FEEDING EFFECT OF GARLIC (*ALLIUM SATIVUM*) AND MORINGA (*MORINGA OLEIFERA*) LEAVES ON GROWTH AND BIOCHEMICAL PARAMETERS IN BROILERS

THESIS

SUBMITTED TO THE

SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY MEERUT-250110, (U.P.) INDIA

BY

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Dedicated
To
My Beloved Family

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CERTIFICATE

This is to certify that the thesis entitled **" Feeding effect of Garlic(*Allium sativum*) and Moringa (*Moringa oleifera*) leaves on growth and biochemical parameters in boilers"** submitted in partial fulfillment of the requirements for the degree of **Master of Science in Agriculture** with major in **Animal Husbandry** of the college of Post Graduate Studies, **Sardar Vallabhbhai Patel University of Agriculture & Technology Meerut** is a record of bona-fide research carried out by **Mr. Ittehad , Id No. 4827** under my supervision and no part of the thesis has been submitted for any other degree or diploma.

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Meerut
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We, the undersigned, members of the Advisory committee of **Mr. Ittehad, Id. No. 4827**, a candidate for the degree of Master of Science in Agriculture with major in Animal Husbandry, agree that the thesis entitled "Feeding effect of Garlic (*Allium sativum*) and Moringa (*Moringa oleifera*) leaves on growth and biochemical parameter in boiler" submitted by **Mr. Ittehad** in partial fulfillment of the requirements for the degree.

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Member	Member	Member	Member

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ABBREVIATION

%	Percentage
@	At the rate of
°C	Degree centigrade/Celsius
ADG	Average Daily Gain
ADGI	Average Daily Gain Intake
ALP	Alkaline phosphatase
ALT	Alkaline aminotransferase
ANOVA	Analysis of variance
AOAA	Association of Official Analytical Chemists
APJ	Apelin receptor
AST	Aspartate transaminase
BW	Body weight
CF	Crude Fiber
Communi	Communication
CP	Crude Protein
Cu	Copper
DAHD	Department of Animal Husbandry and Dairy
DF	Degree of freedom
DM	Dry matter
EDTA	Ethylene Diamine Tetra Acetic Acid
et al.,	Ethically all (and other)
FAO	Food and Agriculture Organization
FI	Feed intake
G	Gram
g/dl	Gram per deciliter
g-1	Gram per
GOI	Government of India
Hb	Hemoglobin

HR	Heart rate
ICAR	Indian council of Agricultural Research
IL-6	Interleukin-6
INFY	Interferon Y
IU	International unit
Kda	Kilo Dalton
Kg	Kilogram
LRC	Livestock Research Centre
MCV	Mean Corpuscular Volume
Mg	Milligram
mg/dl	Milligram per deciliter
Mg/kg	Milligram per Kilogram
ML	Microliter
MM	Micromolar (micromoles/liter)
mM	Milli mole
Mmol/L	Micromole per liter
mmol/L	Millimole per liter
MT	Million ton
ng/ml	Milligram per milliliter
NRC	National Research Center
pg/ml	Pico gram per milli liter
Ppm	Part per million
RBC	Red Blood Cell
Res	Research
Rpm	Round per minute
SEM	Standard error mean
SS	Sum of square
TBARS	Thiobarbituric acid reactive substance
THI	Temperature humidity index
TMR	Total mixed ration
U/L	Unit/liter
Vet	Veterinary
WBC	White Blood Cell
Mg/L	Microgram per Liter

Chapter-1 INTRODUCTION

Poultry production in India has arisen as one of the quickly developing areas among different domesticated animals-based livelihoods as apparent from its change from customary terrace raising to all together commercialized business operations in most recent years. This area involves low, medium and high-income groups giving work to more than 7 million individuals, aside from dietary and nutritional security to a large population of the country. It contributes about 0.5 % to the public GDP and about 10% to the animals GDP. Mechanical help is, subsequently, essential for the supported development of the poultry area.

Over the past few years, poultry has seen most prominent expansion underway among the vast majority of the livestock species and this pattern is probably going to proceed further in future times. Human populace in India will increase at the pace of 61 % up to 2050 which is substantially more than the worldwide normal, bringing about the social and financial changes, causing an incredible ascent in the chicken meat utilization in the country both generally speaking and per individual. the fast increments of human and domesticated animals populations are making expanded requirements for food thus confronting food-deficiencies, excess of cereals and vegetables are typically not accessible therefore animal and poultry production have to rely on some cheaper food substitute for sustained **Odunsi (2007).**

The streamlining of feed cost utilizing less expensive and eccentric feed assets is a significant part of business poultry creation **Muriu *et al.* (2002).** This system could assist with decreasing the expense of creation, and guarantee less expensive meat creation subsequently opening up the significant yields for human utilization **Olugbemi (2010)**. One potential wellspring of modest protein is the leaf suppers of some tropical vegetable peruse plants. yet in

addition some fundamental nutrients, for example, nutrients minerals, and so forth **Gadzirayo (2012)**. The utilization of (Moringa oleifera) as a protein hotspot for poultry cultivating has been as of late of high interest **Akangbe and Ologhobo, (2014).**

