This present study was conducted to evaluate the effects of dietary inclusion of 4, 8 and 12 g kg-1 phytogenic feed additives mixture on performance, egg quality, ovary parameters, serum biochemical parameters and yolk trimethylamine level in laying hens. The results of experiment have shown that egg weight was increased by supplementation of 12 g kg-1 feed additive whereas egg production, feed intake and feed conversion ratio (FCR) were not significantly affected. There were no significant differences in egg quality parameters by supplementation of phytogenic feed additive, whereas yolk trimethylamine level was decreased as the feed additive level increased. The sensory evaluation parameters did not differ significantly. No significant differences were found in serum cholesterol and triglyceride levels between the treatments but low- and high-density lipoprotein were significantly increased. Number of small follicles and ovary weight were significantly increased by supplementation of 12 g kg-1 feed additive. Overall, dietary supplementation of polyherbal additive increased egg weigh, improved ovary characteristics and declined yolk trimethylamine level.

Faramarz Fekri *et al.,* (2014). To evaluate the effect of inclusion of three levels of anise seed (*Pimpinella anisum* L.) as an antibiotic growth promoter substitute on growth performance, carcass traits, and immune responses in broiler chickens. Two hundred and forty, 1-day-old, hatched Ross broilers received a maize-soybean meal basal diet and were allocated randomly in the following five experimental treatments for 6 weeks: basal diet-no additives, basal diet containing 1 g anise/kg diet, basal diet containing 5 g anise/kg diet, basal diet containing 10 g anise/kg diet and basal diet containing flavophospholipol at 4.5 mg/kg diet. At Day 42, two birds per replicate were slaughtered

for determination of carcass and organ weights. At Day 28, serum antibody titers against avian influenza virus were measured by the hemagglutination inhibition test. Bodyweight of broilers fed basal diet was higher at 42 d of age than other groups but it was not statistically significant (P>0.05). Broilers receiving basal diet had higher feed intake compared to broilers receiving difference levels of anise seed (P<0.05). The most efficient feed conversion throughout the study was observed in chicks fed diets supplemented with 1 g anise/kg (P<0.05). Most of the carcass characteristics of broilers slaughtered at Day 42 were not influenced by treatments but carcass yield significantly increased (P<0.05) in broilers supplemented with 10 g anise/kg compared to antibiotic group. Antibody titer against avian influenza virus increased in the group treated with 10 g anise/kg diet compared with other groups (P<0.05). The results suggested that dietary inclusion of 10 g anise/kg can be applied as alternatives to in-feed antibiotics for broiler diets.

Hesam Hosseinzadeh *et al.,* (2014). The effects of using different levels of coriander seed powder or extract on selected blood parameters, intestinal microflora, and immune response of broiler chickens were investigated in this study. A total of 420-day-old broiler chicks were randomly assigned to 7 treatments with 4 replicates and fed for 42 days. Results showed that inclusion of 2.0% coriander powder in broiler diets lowered total cholesterol while blood urea was significantly higher in birds on T_4 compared to T_1 and T_2. Furthermore, there were no treatment effects on Lactobacillus bacteria; however, the population of *E. coli* was significantly higher in the ileum of chickens fed T_0. Noticeable significant improvements of antibody titer against Newcastle, infectious bronchitis, and infectious bursal disease were observed in birds receiving coriander extract in water. Immunoglobulin G antibody against sheep red blood cells showed significant improvement in birds fed T_3; likewise, immunoglobulin M was significantly higher in birds on T_2 and T_3 at 28 d of age. These results revealed that coriander extract or powder can be used as antibiotic alternative in broiler feeds.

Henda Mahmud, (2014). A total number of 400 Japanese quail (Coturnix coturnix japanica) chicks at hatch. The quail chicks were housed in cages at hatch up to 42 days of age. The experiment aimed to study the response of growing Japanese quail to different levels of fennel seeds seeds meal. Quail chicks were divided randomly into four equal experimental treatments (100 in each treatment) and randomly divided into four equal replicates (25 chicks /replicate).The first treatment was fed the basal diet as a control,

while the other three treatments were fed the basal diet supplemented with the fennel seeds seeds meal (as medicinal plants), at levels of 0.25, 0.50 or 0.75 g/kg diet, respectively. The experimental diets were iso-caloric (2900 kcal ME/kg), iso-nitrogenous (24% CP) and iso- fibrous (3.01%). The results obtained could be summarized as follows Live body weight and body weight gain of quail chicks were significantly ($P<0.05$) increased with dietary feed fennel seeds seeds meal (FSM). The highest live body weight and body weight gain were recorded by using fennel seeds seeds meal, while, those fed the control diet recorded the lowest values. It is worth noting that feed intake significantly ($P<0.05$) increased among treatments, compared to the control diet. Fed diet containing 0.50 g/kg FSM recorded the best values ($P<0.05$) of feed conversion ratio (FCR) (g feed/g gain). Mortality rate recorded a non-significant difference between treatments. Dressing percentage showed significant ($P<0.05$) increase with the feed additives, while edible giblets (liver, heart and gizzard) percentage was insignificantly increased by FSM. Digestibility coefficients of OM, CP, CF, EE, NFE and the nutritive values expressed as DCP, TDN % and ME (kcal/kg) were significantly varied ($P<0.05$) among the different experimental treatments. Fed diet containing 0.50 g/kg diet FSM showed the best net return as well as the highest value of economic efficiency among experimental treatments.

El-Deek *et al.,* (2012). The effect of feeding two levels of dietary crude protein (21 vs. 23%) in combination with or without two levels of GT 1.5 and 3 g/kg diet or one level of OTC at 0.1 g/kg was investigated on performance, carcass characteristics, organs weights, immunological response and meat quality traits in a factorial (2 × 4) experimental design. Each treatment was replicated four times with six chicks each. Birds were housed in a room with controlled environment and the experiment lasted from 1 to 45 days of age. Decreasing dietary crude protein level to 21% had no adverse effect on growth rate, meanwhile, GT supplementation at 1.5 g/kg diet increased growth rate at 45 d of age and improved FCR by 10.4%. Dressing percentage of group fed diets containing 21% CP was increased compared to those of 23% one. Feeding 23% CP level significantly increased WBC's at 45 d of age and antibody response to IB at 21 d of age, while OTC supplementation to 23% CP level significantly increased WBC's compared to those supplemented with GT at both protein levels. Dietary CP did not significantly affect plasma total lipid and cholesterol, while increasing CP level significantly increased plasma triglyceride at both 21 and 45 d of age. Supplementation of low CP diet with 1.5

and 3.0 g GT or 0.1 g OTC/kg diet improved the sensory criteria of breast meat, whereas, feeding low CP diet supplemented with 3.0 g GT/kg diet improved the panel test criteria for thigh meat. In conclusion, broiler chickens may be fed 21% CP diet containing adequate methionine and lysine levels based on NRC (1994) when supplemented with 1.5 GT/kg diet from 1-45 d of age without negative effect on productive performance and meat quality. This may contribute to decreased environmental pollution by decreased nitrogen excretion and to more consumer safety in regard to AGP.

Mohammad *et al.*, (2012). The main objective of this study was to determine the effects of biofertilizers on the morphological traits and seed yield in the anise plant height, umbel number per plant, weight of 1000 seeds, biological and seed yield. The experiment was carried out at the Hamand Research Station in Damavand in 2009. Vermicompost (0, 5 and 10 ton/ha) and phosphate solubilizing bacterium, *Bacillus circulans* (non-inoculated, inoculated seeds and inoculated seeds + spray on the plant base at stem elongation stage) were used as the effecting parameters. The results of present study demonstrated that the highest plant height, umbel number per plant, biological and seed yield were obtained after applying 10 ton/ha vermicompost. Phosphate solubilizing bacterium also showed significant effects on umbel number per plant, biological yield and seed yield. The maximum umbel number per plant, biological yield and seed yield were obtained using the phosphate solubilizing bacterium twice.

Farhad Khaligh *et al.*, (2011). A total of 304 day- old male Ross-308 broiler chicks were allocated into six dietary treatments including basal diet with no supplement as control group (C), basal diet plus 10 g/kg of herbal blends including; garlic, cinnamon, thyme, rosemary and anise (B), thyme, caraway, carum copticum (G), alfalfa, senna, corn flower and absinthe (D) alfalfa, liquorice root, great burdock, cinnamon (F), polygermander, water cress, absinthe and echinacea purpura (E). Live body weight (LBW), average daily gain (ADG), daily feed intake (DFI), feed conversion ratio (FCR), carcass characteristics, concentration of some serum metabolites, immunological properties such as antibody titer against Newcastle disease virus as well as relative weights of bursa gland and spleen were studied in the experimental birds. Addition of blend D to the diet resulted in insignificant improvement of LBW whereas blend E decreased the birds LBW when compared with control group ($p < 0.05$) at 21 and 42 days of age. Significant depression of ADG in 1-21 and 1-42 and higher FCR in 1-42 rearing periods were also recorded in the blend E treated chickens ($p < 0.05$). The birds DFI were not affected by the experimental diets.

Higher cholesterol contents of serum in B, F and G groups at day 33 and lower TG and VLDL contents at day 21 of age were noticeable changes in to the measured serum metabolites ($p < 0.05$). The addition of 10 g/kg blend F to the broiler diet resulted in the most consistent improvement in antibody titer against Newcastle disease virus ($p < 0.05$) among the groups. Lower carcass yield was documented in the administration of blend E in broiler diet than control and D treated birds ($p < 0.05$).

Abdullah *et al.,* (2009). An experiment was conducted at the College of Agriculture Poultry Farm, University of Basra from 20/11/2007 to 2/1/2008 to study the effect of adding fennel seeds seeds to the diet on productive performance of broiler chickens. A total of 120 day - old chicks were randomly distributed into four dietary treatments of fennel seeds 0, 1, 2 and 3 g/kg diet contained 36% and 32% chick peas in the starter and finisher diets respectively. Results indicated that there was a significant improvement ($p<0.05$) in final body weight and feed efficiency. Carcass characteristics had no significant differences except true stomach and pancreas weight percentage. Flier repletion was highly significant when fennel seeds was added. However chicks fed 1, 2 and 3 g/kg fennel seeds had significantly ($p<0.05$) higher red blood cells, hemoglobin and packed cell volume. Hetrophil to lymphocyte ratio was significantly ($p<0.05$) declined for the chicks received 2 and 3g/kg fennel seeds.

Abdullah *et al.,* (2009). A total of 120 day - old chicks were randomly distributed into four dietary treatments of fennel seeds 0, 1, 2 and 3 g/kg diet contained 36% and 32% chick peas in the starter and finisher diets respectively. Results indicated that there was a significant improvement ($p<0.05$) in final body weight and feed efficiency. Carcass characteristics had no significant differences except true stomach and pancreas weight percentage. Flier repletion was highly significant when fennel seeds was added. However chicks fed 1, 2 and 3 g/kg fennel seeds had significantly ($p<0.05$) higher red blood cells, hemoglobin and packed cell volume. Hetrophil to lymphocyte ratio was significantly ($p<0.05$) declined for the chicks received 2 and 3g/kg fennel seeds.

Cabuk, *et al.,* (2006). The aim of the present study was to examine the effects of a herbal essential oil mixture on the performance of broilers produced by a young (30 wk) or an old breeder (80 wk) flock. One thousand and eight unsexed day-old broiler chicks (Ross-308) originating from the two breeder flocks were randomly allocated to three treatment groups of 336 birds each. Dietary treatments were: a control and two diets containing 24

mg/kg or 48 mg/kg of an essential oil mixture. There were no significant effects of dietary treatment on body weight of the broilers at 21 and 42 days. The effect of the age of the parents did not have a significant effect on body weight of the broilers at 21 and 42 days of age. Up to 21 days the feed intake of broilers from young breeders was reduced significantly as a result of the inclusion of the essential oil mixture in their diets, and a significant improvement in feed conversion ratio was recorded in these birds. Difference in regression coefficients for feed intake and feed conversion ratio between broilers from young and old breeder flocks was significant. Carcass yield and some internal organ weights such as the liver, pancreas, proventriculus, gizzard and small intestine were not affected by the addition of the essential oil mixture to the diet. Inclusion of essential oil mixture to the diet decreased mortality significantly at 21 days.

Mehmet Ciftci *et al.*, (2005). Different levels of anise oil were added to a standard diet, to determine its effect on feed intake, daily live weight gain and feed conversion ratio compared to control and antibiotic groups. Two hundred day-old broilers (Ross-308) were divided into groups of 40 birds each and randomly assigned to the five treatment diets. Each treatment has four replicates. Experimental groups were as follow: A Control group with no anise oil or antibiotic added, a 100 mg/kg Anise oil group, a 200 mg/kg Anise oil group, a 400 mg/kg Anise oil group with corresponding inclusion levels, and an antibiotic group with 0.1% added antibiotic (Avilamycin). The feed intake was similar in groups ($p>0.05$). The highest ($p<0.01$) daily live weight gain was observed on the 400 Anise oil group (70.35 g) and followed by Antibiotic group (65.84 g), 100 Anise oil group (62.57g), 200 Anise oil group (62.47 g) and control group (61.30 g). The addition of 400 mg/kg anise oil to the diets was improved daily live weight gain by approximately 15% compared to the control group. This improve was remained 7 % level in antibiotic group. Additionally, the addition of 400 mg/kg anise oil to the diets was improved daily live weight gain by approximately 6.5% compared to the antibiotic group. The addition of 400 mg/kg anise oil to the diets was improved feed conversion ratio by approximately 12 % compared to the control group. This improve was remained 7 % level in antibiotic group. Additionally, the addition of 400 mg/kg anise oil to the diets was improved feed conversion ratio by approximately 6 % compared to the antibiotic group. 7. In conclusion, anise oil could be considered as a potential natural growth promoter for poultry.

CHEPTER-III
MATERIALS AND METHODS

3.1 Statement of the research work

The experiment was conducted at the poultry farm, the Department of Dairy and Poultry Science, in Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, to investigate the Effect of Fennel seeds seed on Broiler Production during the period from July to December, 2019. To complete the research the following steps were followed:

3.2 Experimental birds

Total 96 day-old broiler chicks (Cobb 500) were purchased from CP Bangladesh Limited, Ranirbondor, Dinajpur, Bangladesh.

3.3 Preparation of the experimental house and equipment

The experimental birds were rearing in an open farm with one rooms. The experimental house was properly washed and cleaned by forced water using a hosepipe. After washing with clean water, the rooms were disinfected by quick lime and the rooms were left vacant for 15 days. At the same time all feeders, plastic buckets, waterers and other necessary equipments were also properly cleaned, washed and disinfected with detergent and potassium permanganate, subsequently dried and left them empty for at least one week before the arrival of chicks. Ceiling, walls, and wire nets were also thoroughly disinfected by spraying Virocid® (4ml/lit).

3.4 Layout of the experiment

The day-old chicks were reared at brooder house to adjust with the environmental condition up to 7 days. After 7 days, chicks were randomly allocated to four dietary treatment groups of 24 chicks each; each treatment was composed of three replications with 8 birds. The layout of the experiment is shown in Table 3.1.