Garlic is generally utilized as human food having a ghastly smell and the sharp taste. Since monogastric creatures can consolidate dietary parts straightforwardly in their tissues **Scaife *et al.* 1994 Onibi *et al.* (2000)**, advantageous garlic for chicks could intercede in getting the bioactive mixtures in garlic, through oven meat into the human natural pecking order, while keeping away from the hatred because of its immediate utilization. Nonetheless, there is lack of persuading concentrates on amount and type of valuable garlic in broiler nourishment. Moringa leaves have quality credits that make it a possible trade for soyabean supper or fish dinner in non-ruminant eating regimens **Kakengi (2003).** Moringa oleifera is one of the raised feeding peruse plants with all parts been of food significance **Gadzirayi (2012)** and therapeutic properties **Patel (2011)** which could help cut down on anti-microbial use in poultry keeping. Regular restorative items starting from spices and flavors have been utilized as feed added substances for livestock **Guo (2003).** The viability and significance of a specific feedstuff/feed fixing in poultry creation is assessed from its impact on the creation execution/attributes of the birds. Moreover, significant data can be obtained from the investigation of the hematological parameters. This stems from the way that the blood fills in as a significant list of physiological, obsessive and nourishing status of a creature. Data acquired from hematological examine, aside from being valuable for indicative and the executives purposes could similarly be fused into rearing projects **Elagib and Ahmed, (2011).** Blood attributes are providing information in improving development execution, meat quality, against cholesteremic impacts and just as immuno-adjusting consequences in chickens supplemented with dietary inclusions

Gardzielewska *et al.* (2003) Aji *et al.* (2011) Ashayerizadeh *et al. (*2009) Hanieh *et al.* (2010), Ayasan, (2011). It was against this foundation that this investigation was directed to assess the impact of feed supplementation with sun dried garlic powder and moringa on the development execution and body attributes, blood biochemical of chickens. Therefore, based on these facts, the present study was designed with the following objectives.

1. To find out the feeding impact of garlic (*Allium sativum*) and moringa (*Moringa oleifera*) leaves on body performance of broiler chickens.
2. To find influence of garlic (*Allium sativum*) and moringa (*Moringa oleifera*) leaves on blood biochemical parameters of broiler chickens.
3. To evaluate the feeding effect of garlic (*Allium sativum*) and moringa (*Moringa oleifera*) on carcass characteristics of broiler chickens.

Chapter- 2 REVIEW OF LITERATURE

The present study is entitled "Feeding effect of garlic (*Allium sativum*) and moringa (*Moringa oleifera*) leaves on growth and biochemical parameters in broilers" The review of literature was organized under following main heading:

2.1 Importance of poultry production

The gathering name determined to an assortment of tamed birds raised or saved for significant purposes (for meat, eggs, plume creation, diversion and social reasons for existing) is named poultry **Aja (2007).** Poultry creation is embraced in a huge number of ways, using various arrangements of assets, in a wide range of socio-social and financial conditions. Significant poultry species kept incorporate chicken, ducks, guinea fowls, turkeys, pigeons, quails, and ostrich of which chicken rule the business **Chukwu (2010).** The poultry business assumes significant parts in enhancing protein prerequisite required by man. Poultry is the quickest wellspring of meat and its creation cycle is least risky and difficult corresponding to other animals ventures. Consequently, expanding poultry creation is one of the surest and fastest methods of crossing over the creature protein admission hole among creating and created nations of the world **FAO (2009).** Albeit the errand of crossing over this protein consumption hole seems impressive considering the present financial and innovative limitations assailing our animals industry, accentuation is on bird creation which is the way to spanning the protein admission hole **El Boushy and Vanderpoel (2000).** Poultry keeping in Ghana turned out to be one of the significant wellsprings of giving protein got from creature to the steadily developing Ghanaian people, making significant contribution to financial improvement and human nourishment.

Creating poultry in Ghana assumes incredibly crucial parts for mankind through, pay and business age, food arrangement, giving crude materials to certain ventures, working with research works and so on **Chukwu (2010).**

2.2 Origin of moringa

As indicated by **Kristin (2000)** the normal moringa species in the moringaceae family are thirteen in number and that *Moringa oleifera* turned out to be the most generally developed species. These assortments incorporate; *Moringa oleifera*, Moringa borziana, Moringa concanensis, Moringa drouhardii, Moringa hildebrandtii, Moringa longituba, Moringa ovalifolia, Moringa pygmaea, Moringa arborea, Moringa rivae, Moringa ruspoliana, Moringa stenopetala, Moringa peregrine, **Kristin (2000)**. *Moringa oleifera* began from India in the North-West region, south of the Himalayan Mountains. It is right now widely planted and has gotten set up in the jungles **Fahey *et al.* (2001).** *Moringa oleifera* is native to Northern India and Pakistan and was presented all through the jungles and sub-jungles getting naturalized in numerous African nations **Bosch (2004).** Moringa tree is one of the many and financially important uses found in most rainforests. Moringa has incredible nutritional and medicinal properties. The crude protein content (CP) of *Moringa oleifera* is between 71.2 and 391.7 g/kg and varies within the factory. The seeds left in this way have the most obvious CP content, followed by flowers, leaves, whole plants, pairs and pods. Moringa leaves contain polyphenols, monosaccharides, tannins, nutrients, rhamnose, carotenoids, phytic acid, phenolic acids, flavonoids, alkaloids, isothiocyanates, saponins, oxalates and three Terpenoid glucoside **Kidmos *et al.* (2006) Augustin *et al.* (2011).** Moringa leaves contain 8.13 g/kg of nutrient (Ferreira., 2008), the nutrient of 6.66 mg/100 g is mixed more in dry leaves, from 17.6 to 39.6 mg/100 g of dry weight **Moyo *et al. (*2011).**

2.2.1 COMMON NAMES OF MORINGA

Hindi : Munga ara, Shajmah, Sahgan, Segra.

Bengal : Munga ara, Sajna, Sojna, Sujana.

English: Horseradish tree, Radish tree, Drumstick tree, Mother's Best Friend, West Indian

Gujarati: Midho-saragavo,

Marathi: Sujina, Shevga, Shivga.

Punjabi : Sanjina, Soanjana.

Rajasthan : Lal Sahinjano.

Tamil : Morunga, Murungai, murunkak-kai.

Sankrit : Danshamula, Shobhanjana, SigruShobhanjan, Sobhajana.

2.2.2 Uses of *Moringa oleifera*

Chickens will not voluntarily consume Moringa leaves or Moringa leaf powder. However, about half the protein content can be extracted from the leaves in the form of a concentrate that can be added to chicken feed **Price (2007).** According to **Fuglie (2000)** the nutrient value of Moringa leaves can be increased for chickens through the addition of phytase to break down phytate leading to increased absorption of phosphorus. **Onu and Aniebo (2011)** reported that broiler diets included at 7.5% Moringa oleifera leaf meal significantly effects ($p<0.05$) the average final body weight, average daily gain, average daily feed intake and feed conversion of broiler as compared to control diet. Tesfaye et al. (2013) investigated the effects of inclusion of five levels (0%, 5%, 10%, 15% and 20%) of Moringa oleifera leaf meal (MOLM) on growth performance of broilers and reported that MOLM can be substituted to soybean meal in broilers diet up to a level of 5% inclusion in the total ration without negative effect on biological performance of birds.

David et al. (2012) reported that addition of the two levels (0.05% and 0.1%) of moringa leaf powder in broiler rations have the potential to improve the growth performance and

carcass yield of broilers. Similar results were observed that in another study conducted by **Karthivasnan et al. (2015). Nkukwana et al. (2014)** observed the positive effect of Moringa oleifera leaf supplementation on productive performance, intestinal integrity, digestive organ size, digestibility, bone breaking strength and bone ash content, and meat yield of broiler chickens throughout the production period. Unlike these studies, **Paguia et al. (2014),** reported that the addition of moringa leaf powder on broiler diets did not significantly influence the broiler's feed intake, body weight gain, feed conversion ratio, final weight, feed cost per kg of broiler produced and income over feed and chick cost. **Annongu et al. (2014)** observed that the growth performance of broiler decreased following increasing level of moringa in the diet. However, in the study investigated the effects of moringa leaf meal as a substitute for soybean meal on growth performance of broilers was reported that addition of moringa leaf meal as protein supplement in broiler diets at 25% promoted more growth than commercial diets **(Gadzirayi et al. 2012).**

The study conducted by **Zanu et al. (2011)** reported that Moringa oleifera can partially used to replace fish meal. Besides studies conducted with broiler, there are many studies conducted to investigate the effects of Moringa oleifera on performance of laying hens. In one of these studies, **Olugbemi et al. (2010)** found that Moringa oleifera leaf meal (MOLM) can be safely included in cassava-based layer diets up to 10% without negatively affecting productivity. Similarly, various studies reported that Moringa oleifera leaf meal could be acceptable up to 10% -15 % in laying hen rations **(Kakengi et al. 2007; Abou Elezz et al. 2011, 2012).** Several additives of moringa are in shape for human consumption, with local usage various extensively. Juvenile seed pods, foliage, flowers, mature seeds are all edible **Peter (2008)**. The leaves are the maximum nutritious a part of the plant, being a large supply of nutrition B, nutrition C, seasoned nutrition A as beta-carotene, nutrition K, manganese, and proteins, amongst different critical nutrients **Olsen and Hammack (2001)**

Peter (2008) are all edible. The leaves of *Moringa oleifera* are extensively applied historically for its antimicrobial capabilities **Suarez *et al.* (2005)** and its pharmacological characteristics **Mehta *et al.* (2003)**. Also, moringa (*Moringa oleifera*) leaves had been used as a natural antioxidant for its antioxidant activity **Yang *et al.* (2006).** It has far above the ground amounts of polyphenols **Sreelatha and Padma (2009).** The seeds and leaves of moringa were investigated by specialists and they discovered that these pieces of moringa help in advancing the insusceptible reaction and physiological and gainful execution of birds **Abbas and Ahmed (2012).** Moringa can possibly support food security, encourage provincial turn of events, improve sustenance, and keep up manageable land care in agricultural nations **National Research Council (2006).** *Moringa oleifera* leaf powder was pretty much as powerful as cleanser for hand washing when wetted ahead of time to empower against septic and cleanser properties from phytochemicals in the leaves **(Ndabigengesere and Narasiah, (1995).** Moringa seed cake, gotten as a result of squeezing seeds to get oil, is utilized to channel water utilizing flocculation to deliver consumable water for creature or human utilization **Ndabigengesere and Narasiah (1995).** Moringa seeds contain dimeric cationic proteins which retain and kill colloidal charges in turbid water, making the colloidal particles cluster together, making the suspended particles simpler to eliminate as muck by one or the other settling or filtration. Moringa seed cake eliminates most pollutants from water. This perspective is quite compelling for being non-poisonous and maintainable contrasted with different materials in moringa-developing areas where drinking water is influenced by toxins **Hellsing *et al.* (2013).** The logical exertion of this exploration gives experiences on the utilization of moringa as a solution for diabetes and disease and fortress of moringa in business items. This audit investigates the utilization of moringa across disciplines for its therapeutic worth and manages development, sustenance, business and noticeable pharmacological properties

of this "Wonder Tree" **Gopalakrishnan *et al. (*2016).** Some tropical vegetables and plants were brought into poultry eats less carbs as protein sources to diminish the expense of the feed. *Moringa oleifera* is a tree with numerous utilizations, and of extraordinary monetary significance, found all through the greater part of the jungles. It was fused into the poultry diet by nutritionists to inspect its impacts on ovens', and laying hens' gainful exhibition **Abbas, T. E. (2013).**