Table 3.1 Layout showing the distribution of experimental broilers

Dietary treatments		Number of broilers in each replication			Total
		R_1	R_2	R_3	
Control (without fennel seeds powder)	T_0	8	8	8	24
Control+0.5% fennel seeds powder	T_1	8	8	8	24
Control+1% fennel seeds powder	T_2	8	8	8	24
Control+2% fennel seeds powder	T_3	8	8	8	24
Total No. of broilers		32	32	32	96

3.5 Procurement of feed ingredients

Feed ingredients for making the experimental diets were procured from the local market of Dinajpur town. During procurement, ingredients were evaluated carefully for their freshness by observing its color with naked eye and smell with nose.

3.6 Collection, processing and storage of fennel seeds powder

Dried fennel seeds (*Foeniculum vulgare* L.) purchased from local spices market, Dinajpur Bangladesh. The samples were further ground into powder by machine at chirirbondor, Dinajpur. The obtained powder was packed in a polyethylene bag and preserved in the feed storage room until used for feed formulation. Proper care was taken in the feed storage room to avoid spoilage.

3.7 Preparation of the experimental diet

Ready feed was used throughout the experimental study. The experimental period were divided into two phases (broiler-starter and broiler-finisher). The broiler chicks were fed broiler starter for 0 and 14 days and broiler finisher for 15 to 28 days of age. Fennel seeds powder was incorporated into the experimental diets manually in appropriate doses.

At first required amount of ready feed ingredients were weighed by digital weighing balance. Then different level of fennel seeds powder was mixed with different treatment. During the time of mixing cross mixing was applied. Mixing was done manually and no

coccidiostat or any other feed additives were added to the formulated diets in order to obtain clear-cut effect of the test-diet. The experimental diets were designed as-

T_0 : control

T_1 : control+ 0.5 % fennel seeds powder

T_2 : control+ 1 % fennel seeds powder

T_3 : control+ 2 % fennel seeds powder

Table 3.2 Chemical compositions of the experimental starter and grower diets fed to broilers

Nutrients	**Amount (kg/100kg feed)**	
	Starter (1-14 days)	**Finisher (15-28days)**
Metabolizable Energy, ME (kCal/kg)	3135	3195
Crude protein (%)	21.29	20.18
Calcium (%)	0.93	0.87
Nonphytate P (%)	0.47	0.45
Arginine (%)	1.37	1.29
Lysine (%)	1.21	1.07
Methionine (%)	0.57	0.51
TSAA (%)	0.93	0.85

3.8 Management of the experimental birds

Similar care and management in all treatment groups throughout the experimental period was practiced. At the initiation of the experiment, chicks were individually weighed recorded as initial body weight. The following management practices were followed during the whole experimental period and these management practices were identical for all dietary groups.

3.8.1 Litter management

During the experiment period for the first 7 days litter was covered by clean newspaper and newspaper was removed when it became dirty. After that period the birds were reared on rice husk littered floor having a depth of 4 cm. Before use of litter calcium carbonate was spread on the floor. After first week, upper part of the litter with droppings were removed regularly and stirred three times a week up to the end of the experiment. The litter was disinfected with Virocid® solution in every other day. Litter materials, when found damp for any reason, were removed to prevent accumulation of ammonia and other harmful gases. At the end of each week, litter was stirred to break its compactness and maintain proper moisture. At the end of 2^{nd} and 3^{rd} weeks of age, dropping were cleaned from the surface of litter.

3.8.2 Brooding

The experiment was conducted in summer (April to May/2019). Additional heat was provided to brood the chicks when it was necessary. Brooding temperature was kept at 37^{o} C in the first 1 week of age and decreased gradually at the rate of 3^{o}C in each week until they were adjusted to normal environmental temperature of the house and final temperature was 28^{o} C at the end of experiment. Additional heat was provided by fitting 100-walt electric bulb at the center of the pen about 12 inches above the floor from the 7-day old. The height of the bulbs was increased by raising the bulb gradually as per need of temperature. Papers were used on two sides of the house and in ventilators to protect cold and stormy wind. These sheets were removed partly or completely particularly at the later stage of finishing period when room temperature was found favorable. Daily room temperature (^{o} C) was recorded every six hours with a thermometer.

3.8.3 Lighting

All birds were exposed to continuous lighting of 23 hours and one hour dark period per day throughout the experimental period. The dark period was practiced to make the broilers familiar with the possible darkness due to electricity failure. Supplementary light at night was provided by electric bulb by hanging at a height of 2.8 meters to provide necessary lighting.

3.8.4 Floor, feeder and water space

An area of 8 sq. feet was allotted for 8 birds in each pen; therefore floor space for each bird was 1 sq. feet. One round feeder and one round waterer were provided in each pen for 8 birds; required feeding and drinking space was providing according to the number of birds in each replication.

3.8.5 Feed and water management

At the first week Feeds were supplied to the chicks on clean newspapers at three hours interval for the first 3 days. Linear feeder and round plastic drinker were used during brooding period. After that linear feeder was replaced by round plastic drinker. After 2 weeks, feeds were supplied thrice daily (once at morning, at noon and again at night) and water was supplied thrice daily (once at morning, at noon and again at night). Feed and fresh water were offered to the bird manually according to experimental schedule. Feeders were cleaned at the end of each week and drinkers were washed daily. All broilers in different treatments had fresh feed and drinking water *adlibitum* throughout the experimental period.

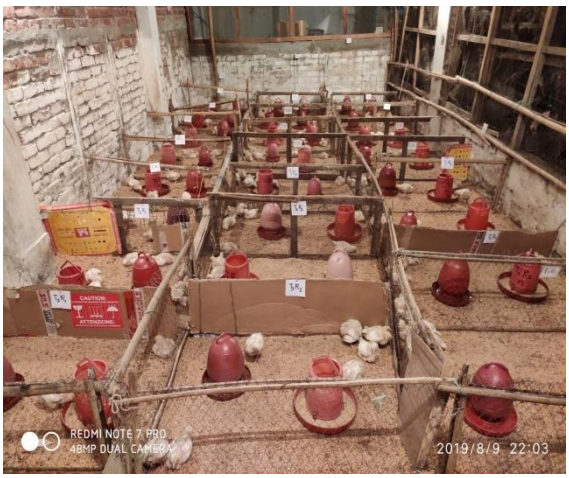

Fig. 3. Feeding of broiler

Fig. 4. Watering of broiler

3.8.6 Immunization

All birds were vaccinated against Baby chick Ranikhet Disease and Infectious Bronchitis at day one by the company. The birds were vaccinated against Ranikhet and Infectious Bursal (Gumboro) diseases by following schedule at the evening-

Table 3.3 Applied vaccination program

Diseases	Day	Vaccine	Route	Time
Ranikhet	4	RDV L	Eye	Evening
Gumboro	10	Gumboro vac	Eye	Evening
Gumboro	16	IBD VAC L	Drinking water	Evening
Ranikhet	21	RDV L	Drinking water	Evening

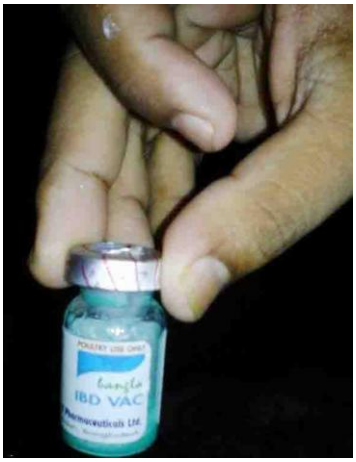

Fig.5. Vaccine of IBD

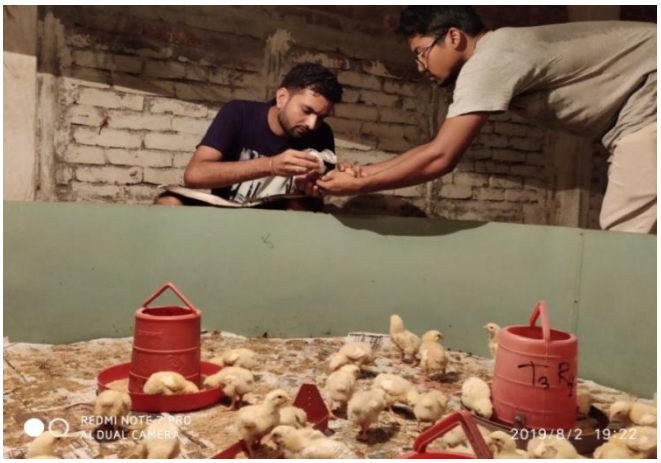

Fig.6: Vaccination of broiler

3.8.7 Medication

Immediately after unloading from the chick boxes the chicks were given Glucose and Vitamin-C to prevent the stress occurring during transport. Water soluble vitamin and normal saline were also provided for the first 3 days of brooding. During the course of experimental period, electrolytes and vitamin-C were added with the drinking water to combat stress due to high environmental temperature (33 to 37^{o} C).

3.8.8 Sanitation

Proper hygienic measures and strict sanitation programs were followed during the experimental period. The entrance of the farm and surrounding were kept clean and disinfectant (Virocid®) was sprayed regularly. In addition, the service area of the experimental rooms, outside wall and feed storage room were kept clean.

3.8.9 Bio-security

To prevent the outbreak of diseases, the following measures were taken to maintain biosecurity.

i. Entrance of visitors was not allowed except worker, researcher, supervisor and co-supervisor who visited farm by following special care.
ii. Before entrance, hands were washed with soap and shoes were changed, feet were dipped in a footbath containing disinfectant solution (potassium permanganate) and the footbath was at the entrance point.
iii. All equipment of the experimental house was kept clean.
iv. Sick broilers were promptly isolated to a separate place from the experimental pens.
v. Dead broilers were removed promptly and buried far away the experimental house.
vi. The experimental areas were kept free of rats, cats, dogs, and wild flying birds.

3.9 Processing of broilers

After termination of the experiment, one bird weighing average of pen weight from each replication was selected randomly. Feed was withdrawn from the pens 24 hours prior to slaughter but water was available to facilitate proper bleeding. Birds were slaughtered according to halal method. Following slaughter, broilers were allowed to bleed for about 2 minutes. Then the birds were scaled in hot water (55-65^{o} C) for about 120 seconds in order to loosen the feather of the carcasses and weighed again. Breast meat, thigh meat, drumstic meat were separated from the carcass. Finally, processing was performed by removing head, shank, viscera, oil gland, kidney and giblets. As soon as these were removed the gall bladder was removed from the liver and pericardial sac and arteries were cut from the heart. Cutting it loose in front of the proventriculus and then cutting with

both incoming and outgoing tracts removed the gizzard. Then, it was split open with knife, emptied and washed and the lining removed by hand.

3.10 Data collection and record keeping

The following records were kept during 30 days of rearing period:

i. Live weight.
ii. Feed consumption.
iii. Feed conversion ratio (calculated).
iv. Survivability: Recorded from mortality.
v. Temperature: Five times daily during the experimental period.
vi. Dressing yield: At the end of the experiment one broiler was slaughtered from each replication to estimate dressing yield.

3.10.1 Live Weight gain

The average body weight gain of each replication was calculated by deducting the initial body weight from the final body weight of the birds.

Body weight gain = Final weight — Initial weight.

3.10.2 Feed intake

Feed intake was calculated as the total feed consumption in a replication divided by number of birds in each replication.

$$\text{Feed Intake (g/bird)} = \frac{\text{Feed intake in a replication}}{\text{No.of birds in a replication}}$$

3.10.3 Feed conversion ratio

Feed conversion ratio (FCR) was calculated as the total feed consumption divided by weight gain in each replication.

$$\text{FCR} = \frac{\text{Feed intake (kg)}}{\text{Weight gain (kg)}}$$

3.10.4 Survivability

Survivability percentage was calculated as the total broilers survived divided by the number of starting birds multiplied by 100.

3.10.5 Dressing yield

Dressing yield is based on the relationship between the dressed carcass weight and live bird weight after things like the skin and internal organs have been removed. Dressing yield can be calculated by taking weight of the carcass divided by weight of live bird.

$$\text{Dressing yield} = \frac{\text{Weight of the carcass}}{\text{Weight of live bird}}$$

Fig.7. Carcass of broiler

3.11 Statistical analysis

Data on different variables were subjected to analysis of variance (ANOVA) in a Completely Randomized Design (CRD) (Steel and Torrie, 1980). The significant differences between the treatment means were calculated from analysis of variance (ANOVA) table. All analyses were performed by using "IBM SPSS statistics 20" Program.

CHAPTER IV
RESULTS AND DISCUSSION

4.1 Performance of broiler of experimental birds

This experiment was conducted to study on feed consumption, feed conversion ratio, live weight gain, dressing yield, organ growth traits, survivability were used as criteria of response of broiler to different dietary levels of Fennel seeds (*Foeniculum vulgaris* L.) powder are presented in dressing yield, the following sections.

4.2 Effect of Fennel seeds (*Foeniculum vulgaris* L.) powder on body weight gain

Initial body weight of day-old broiler chicks fed on all treatments were similar (P>0.05) (Table 4.1). From 1 to 7 days of age, the body weight was not significant in different treatment groups. Significant differences (<0.05) were found at 8-14 days, 15-21 days and 22-28 days of age on body weight of birds at the level of 0.5%, 1% and 2% Fennel seeds powder. 8-14 days, 15-21 days and 22-28 days of age the height body weight gain 1%Fennel seeds powder. During 1 to 28 days of age, the body weight gain (1463.59gm) in birds fed diet containing Fennel seeds *(Foeniculum vulgaris L.)* powder at level of 1% feed was significant(P<0.05) followed by birds received 2%(1433.14g), 0.5% (1416.58g) and 0% (1298.69g) Fennel seeds powder. The significantly increase in body weight in treatment T_2 (1463.59g). The significant effect of Fennel seeds *(Foeniculum vulgaris L.)* powder on body weight gain was in agreement with the findings reports (Shane, 2004; Goodell, 1981). They found that inclusion of Fennel seeds at the rate of 1%, 3% and 0.5% feed significantly increase body weight of broiler. But these findings contradict with the observation of (Saleh Lemrabt *et al.,* 2018; Tollba, 2003;), who stated that broiler fed on Fennel seeds 0.2 and 0.4% level did not significantly affect body weight gain.

4.3 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder on feed intake

The differences in feed intake were not significant (P>0.05) at 8-14 days, 15-21 days and 22-28 days of age. However significant differences (P>0.05), in feed intake were found at 1 to 28 days of age at the level of 0.5%, 1% and 2% Fennel seeds *(Foeniculum vulgaris L.)* powder (Table 4.1). The above results agreement with (Abdullah and Rabia, 2009; Adeyemo, *et al.,* 2013). However, these results disagreed with (Acimovic *et al.,* 2016) who found that broiler fed on Fennel seeds 500 and 5000 mg/kg diet did not significant difference in feed consumption.