2.2.3 Nutritive value of *Moringa oleifera*

Moringa is known to contain in any event 12 MJ/Kg of metabolizable energy, 23% rough protein, and have 79.7% edibility **Becker (1995).** It likewise contains sufficient measure of cystine, carotene, ascorbic corrosive, iron and methionine **Makkar and Becker (1996).** *Moringa oleifera* leaves are loaded with supplements significant both for people and creatures. A rough protein level of 25-27% recommends that the leaves are acceptable wellspring of protein for animals. The high extent of this protein is accessible in the digestive organs **Makkar and Becker (1997).** the low degrees of enemies of supplements and the adequate degrees of significant amino acids present in moringa show their dietary benefit. The low corrosive cleanser insoluble protein (1-2%) and high pepsin solvent nitrogen (82-90%) values for the leaf dinner of moringa infers that dominant part of the protein content in the MoLM is open to most livestock **Makkar and Becker (1997).** During the rainy season in June 2011, Moringa leaves were collected from Rafia, Nasarawa State, Nigeria for total mineral and phytochemical analysis. The result of rough analysis showed that there are a large amount of crude protein (17.01%±0.1) and carbohydrate (63.11%±0.09). The leaves also contain a lot of crude fiber (7.09%±0.11) and ashes (7.93%±0).12), crude fat (2.11%±0.11) and fatty acid (1.69%±0.09). The total ash content shows that it contains minerals: Ca (1.91% ± 0.08), K (0.97% ± 0.01), Na (192).95±4,4), Fe(107,48±8,2), Mn(81,65±2,31), Zn(60,06±0.3) and P(30,15±0.5) ppm (million One

part).Magnesium (0.38%±0.01) and copper (6.10±0.19) are the lowest. The results of phytochemical analysis and anti-nutritional analysis showed the presence of tannin (21.19% ± 0.25), phytic acid (2.57% ± 0.13) and trypsin inhibitor (0% ± 0.04), saponins (1.60% ± 0.05), oxalate (0.45% ± 0.01) and cyanide ((0.1% ± 0.01). The presence of these important nutrients and minerals indicates that Moringa oil is a Nasarawa state pull. It can be used as a dietary supplement to improve the growth and health of poultry **Ogbe and Affiku (2020).** Moringa is almost available and widely used all over the world. Leucaena estimates it has global coverage 2 to 5 million hectares **Bryubaker and Sorensson (1990) and Kakengi *et al. (*2007)** LLM and MOLM are high-protein. On a dry matter basis, the content of CP in LLM is 20% to 34%, while the content of CP in MOLM is 20% to 29%. They also have the average metabolizable energy content of pasture poultry farms. In addition to the distinctive features of essential amino acids, vitamins and minerals, on a dry basis, LLM is 700 to 1365 kcal/kg, **DMello and Taplin (1978) Makkar and Becker (1997, Ramirez (2000). Echeverría *et al. (*2002), Elkhalifa *et al. (*2007), Kakengi *et al. (*2007), Atawodi *et al. (*2008).** Table 2.1 and 2.2 shows the nutritional value of the various parts of *Moringa oleifera* plant.

Table 2.1: Nutritional value per 100 g of *Moringa oleifera* leaf

CONTENT	VALUE
Energy	64 kcal (270 KJ)
Carbohydrates	8.28 g
Dietary fiber	2.0 g
Fat	1.40 g
Protein	9.40 g
Vitamin A equiv.	378 μg
Thiamine (B1)	0.257 mg
Riboflavin (B2)	0.660 mg
Niacin (B3)	2.220 mg
Pantothenic acid (B4)	0.125 mg
Vitamin B	1.200 mg
Folate (B)	40 μg
Vitamin C	51.7 mg
Calcium	185 mg
Iron	4.00 mg
Magnesium	147 mg
Manganese	0.36 mg
Phosphorus	112 mg
Potassium	337 mg
Sodium	9 mg
Zinc	0.6 mg
Other constituents	
Water	78.66 g

Source: USDA Nutrient Database (Units μg = micrograms; mg = milligrams IU = International units)

Table 2.2: Nutritional value per 100 g of *Moringa oleifera* pod

CONTENT	VALUE
Energy	37 kcal
Carbohydrates	8.53 g
Dietary fiber	3.2 g
Fat	0.20 g
Protein	2.10 g
Vitamins	
Vitamin A equiv.	4 μg
Thiamine (B1)	0.0530 mg
Riboflavin (B2)	0.074 mg
Niacin (B3)	0.620 mg
Pantothenic acid (B4)	0.794 mg
Vitamins B	44 μg
Folate (B)	141.0 mg
Minerals	
Calcium	30 mg
Iron	0.36 mg
Magnesium	45 mg
Manganese	0.259 mg
Phosphorus	50 mg
Potassium	461 mg
Sodium	42 mg
Zinc	0.45 mg
Other constituents	
Water	88.20 g