Table 4.1 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder supplementation feed consumption of broiler

Parameters	**T_0**	**T_1**	**T_2**	**T_3**	**Level of significance**
Feed consumption (g/bird)					
1-7 days	27.79±1.76	24.43±1.62	24.31±1.68	23.86±1.62	NS
8-14 days	58.80±2.36	54.92±2.27	54.33±2.29	54.10±2.26	NS
15-21 days	102.57±3.34	98.29±3.31	97.98±3.20	97.48±3.15	NS
22-28 days	147.10±2.60	142.80±2.64	142.61±2.73	142.08±2.66	NS
1-28 days	2455.82±1.29^{b}	2244.08±0.73^{a}	2235.62±0.94^{a}	2223.61±0.95^{a}	NS

Where, T_0 =0 %; T_1 =0.5 %; T_2 =1 %; T_3 =2 %

^{abcd} Figures in the row with similar superscripts alphabet did not differ significantly.

*=(P<0.05), NS=(Non-significant).

Table 4.2 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder supplementation weight gain of broiler

Parameters	T_0	T_1	T_2	T_3	Level of significance
Initial body weight (g/bird)	46.00±0.050	46.00±0.005	46.15±0.050	46.15±0.050	NS
Weight gain (g/bird)					
1-7 days	92.52±7.02	108.79±8.80	113.63±9.50	108.86±8.89	NS
8-14 days	259.61±15.45^{a}	307.62±17.23^{ab}	326.39±18.36^{b}	308.02±17.47^{ab}	*
15-21 days	600.52±26.69 ^{a}	676.61±28.38^{ab}	713.39±29.34^{b}	682.56±28.86^{ab}	*
22-28 days	1067.73±33.58 ^{a}	1172.04±35.39^{b}	1218.63±35.51^{b}	1185.00±35.90^{b}	*
1-28 days	1298.69±0.44^{a}	1416.58±0.36^{b}	1463.59±0.30^{c}	1433.14±0.07^{bc}	*

Where, T_0 =0 %; T_1 =0.5 %; T_2 =1 %; T_3 =2 %

^{abcd} Figures in the row with similar superscripts alphabet did not differ significantly.

*=(P<0.05), NS=(Non-significant).

Table 4.3 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder supplementation feed conversion ratio of broiler

Parameters	T_0	T_1	T_2	T_3	Level of significance
FCR					
1-7 days	0.92±6.8b	0.68±0.06 a	0.64±0.05 a	0.66±0.06 a	*
8-14 days	1.56±0.016	1.20±0.02	1.29±0.28	1.26±0.02	NS
15-21 days	1.64±0.006d	1.35±0.01c	1.26±0.015 a	1.31±0.013b	*
22-28 days	1.76±0.007c	1.52±0.009b	1.45±0.01 a	1.47±0.02 a	*
1-28 days	1.48±0.00b	1.20±0.003a	1.17±0.06a	1.19±0.008a	*
Survivability (%)	100±0.000	100±0.000	100±0.000	100±0.000	NS

Where, T_0 =0 %; T_1 =0.5 %; T_2 =1 %; T_3 =2 %

[abcd] Figures in the row with similar superscripts alphabet did not differ significantly.

*=(P<0.05), NS=(Non-significant).

Table 4.4 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder supplementation in diet of broiler on meat yield at 28 days of age

Parameters(g)	T_0	T_1	T_2	T_3	Level of significance
Abdominal fat	2.73 ± 0.006^{d}	1.73 ± 0.004^{c}	1.59 ± 0.004^{a}	1.63 ± 0.004^{b}	*
Heart	6.46 ± 0.001^{a}	7.30 ± 0.01^{b}	8.1 ± 0.12^{c}	7.5 ± 0.011^{b}	*
Liver	38.1 ± 0.06^{a}	38.52 ± 0.01^{a}	41.21 ± 0.006^{d}	39.98 ± 0.006^{c}	*
Gizzard	37.47 ± 0.001^{a}	37.56 ± 0.01^{a}	38.77 ± 0.01^{b}	37.8 ± 0.1^{a}	*
Dressing yield (%)	58.32 ± 0.06^{a}	59.00 ± 0.58^{a}	62.25 ± 0.01^{c}	61.41 ± 0.06^{b}	*

Where, T_0 =0 %; T_1 =0.5 %; T_2 =1 %; T_3 =2 %

^{abcd}, Means in the same row with uncommon superscripts differ significantly.
*=(P<0.05), NS=(Non-significant).

4.4 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder on feed conversion ratio

From 1 to 7 days of age, the feed conversion ratio was non significant (P>0.05) in different treatment groups. Significant difference (P<0.05) were found at 8-14 days, 15-21 days and 22-28 days of age on feed conversion ratio of birds at the level of 0.5%, 1% and 2% Fennel seeds powder. At the end of the trial (28 days of age), better FCR was in treatment T_2 (1.17) followed by T_3 (1.19), T_1 (1.20) and T_0 (1.48), respectively (Table 4.1).similar result was found by with (Zanu *et al.,* 2011; Adeyemo, *et al.,* 2013 and Wankar *et al.* 2009). They reported that broilers that received diet with 0.5%, 1%, 3% and 1 g/kg Fennel seeds *(Foeniculum vulgaris L.)* powder utilized their diets more efficiently. However, these results disagreed with (Nidaullah *et al.,* 2010 and Nnenna, 2013), who did not found any significant effects of 0.2 and 0.4% Fennel seeds powder.

4.5 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder on survivability

Survivability of broilers fed on different dietary treatments was very high during the study period. The survivability did not vary significantly (P>0.05) among different treatment groups during the whole experimental period.

4.6 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder on fat content

Data on carcass characteristics and organ weights are presented in Table 4.2. This study showed that fat content of broiler was decreased significantly by supplementation of Fennel seeds *(Foeniculum vulgaris L.)* powder in broiler ration (P<0.05). Among different dietary treatments, amount of abdominal fat was lowest in T_2 (1.59g) followed by T_3 (1.63g), T_1 (1.73g) and T_0 (2.73g), respectively (Table 4.2). These results agreed with some other researchers (Klasing K.C., 2000; Scanes *et al.,* 2004), who reported lower fat content in broilers at the level of 0.5, 1 and 3% Fennel seeds supplementation.

4.7 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder on the weight of internal organs

The significant (P>0.05) effect of Fennel seeds *(Foeniculum vulgaris L.)* powder on the weight of internal organs (liver, heart and gizzard) of broilers fed experimental rations was in close agreement with the observation (Kashan *et al.* 2005; Scanes *et al.,* 2004) who reported that feeding of Fennel seeds *(Foeniculum vulgaris L.)* powder alter the size of liver, heart and gizzard.

4.8 Effect of Fennel seeds *(Foeniculum vulgaris L.)* powder on the dressing yield

This study demonstrated significant ($P < 0.05$) in dressing yield. The highest dressing yield (62.25) was found in T_2 (1% GP) followed by T_3 61.41% (2% GP), T_1 59.00% (0.5% GP) and the lowest value (58.32%) found in T_0. (Kashan *et al.* 2005) used Fennel seeds *(Foeniculum vulgaris L.)* powder diet with 3% and found dressing percentage significant ($P<0.05$). These results agreed with . (Kashan *et al.* 2005) who found that 3% and 2 g/kg Fennel seeds supplementation did significantly affect dressing yield.

CHAPTER V
SUMMARY AND CONCLUSION

Present study evaluated the different doses of Fennel seeds *(Foeniculum vulgaris L.)* powder supplemented diets on broiler chicks. The feeding value of Fennel seeds *(Foeniculum vulgaris L.)* powder on (96) vigorous day-old Broiler chicks was evaluated in the poultry farm, Hajee Mohammad Danesh Science and Technology University, Dinajpur. In a feeding trial, four diets were prepared including of Fennel seeds *(Foeniculum vulgaris L.)* powder at levels of 0% (control), 0.5%, 1% and 2% GP. Body weight and feed consumption were recorded on weekly basis. At the last day of the experiment, a total of eight broilers were sacrificed and meat yield, dressing percentage, internal organ weight and fat content were recorded.