Source: USDA Nutrients Database (Units μg = micrograms; mg = milligram IU = International units)

TABLE 2.3: Proximate Composition of Moringa oleifera

Parameter	%	Reference
Dry Matter (DM))	89	**Sameh G.A. Ramadan (2017)**
Crude protein (CP)	7.25	
Ether Extract (EE)	11.7	
Ash	12.3	
Calcium	2.10	
Phosphorus	0.77	

2.4 Effect of *Moringa oleifera* on performance of broilers

Naazie and Akoto (2011) reported that dietary supplementation of Moringa oleifera at 2.5%, 5% (with or without antibiotics inclusion) levels respectively has increase immune ability of broilers and hence the wellbeing of the birds recorded throughout their period experimentation was influenced by the inclusion of MoLM in the diets. **Zanu *et al.* *(*2012)** reported that the mean body weight acquires, last body weight (FBW), feed change proficiency altogether declined (P<0.05) with the incorporation levels of 5%, 10%, 15% and 20% MoLM. **Olugbemi, (2010)** also reported a decrease in weight gain and final weight with increasing the levels of MoLM in cassava-based diets. **Atuahene *et al* (2008)** FCE was most elevated for birds took care of diets containing 750g/100kg moringa leaf dinner and declined as the extent of it in the eating regimen diminished. **Mahfuz and Piao (2019)** reported as M *oleifera* a surprise tree resulting from its properly off asset of various dietary supplements with excessive natural qualities. M. *oleifera* has been applied as an improvement advertiser, invulnerable enhancer, molecular reinforcement, and has a hypo-

ldl cholesterol effect on chickens. It has each healthful and remedial quality. Be that because it may, there may be nonetheless a variety of disarray in beyond dispensed articles which include the giant jobs of M. *oleifera* underway execution and wellbeing reputation of chickens. **Gakuya *et al. (2014*)** in this investigation on analysis done to know the dietary effect of MOLM by dissected for rough protein and afterward added to eats less at levels of 7.5%, 7.5% (without Methionine and lysine), 15 and 30%. The MOLM unrefined protein level was 23.33%. The weight acquire was altogether extraordinary between the different eating regimens with the most noteworthy weight acquire being in T1 at 1464 and the least in diet T5 at 500. MOLM supplementation at levels above 7.5% diminished the feed admission and dry matter absorbability. The yellow shade of the corpse expanded with the expanded degrees of MOLM. **Aderinola*et al (*2013)** noticed distinctive serum and hematological qualities of birds took care of diets containing MoLM (0%, 0.5% MoLM, 1% MoLM, 1.5%MoLM and 2% MoLM). Their discoveries show that the mean PCV esteems were essentially extraordinary ($P<0.05$) from one another and were in concurrence with the consequences of **Iheukwumere *et al.* (2008.** This demonstrates that despite the fact that some measure of poisonous factor is available in moringa leaf feast; it shows that all the treatment bunches had healthful sufficiency **Church *et al. (*2004).** This affirms that the consideration of MOLM on poultry diet had little impact on the general amount of platelets as contrasted and the all out volume of blood **(Health and Olusanya (2005)**. The estimation of RBC and Hb starts to decrease from T3. Decrease in the hemoglobin might be joined by a fall in the red cell check (RBC) and stuffed cell volume (haematocrit). The significant capacity of the red platelets is to ship hemoglobin, which thusly conveys oxygen from the lungs to the tissues. The RBC esteems falls inside the ordinary scope of (1.58-3.82×106/µL) portrayed by **Animashahun *et al. (*2006).** Diminished RBC means that the oxygen conveying limit of the creatures' blood would be decreased. Hackbath*et al.,* (1983)

detailed that expanded RBC esteems were related with great dietary protein and with sickness free creatures. **Voemesse *et al.* (2018)** explored the impact of various degrees of *Moringa oleifera* leave feast (MOLM) on execution and serum biochemical boundaries of egg-type chicken from one day old to about two months old enough. The gatherings were treatment taken care of with abstains from food containing 0, 1 and 3% of Moringa leaf. During exploratory period, feed consumption, body weight and feed change proportion were recorded week after week. Results showed closeness between feed consumption, liver relative weight while critical contrasts (p</0.05) between treated gatherings and the control one were seen on body weight, every day weight acquire, feed transformation proportion and gizzard relative weight. The lower RBC could be because of the lessening unrefined protein content in the bird slims down with consideration MOLM content. Red Blood Cells (RBC) are answerable for the transportation of oxygen and carbon dioxide in the blood just as assembling of hemoglobin subsequently higher qualities show a more prominent potential for this capacity and a superior condition of wellbeing **Olugbemi (2010).** The examination noticed a critical (P<0.05) distinction in the WBC boundaries among medicines with T5 (20% MOLM) having the most noteworthy incentive for WBC. This perception shows that the chief capacity of phagocytes, which is to guard against attacking microorganisms by ingesting and obliterating them, hence adding to cell incendiary cycles, was improved **Adedapo *et al.* (2012)** which may represent its antibacterial action (Fahey *et al.*, 2001). Along these lines improving the ailment of the trial birds which was in accordance with **Du *et al.* (2007)**