By using experimental diets feed intake of different dietary treatments were the differences statistically significant (showed in Table 4.1). Feed consumption by the broilers during the entire experiment period in different treatment groups was recorded and expressed as g/bird. Although the rate of feed intake varied from day to day the highest feed intake (g/bird) was recorded in control group (2455.82g) followed by in treatments containing 0.5% GP (2244.08g), 1% GP (2235.62g) and 2% GP (2223.61g) level of Fennel seeds powder. Data obtained on final average body weight indicated that there was no positive correlation between body weight and feed consumption. Feed conservation ratio (FCR) was the highest at 1% level of Fennel seeds *(Foeniculum vulgaris L.)* powder (1.20) compared with other groups. The FCR values were 1.48, 1.19, and 1.17 at 0% GP, 0.5% GP and 2% per kg feed.

Survivability was almost similar in all dietary treatments ($p>0.05$). In this experiment, highest survivability (100%) was observed in all treatment group. Fat content was reduced due to inclusion of Fennel seeds powder. The highest fat content was observed in control group (2.73g) and the lowest (1.59g) at 1% level of Fennel seeds powder.

The slaughter data of broiler chicks fed experimental diets were represented in % of live weight. Significant ($p>0.05$) effect was observed for internal organs (heart, liver and gizzard) weight of broilers fed experimental rations and dressing yield. The highest dressing yield (62.25%) was found in T_2 (1% GP) and the lowest value (58.32%) found in control group.

Based on the results of the present study, it may be concluded that Fennel seeds *(Foeniculum vulgaris L.)* powder supplemented at a level of 1% has significant effect on body weight gain, FCR, abdominal fat content, except feed intake and dressing percentage. The results of the study also suggest that the supplementation of Fennel seeds *(Foeniculum vulgaris L.)* powder at 1% level in diets has high potential as commercial applications for production performance of broiler. Therefore, Fennel seeds *(Foeniculum vulgaris L.)* powder can be used along with the other conventional feed ingredients is the poultry diet ration.

REFERENCES

Abd El-Latif SA, Ghally KA and Shoulkamy MO, (2019). Effect of Fenugreek and Yeast Additions to Japanese Quail Diet on Digestibility and Economical Responses. Volume 3 Issue.

Abdullah A, Mohammed and Rabia J, Abbas (2009). The Effect of Using Fennel seeds Seeds (*Foeniculum vulgare* L.) on Productive Performance of Broiler Chickens. *International Journal of Poultry Science.* 8 (7): 642-644.

Abou–Egla, El-Samra H, Attia YA, El-Deek AA and Mafret. Saleh El-Din, (1995): Growth promoting influence of some herbs on performance and carcass quality of broilers and ducklings. *J. Agric. Sci. Mansoura Univ.* 20, 3315–3332.

Acimovic MG, Kostadinovic LM, Puvaca NM, Popovic SJ and Urosevic MI, (2016). Phytochemical constituents of selected plants from Apiaceae family and their biological effects in poultry. *Food and Feed Research,* 43(1), 35-41.

Adeyemo GO and Akanmu AM, (2013). Effects of neem (Azadirachtaindica) and Pawpaw (Carica papaya) leaves supplementation on performance and carcass characteristics of broilers. Available from: http://wwwen.engormix.com/ MA-poultry industry/ nutrition/ articles. *Last accessed on* 08-12-2013.

Agarwal R, Gupta SK, Agrawal SS, Srivas-Tava S and Saxena R, (2008). Oculohypotensive effects of Foeniculum vulgare in experimental models of glaucoma. *Indian J. Physiol. Pharmacol,* 52: 77-83.

Alcicek A, Bozkurt M and Cabuk M, (2003). The effect of essential oil derived herbs growing wild in Turkey on from selected broiler combination performance. *South African J. Anim. Sci.,* 33: 89-94.

Ali Asghar Saki, Hassan Aliarabi, Sayed Ali Hosseini Siyar, Jalal Salari, and Mahdi Hashemi, (2014). Effect of a phytogenic feed additive on performance, ovarian morphology, serum lipid parameters and egg sensory quality in laying hen. *Vet Res Forum. Autumn;* 5(4): 287–293. PMCID: PMC4299994,PMID: 25610580.

Arif M, Hayat Z, Abd El-Hack ME, Saeed M, Imran1 HM, Alowaimer AN, Saadeldin IM, Taha AE and Swelum AA,(2019). Impacts of supplementing broiler diets with a powder mixture of black cumin, Moringa and chicory seeds. *South African Journal of Animal Science, 49 (No. 3).*

Ayssiwede SB, Zanmenou JC, Issa Y, Hane MB, Dieng A, Chrysostome CAAM, Houinato MR, Hornick JL and Missohou A, (2011). Nutrient Composition of Some Unconventional and Local Feed Resources Available in Senegal and Recoverable in Indigenous Chickens or Animal Feeding. Year:,Volume: 10,Issue:8 Page No.: 707-717. DOI: 10.3923/pjn..707.717.

Banglapedia, (2015). Livestock. National Encyclopedia of Bangladesh.

BBS, (2017-18). Contribution of Livestock and Poultryin the National Economy of Bangladesh.

Cabuk M, Bozkurt M, Alcicek A, Akbas Y and Kuçukyılmaz K, (2006). Effect of a herbal essential oil mixture on growth and internal organ weight of broilers from young and old breeder flocks. *South African Journal of Animal Science,* 36 (2) © South African Society for Animal Science.

Chainy GB, Manna Sk, Chaturvedi MM, Aggarwal BB, (2000). Anethole blocks both early and late ceallular responses transduced by tumor necrosis factor: effect on NF-kappaB, AP-1, JNK, MAPKK and apoptosis. Oncogene 19(25): 2943-50 2000. PMID: 12930.

Chang-Song Ria, Xian-Ren Jianga, Myong-Ho Kima, Jing Wanga, Hai-Jun Zhanga, Shu-Geng Wua, Valentino Bontempoc and Guang-Hai Qia (2017). Effects of dietary oregano powder supplementation on the growth performance, antioxidant status and meat quality of broiler chicks. *Italian Journal of Animal Science,* http://dx.doi.org/10.1080/ 1828051X. 2016.1274243

Digilio MC, Mancini E, Voto E and De Feo V, (2008). Insecticide activity of Mediterranean essential oils. *Journal of Plant Interactions*, 3:17-23.

DLS, (20 16-17). Annual Report of Directorate of Livestock Services, Bangladesh.

Ebile Dayan A, Kana JR, Pimagha Moffo HJ, Edie Nounamo LW, Nguefack Djieufo G, Ngouana Tadjong R and Fonteh AF, (2018). Effects of Dichrostachys Glomerata Feeding Regimes on Growth Performance, Gut Microbiota and Haemato-Biochemical Profile of Japanese Quails. *Journal of Animal Research and Nutrition*. ISSN 2572-5459. Vol.3 No.2:5

El-Deek A, Al-Harthi MA, Mona Osman, Fahd Al-Jassas and Rehab Nassar, (2012). Effect of different levels of green tea (Camellia sinensis) as a substitute for oxytetracycline as a growth promoter in broilers diets containing two crude protein levels. *Arch.Geflugelk.,* 76 (2). S. 88- 98. ISSN 0003-9098. © Verlag Eugen Ulmer, Stuttgart.

EL-Deek AA, Attia YA and Hannfy MM, (2003). Effect of anise (Pimpinella anisiumj), ginger (Zingiber officinale roscoe) and Fennel seeds (Foeniculum vulgare) and their mixture of performance of Broilers. *Arch. Geflugelk.*, 67: 92-96.

Ensminger AH, Esminger MKJ *et al*,(1986). Food for:A Nutrition Encyclopedia. Clovis, California: Pegus Press; 1986.PMID:15210.

Faramarz Fekri, Yazdia, Gholamreza, Ghalamkaria, Majid, Toghiania, Mehrdad, Modaresia, Nasir, Landyb, (2014). Anise seed (Pimpinella anisum L.) as an alternative to antibiotic growth promoters on performance, carcass traits and immune responses in broiler chicks. Author links open overlay panel. *Asian Pacific Journal of Tropical Disease.* Volume 4, Issue, Pages 447-451.

Farhad Khaligh, Ghorbanali Sadeghi, Ahmad Karimi and Asaad Vaziry, (2011). Evaluation of different medicinal plants blends in diets for broiler chickens. *Journal of Medicinal Plants Research*. Vol. 5 (10), pp. 1971-1977, Available online. ISSN 1996-0875 ©2011 Academic Journals.

Fritz Z, Schleicher A, Kinal S, Jarosz L and Majdanski F, (1993). Herbs in feed mixtures for broilers. Vitamine und weitere Zusatzatoffe bei Mensch und Tier: 4 Symposium edited by G. *Flachowsky and R. J. Schubert, Friedrich Schiller Universitat, Germany.*

Gaikwad DS, Fulpagare YG, Bhoite UY, Deokar DK and Nimbalkar CA, (2019). Effect of Dietary Supplementation of Ginger and Cinnamon on Growth Performance and Economics of Broiler Production. *International Journal of Current Microbiology and Applied Sciences.* ISSN: 2319-7706 Volume. Journal homepage: http://www.ijcmas.com.

Gharaghani H, Shariatmadari F, Torshizi MA (2015). Effect of Fennel seeds (*Foeniculum vulgare* Mill.) Used as a Feed Additive on The Egg Quality of Laying Hens Under Heat Stress. *Brazilian Journal of Poultry Science.* ISSN 1516-635X Apr - Jun / v.17 / n.2 / 199-208.

Goodell RH, (1981). Pig and poultry production. International Fair. Hannover, West Germany.; pp. 76.

Gulfraz M, Mehmood S, Minhas N, Jabeen N, Kausar R, Jabeen K and Arshad G, (2008). Comosition and antimicrobial properties of essential oil of Foeniculumvulgure. A/r .j Biotechnol .,7:4364-4368.

Hanefi Ozbek, (2005). The Anti-inflammatory Activity of the *Foeniculum vulgare* L. Essential Oil and Investigation of its Median Lethal Dose in Rats and Mice. *International Journal of Pharmacology.* 1(4) with 501 Reads. DOI: 10.3923/ijp.2005.329.331.

Henda Mahmud A, (2014). Response of Growing Japanese quail To Different Levels of Fennel seeds Seeds Meal. *Egypt. Poult. Sci.* Vol (34) (III): (795-807) (1514).

Hertrampt JW, (2001). Alternative antibacterial performances. *Poult. Lnt.,* 40: 50-52.

Hesam Hosseinzadeh, Ali Ahmad Alaw Qotbi, Alireza Seidavi, David Norris and David Brown, (2014). Effects of Different Levels of Coriander (Coriandrum sativum) Seed Powder and Extract on Serum Biochemical Parameters, Microbiota, and Immunity in Broiler Chicks. *The Scientific World Journal Volume,* Article ID 628979, 11 pages http://dx.doi.org/10.1155/2014/628979.

Huang YF, Ma HI, Wu DF, Zhou JI, Zhou KS and Qi ZY, (1992). Effect of Chinese medicinal herbs additives on the growth of broilers. *J. Fujian Agric. College.* 21(1), 93–96.

Kadir Emre Bugdayc, Fatma Karakaş Oguz1, Mustafa Numan Oguz, Eren Kuter (2018). Effects of fennel seeds seed supplementation of ration on performance, egg quality, serum cholesterol, and total phenol content of egg yolk of laying quails. *Revista Brasileira de Zootecnia Brazilian Journal of Animal Science* © Sociedade Brasileira de Zootecnia ISSN 1806-9290.

Kashan NEJ, Manafi Azar GH, Afzalzadeh A, Salehi A, (2005). Growth performance and carcass quality of fattening lambs from fat-tailed and tailed sheep breeds. *Small Rumin. Res.* 60, 267–271.

Kazemi-Fard M, Kermanshahi H, Rezaei M and Golian A, (2013). Effect of different levels of fennel seeds extract and vit D3 on performance, hatchability and Immunity in post molted broiler breeders. *Iranian Journal of Applied Animal Science*. 3:733-745.

Kumar P, Patra AK, (2017). Beneficial uses of black cumin (Nigella sativa L.) seeds as a feed additive in poultry nutrition. *Get access* Volume 73, Issue 4, pp. 872-885. DOI: https://doi.org/10.1017/S0043933917000848

Maha M, Hady MM, Zaki Wafaa, Abd EL-Ghany and Reda, Korany MS, (2016). Assessment of the broilers performance, gut healthiness and carcass characteristics in response to dietary inclusion of dried coriander, turmeric and thyme. *International Journal of Environmental and Agriculture Research*. (IJOEAR) ISSN:[2454-1850] [Vol-2, Issue].

Majid Hemati, Jafar Fakhraei, Akbar Yaghobfar , Hossein Mansoori Yarahmadi, (2019). Effects of Hydroalcoholic Extract of Hogweed and Anise on Broiler Meat Quality, Immune Responses, and Intestinal Microflora and Morphology. *Undishapur Journal of Natural Pharmaceutical Products:* 15 (1); e90870. Published Online.

Mehmet Ciftci1, Talat Guler, Bestami Dalkilic and O. Nihat Ertas (2005). The Effect of Anise Oil (Pimpinella anisum L.) On Broiler Performance. *International Journal of Poultry Science*. 4 (11): 851-855, ISSN 1682-8356.

Miroslava Kacaniova, Martin Mellen, Nenad L, Vukovic, Maciej Kluz, Czeslaw Puchalski, Peter Hascik and Simona Kunova, (2019). Combined Effect of Vacuum Packaging, Fennel seeds and Savory Essential Oil Treatment on the Quality of Chicken Thighs. Microorganisms, 7, 134; doi:10.3390/microorganisms7050134 www.mdpi.com/ journal/ microorganisms.

Mohamed S, Hassaan and Magdy Soltan A, (2016). Evaluation of Essential Oil of Fennel seeds and Garlic Separately or Combined with Bacillus licheniformis on the Growth, Feeding Behaviour, Hemato-biochemical Indices of Oreochromis niloticus (L.) Fry.0 *Hassaan and Soltan, J Aquac Res Development*, 7:4 DOI: 10.4172/2155-9546.1000422.

Mohammad Taghi Darzi, Mohammadreza Haj, Seyedhadi and Farhad Rejali, (2012). Effects of the application of vermicompost and phosphate solubilizing bacterium on the morphological traits and seed yield of anise (Pimpinella anisum L.) *Journal of Medicinal Plants Research.* Vol. 6(2), pp. 215-219, 16 January, 2012 Available online at http://www.academicjournals.org/JMPR DOI: 10.5897/ JMPR11. 949 ISSN 1996-0875 ©2012 Academic Journals.

Mohammed AA and Abbas RJ, (2009). The effect of using fennel seeds seeds (Foeniculum vulgare L.) on productive performance of broiler chickens. *International Journal of Poultry Science.* 8:642-644.

Mohammed HN, (2019). Broiler performance response to anise seed powder supplementation. *Iraqi Journal of Veterinary Sciences*, Vol. 33, No. 1, 2019 (131-135).