2.5 Effect of garlic supplementation in broilers

Heath *et al.* (1982) noticed the impact of taking care of wheat sullied with garlic to chicks. From 1 to 21 days 150 male oven chicks were benefited from one of 3 weight control plans each containing half wheat. Diets 1, 2 and 3 contained wheat with no garlic, wheat with 50 garlic bulblets/kg and wheat with 100 garlic bulb lets/kg, individually. From 22 to 42 days old enough weight control plans 4, 5 and 6, which contained indistinguishable degrees of garlic to counts calories 1, 2 and 3, were taken care of to the chickens which had gotten abstains from food 1, 2 and 3. At 42 days old enough 10 birds from each pen were butchered and the remnants in each pen were separated into 2 pens each containing 20 birds for the time frame 43 to 50 days. 1-laif the pens were given eating regimens containing no garlic while the other half were given weight control plans containing the very degree of garlic that they were given in the past period. Albeit little diffcrcncc were dctcctcd in both weight gain and feed transformation productivity no patterns could be recognized. As aresuk of organoleptic tests it was presumed that garlic can be taken care of in starter eats less carbs and not be distinguished in the cooked meat, given no garlic is remembered for either the finisher or withdrawal eats less carbs. It takes longer than the ten days eating which the finisher eats less carbs were given for the impact of the garlic to be dispensed with from the tissue. **Heath *et al.* (1983)** evaluated the effect of feeding wheat contaminated with garlic to broilers. From day one until 21 days, 480 male chickens were given commercial mash diets with 50% wheat plus 0, 33, 66, 100 or 133 garlic bulb lets per kg wheat. A sixth group was given 50% wheat plus 100 bulb lets from the previous year's supply of garlic per kg wheat Finisher diets were given from 22 until 42 days and contained the same amount of wheat and garlic as was supplied in the respective starter diets. At 42 days of age half of the birds were given withdrawal diet until 49 days with 50% wheat but no garlic. The other birds were given a withdrawal diet that contained wheat and the same

amount of garlic as in the starter and finisher diets. Garlic had no obvious effect on weight gain or feed conversion efficiency. From results of organoleptic tests it is suggested that garlic can be given to broilers at 33 bulblets per kg wheat without affecting the flavor of the cooked meat. Different sources of garlic bulblets may change the levels at which flavor differences can he detected. There are considerable efforts to introduce garlic as an effective growth promoter for broiler chickens and the most reports have indicated promising outcomes **(Javed et al. 2009; Aji et al. 2011).** However, the differences in the experimental conditions, birds genetic and health status as well as the type, processing and quality of garlic products have resulted in some controversial recommendations. **Shi et al. (1999)** fed 0.2, 1 or 2% garlic meal to broilers and found the best performance in birds fed 1% garlic meal. In a comparable report, **Jagdish and Pandey (1994)** reported a different effective dosage such that a lower FCR was found with 0.25% garlic meal in compare to control group and 0.5% level. However, Qureshi et al. (1983b) found no differences in growth performance of broilers up to 5% garlic meal, and in the study of **Horton et al. (1991)** there was no improvement in the performance of broilers fed 0.01, 0.1 or 1% garlic meal. **Reddy et al. (1991)** and Chowdhury et al. (2002) also reported that the sun-dried garlic meal and garlic oil did not affect growth performance. The inconsistency in results may be because of differences in experimental diets and birds, and the quality and quantity of the active components in the garlic product. Some researchers tried to combine the garlic and other feed additives to achieve more benefits. **Choi et al. (2010).**

Varmaghany et al. (2015) studied the effects of dietary garlic at 0, 0.5, 1.0 or 1.5% dosage on haematological parameters, ascites incidence, and growth performance of an ascites susceptible broiler hybrid under both standard and cold temperature conditions. The final body weight decreased, with increasing dietary garlic in the standard temperature, however the FCR did not affect among all groups under both temperature conditions. They

concluded that the 0.5% dietary garlic meal effectively decreased systemic hypertension and prevalence of ascites without any negative effects on broiler chicken performance. **Calai *et al.* (1997)** revealed the utilization of garlic in the eating regimens of oven chickens multi day-old Arbor-Acre chicks were separated into five equivalent gatherings with six imitates to contemplate the impact of consolidating newly minced garlic at 1 % and dried garlic at 1, 2 and 3% in bird abstains from food on the development execution, cadaver characteristics, actual meat quality and blood serum cholesterol. Garlic at 3% diminished body Wight during the initial 5 weeks of the investigation, later-on this adverse consequence vanished. Garlic had no unfriendly impact on feed admission besides at about fourteen days old enough and this impact was more articulated on account of joining of new garlic instead of dried garlic. Garlic had no impact on feed transformation or remains qualities. New garlic had no impact on the keeping nature of bosom meat, while dried garlic weakened (P<O.05) the keeping quality, yet this inconvenient impact was diminished with expanding the degree of dried garlic in the eating regimen. Garlic had no injurious impact on the pressure defenselessness of birds during butchering, the pace of glycolysis cycle and squeeze content in the bosom. **Javandel *et al.* (2008)** enhanced oven's weight control plans with 0, 0.125, 0.25, 0.5, 1 or 2% garlic supper. The eating regimens containing under 2% garlic dinner improved development rate and feed change proportion (FCR) contrasted with the benchmark group. Anyway the 2% dietary garlic supper ap-parently effectsly affects oven execution. There is an assortment of conceivably helpful feed added substances that could be added to poultry feed to improve creation or to diminish the spread of sickness. One of such elective feed added substance is Garlic (*Allium sativum*). Garlic (*Allium sativum*) is broadly disseminated and utilized in all pieces of the world as a zest and natural medication for the counteraction and treatment of an assortment of illnesses, going from microbial pharmacologic contaminations to respiratory infections. Garlic is thought to have

different properties. **Horton and Prasad (1991)** announced that garlic as a feed added substance, improved oven development, feed change proportion (FCR) and diminished death rate. Additionally, **Demir *et al.* (2003)** announced that garlic might be utilized an elective anti-microbial development advertiser in oven creation. **Javandel *et al.* (2008)** likewise detailed that the utilization of normal feed added substances like garlic has made it feasible for one to stay away from the unsafe impacts of engineered anti- microbials.