Muhammad Arif1, Abdur Rehman1, Muhammad Saeed, Mohamed Ezzat ABD El-Hack, Mahmoud Alagawany, Haider Abbas, Muhammad Asif Arian, Sarfaraz Ali Fazlani, Abbasi Imtiaz Hussain, Tugay Ayasan (2017). Effect of different processing methods of pigeon pea (Cajanus cajan) on growth performance, carcass traits, and blood biochemical and hematological parameters of broiler chickens. *Turkish Journal of Veterinary and Animal Sciences Turk J Vet Anim Sci* . 41: 38-45 © TÜBİTAK doi:10.3906/vet-1602-11.

Munir Oktaya IhamiGulcinb and Irfan Kufrevioglub, (2003). Determination of in vitro antioxidant activity of fennel seeds (*Foeniculum vulgare*) seed extracts Author links open overlay panel. Volume 36, Issue 2, Pages 263-271.

Nichita G, Sarandan H, Padeanu O and Cocean V, (1984). Extracted seeds of fennel seeds in animal feeding. *Nutrition Abstracts and Reviews ser.* B. 54, 4652.

Nidaullah H, Durrani FR, Ahmad S, Jan IU and Gul S, (2010). Aqueous extract from different medicinal plants as anticoccidial, growth promotive and immunostimulant in broilers. *J. Agric. Biol. Sci.,* 5(1): 53-59.

Nnenna OP and Okey AA, (2013). Toxicity and nutritional assessment of aqueous Azadirachtaindica (neem) leaf extract in broiler chicks. *Int. J. Biosci.,* 3(6): 172-180.

Ntchapda Fidele, Barama Joseph, Talla Emmanuel and Dimo Theophile, (2017). Hypolipidemic, antioxidant and anti-atherosclerogenic effect of aqueous extract leaves of Cassia. occidentalis Linn (Caesalpiniaceae) in diet-induced hypercholesterolemic rats. BMC Complementary and Alternative Medicine. volume 17, Article number: 76 Cite this article 1796 Accesses.

Okoro, Marcellina Chioma Agric B, (IMSU) (2016). Effect of Dietary Inclusion of ginger (Zingiber Officinale) on Performance of Broilers and laying chickens.

Ostad N, Soodi M and Sariffzadeh M, (2001). The effect of fennel seeds essential oil on uterine contraction as a model for dysmenorrhoeal: pharmacology and toxicology study. *J. Ethnopharmacol,* 76: 299-304, 2001.

Owens B, Tucker L, Collins MA and Mc Cracken KJ, (2008). Effects of different feed additives alone or in combination on broiler performance, gut micro flora and ileal histology. *British Poultry Science*, 49: 202-212.

Pavela R, Zabka M, Bednar J, Triska J and Vrchotova N, (2016). New knowledge for yield, composition and insecticidal activity of essential oils obtained from the aerial parts or seeds of fennel seeds (Foeniculum vulgare Mill.). *Industrial Crops and Products.* 83:275-282.

Pimpinella Anisum L, (2017). Effect of Various Concentrations of an Anise Seed Powder Supplement on Selected Hematological and Biochemical Parameters of Broiler Chickens. *Brazilian Journal of Poultry Science.* ISSN 1516-635X Jan - Mar 2017 / v.19 / n.1 / 041-046.

Ragab MS, Namra MMM, Aly MMM and Fathi MA, (2013). Impact of inclusion fennel seeds seeds and thyme dried leaves in broiler diets on some productive and physiological performance during summer season. *Egyptian Poultry Science Journa.l* 33:197-219.

Ribadiya NK, Savsani HH, Patil SS, Padodara RJ, Bhadaniya AR, (2017). Fefar. Effect of feeding varying levels of groundnut Haulms on body weight and Haematobiochemical Profile in broiler birds. *International Journal of Science, Environment*. ISSN 2278-3687 (O) and Technology, Vol. 6, No 1, 332 – 338 2277-663X (P).

Sahar Abdalwahab Hassan Ahmed, (2015). Evaluation of Shamar (Foenicum vulgre) Seeds as Natural Growth Promotion (NGP) in Broiler Chicks.

Saki AA, Kalantar M, Rahmatnejad E and Mirzaaghatabar F, (2014). Health characteristics and performance of broiler chicks in response to Trigonella foenum graecum and Foeniculum vulgar. *Iranian Journal of Applied Animal Science*, 4:387-391.

Saleh Lemrabt, Ram Pal Singh, Sasya Nagar, (2018). Efficacy of Foeniculum vulgare seeds powder on growth performance in broilers. *International Journal of Food Science and Nutrition,* Volume 3; Issue 5; Page No. 167-170.

Santi Devi Upadhaya, In Ho Kim (2017). Efficacy of phytogenic feed additive on performance, production and health status of monogastric animals – a review. *Ann. Anim. Sci.*, Vol. 17, No. 4 929–948 DOI: 10.1515/aoas-2016-0079.

Scanes CG, Brant G, Ensminger ME, (2004). Poultry Science; Fourth Edition. Pearson Education, Inc, Upper saddle River, New Jersey.

Schwarz S, Kehrenberg C and Walsh TR, (2001). Use of antimicrobial agents in veterinary medicine and food animal production. *International Journal of Antimicrobial Agents,* 17: 431-437.

Serhat Akyildiz, Muzaffer Denli, (2016). Application of plant extracts as feed additives in Poultry nutrition. *Scientific Papers. Series D. Animal Science.* Vol. LIX, ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750.

Shane S, (2004). Practical biosecurity. A perspective for China. American Soybean Association. *Poultry Seminar programme, China.;* pp. 1-3.

Syed Muddassar, Hussain Gilani, Sitwat Zehra, Faiz-ul-Hassan, Saddia Galani, Asma Ashraf (2018). Effect of natural growth promoters on immunity, and biochemical and haematological parameters of broiler chickens. *Tropical Journal of Pharmaceutical Research*. April 2018; 17 (4): 627-633. ISSN: 1596-5996 (print); 1596-9827 (electronic).

Tollba AAH, (2003). Using some natural additives to improve physiological and Productive performance of broiler chicks under high temperature conditions 1- Thyme (Thymus vulgaris L.) or fennel seeds (Foenicullum vulgare L.). *Egyptian Poult. Sci. J.*; 23:313-326.

Ulsagheer Mohanad K, Ibrahim Saleem MR and Mohammed Jard Kadhim, (2019). Effect of using natural apple vinegar, garlic powder (Alsin) and black bean seed on the immune system and some of characteristics of the blood broilers Ross 308. *Journal of Physics: Conf. Series.* 1294092006.doi:10.1088/1742-6596/1294/9/092006.

Vakili R and Majidzadeh Heravi R, (2016). Performance and Egg Quality of Laying Hens Fed Diets Supplemented with Herbal Extracts and Flaxseed. *Poultry Science Journal*. ISSN: 2345-6604 (Print), 2345-6566 (Online) http://psj.gau.ac.ir. DOI: 10.22069/PSJ.2016.9833.1156

Wankar AK, Shirbhate RN, Bahiram KB, Dhenge SA and Jasutkar RA, (2009). Effect of neem leaf powder supplementation on growth in broilers. *Vet. World.,* 2(10): 396-397.

Zanu HK, Kagya-Agyemang JK, Kwenin WKJ, Bonsu FRK, Antwi E and Ateni S, (2011). Physiological response of broiler chickens to neem and akakapenpen decoctions: Performance and carcass characteristics. *Int. J. Poult. Sci.,* 10(9): 730-733.

Zoubiri S, Baaliouamer A, Seba N and Chamouni N, (2014). Chemical composition and larvicidal activity of Algerian Foeniculum vulgare seed essential oil. *Arabian Journal of Chemistry*, 7:480-485.