2.6 Effect of garlic on production and physiology

Khan *et al.* (2012) detailed that the garlic is the outstanding useful impacts have been seen on development, feed productivity, egg creation and quality, just as incitement of resistant framework and bringing down blood cholesterol levels in poultry birds. The outcomes announced shift from one creator to another presumably because of varieties in the portion of the item took care of, the span of taking care of and handling procedures utilized. **Rahman (2007)** garlic is to forestall cardiovascular infection by different impacts, one of which is the restraint of platelet accumulation and its capacity to do this has been widely explored in vitro, notwithstanding, in vivo considers are restricted. In vitro contemplates demonstrate that garlic forestalls restraint of platelet collection by repressing cyclooxygenase action and subsequently thromboxane A2 development, by stifling assembly of intraplatelet Ca2+, and by expanding levels of cAMP and cGMP. Garlic likewise shows solid cancer prevention agent properties and initiates nitric oxide synthase (NOS), prompting an expansion in platelet-derived. **Ogbuewu *et al.* (2019)** in this investigation an examination is outcome to know the effect of garlic nutritionists to utilize common options as development advertisers, for example, prebiotics, probiotics, natural acids, spices and a few others. Garlic (*Allium sativum*), one of such common elective development advertisers, is utilized all around the world as a zest in human food arrangement. Studies have uncovered that garlic is a rich wellspring of fundamental

supplements and advantageous phytochemicals that can be joined in creature feed to improve gut movement and advance development in animals and poultry. **Hanieh *et al.* (2010)** led an investigation with the impact of garlic (*Allium sativum*) has been utilized in the poultry. It has had antibacterial, antifungal, hostile to parasitic, antiviral and cell reinforcement, against cholesteremic, against harmful, and vasodilator qualities.

Table 2.4: Nutritive value of garlic/100g garlic

CONTENT	VALUE
Protein	0.57 g
Total lipid	0.04 g
Carbohydrates	2.98 g
Energy	13.41kcal
Calcium	16.29 mg
Iron	0.15 mg
Magnesium	2.25 mg
Phosphorus	13.77 mg
Potassium	36.09 mg
Sodium	1.53 mg
Zinc	0.1 mg
Copper	0.03 mg
Manganese	0.15 mg
Selenium	1.28 mg
Thiamin (B1)	0.02 mg
Riboflavin (B2)	0.01 mg
Niacin	0.06 mg
Vitamin (B6)	0.11mg
Folate	0.27 mg
Vitamin C	2.81 mg
Vitamin K	0.13 mg
Fatty acids	0.03g

Source: URMC Nutrition Database (Units kcal = kilocalorie; g = gram; mg = milligram)

2.7 Effect of garlic in growth performance in Boiler

Ao *et al.* (2011) the impacts of dietary enhanced with aged garlic powder (FGP) on development execution. The investigation went on for 5 weeks and dietary medicines were as per the following: 1) CON (basal eating regimen); 2) FGP1 (basal eating routine + 1 g/kg matured garlic powder); 3) FGP2 (basal eating regimen + 2 g/kg aged garlic powder); 4) FGP4 (basal eating regimen + 4 g/kg aged garlic powder). No impacts were noticed ($P > 0.05$) in body weight acquire (BWG), feed consumption (FI) or feed transformation proportion (FCR) all through the entire investigation. **Mansoub (2011)** trial included T1, control bunch, T2, basal eating regimen containing 1% probiotic (L. acidophilus and L. casei)1-28, T3, was taken care of by basal eating routine in addition to 1 gr/Kg Garlic powder. When contrasted with the benchmark group with different gatherings recognizably to give improve execution in the entirety of the test ($P<0.05$). **Fadlalla *et al.* (2010)** and **Onibi *et al.* (2009)** they found that there is no difference between control group and broilers fed with garlic in both body weight gain and feed intake. **Pagrut *et al.* (2018)** an examination was directed to evaluate the impact of garlic supplementation in diets of oven as a substitution anti-toxin on gainful execution of the chicks. The gatherings are treated with garlic strengthening @ 0.5 and 1 kg/ton in the birds. The birds utilizing apportion enhanced with 0.5 kg/ton garlic put on the most elevated live weight (g) among the treated gatherings and the best-feed transformation proportion despite the fact that they devoured a similar food ($p<0.05$). **Ahmad (2005)** these outcomes were likewise revealed by in which he expressed that higher weight acquire in chicks took care of apportions enhanced with garlic. The improvement in weight gain of the birds utilizing garlic in their proportions may likely be because of the way that allicin (an anti-toxin substance found in garlic), represses development of intestinal microbes like S. aureus and E. coli and repress aflatoxins delivering parasites.

Lukanov *et al.* (2015) the motivation behind the investigation was to assess the impact of feed supplementation with garlic powder on development execution, cadaver yield and meat quality in oven chickens. The investigation was directed with 120 male bird chickens enhanced with 0.2%, 0.4% and 0.8% garlic powder. The outcomes showed a consistent inclination towards expansion in live body weight all through the swelling period relatively to the degree of dietary garlic powder supplementation. After feed supplementation with expanding dosages of garlic powder, feed change proportion (kg/kg) kept a steady sure propensity up to the seventh seven day stretch old enough. **Raeesi *et al.* (2010)** discovered that feed supplementation with garlic powder during the finisher time frame positively affected the development execution of birds. **Makwana *et al.* (2019)** a trial is done to comprehend the impacts of adding evaluated levels (0, 0.1 and 0.5%) of garlic (*Allium sativum*) powder to the basal test diet on the development execution and remains attributes of broiler chicks. Results uncovered that dietary supplementation of 0.1% garlic powder (T2) fundamentally (p under 0.01) improved body weight, body weight acquire, feed admission and FCR when contrasted with birds enhanced with 0.5% garlic powder (T3) and control diet (T1). Dietary supplementation of 0.1% garlic (T2) brought about critical (p under 0.05) improvement in dressed yield when contrasted with T3 and T1.

2.8 Effect of garlic in blood biochemical in Boilers

Mansoub (2011) the point of this investigation was assessed the impacts of Garlic and Probiotic biochemical structure of oven chickens. Also, the garlic powder strengthening with @ of 1 g/kg in the broiler chickens. As per the outcomes, all out cholesterol (Chol), fatty oil (TG), HDL and LDL were estimated in blood tests of day 42. The measure of all out Chol and fatty oil (TG) in the biochemical showed critical contrasts, however HDL and LDL were not essentially unique among gatherings. **Endens *et al.* (2003)** in the current investigation the effect of garlic powder in the birds with @ 1 g/kg

shows that the cholesterol level of serum altogether diminished in bunches enhanced with probiotics in contrasted with control bunch. **Ologhobo *et al.* (2008)** detailed that Garlic has diminishing impact on fatty substance level and the best outcome was acquired in 2 % of garlic in the basal eating regimen. **Oleforuh-Okoleh *et al.* (2015)** a test was done to research the hematological and serum biochemical reaction in the broiler chickens to watery concentrate of garlic powder. The dietary of garlic powder @ 14 g blended in with apportion providing for the chicks. Critical ($p < 0.01$) increments were seen in hemoglobin fixation, pressed cell volume, white platelet, and red platelet of the ginger and garlic treated birds. The serum biochemical boundaries estimated were fundamentally ($p < 0.05$) extraordinary. Cholesterol diminished altogether ($p > 0.05$) while there was critical expansion in the all out protein, egg whites, and globulin of the treated birds ($p < 0.01$).

Ismail *et al.* (2020) detailed that the effect of garlic powder in the birds with the dietary @ 0.25, 0.50, 0.75 g GP/kg diet in the gatherings which shows that red platelets and hemoglobin were improved in chickens took care of diets enhanced with garlic powder. broiler chickens got counts calories containing either GP recorded the higher qualities ($p<0.05$) of absolute protein, globulin, high-thickness lipoprotein, immunoglobulin M (IgM) and IgG, superoxide dismutase and all out-cell reinforcement limit; while, blood totl cholesterol, low-thickness lipoprotein, aspartate- aminotransferase and malondialdehyde were brought down ($p<0.05$) contrasted with control-diet. **Ademola *et al.* (2004)** form an examination to consider the impact of dietary garlic on blood creation of oven chickens was researched. Medicines of garlic @ 5g/kg, 10g/kg and 15g/kg. There were general reductions in the majority of the hematological boundaries of birds took care of garlic. Birds in medicines with 10.3%, 4.8%, 8.5% and 13.9% decreases in pressed cell volume individually, while all out white platelets and neutrophils were expanded by about 18.7% and 20.4% for birds on garlic medicines when contrasted with those on the control diet.

Lymphocytes, monocytes, eosinophils, serum complete protein and egg whites were not influenced by the dietary medicines. **Jafari *et al.* (2011)** the point of the current examination was to research the impact of garlic, in powder structure, on protein parts of birds' sera. The chicks in bunches are diet enhanced with 1% and 3% garlic powder. The outcomes showed that the previously mentioned boundaries, with the exception of γ globulin, were not influenced by the eating regimen ($p > 0.05$). The degree of γ globulin had decay with age in gatherings, though it expanded in completely immunized gatherings. Besides, when contrasted and different gatherings, treated gatherings had a fundamentally higher measure of γ globulin from day 21 onwards, and the increment was portion subordinate. **Fallah (2014)** the current investigation was intended to assess the impact s of valuable various degrees of garlic powder on blood biochemical boundaries and resistant reaction in oven. The treatment bunches are enhanced with @ 1.5, 3 g/kg BW. The aftereffect of this examination shows that no huge contrast in the heterophil to lymphocyte. On different gatherings aftereffect of this examination shows that bird accepting the garlic powder had lower blood glucose, complete cholesterol, high-thickness lipoprotein, low-thickness lipoprotein and fatty substances. **Ala Al Deen (2007)** this examination was directed to explore the impacts of adding crude garlic in the weight control plans on certain hematological and serum natural chemistry of broiler chick. The birds are enhanced with benefited from 5% and 10% crude garlic with basal eating routine. The outcomes showed that there was no huge adjustment in PCV and RBCs in the gathering which benefited from 10% crude garlic contrasted and the control one; any way this gathering showed critical.

2.9 Effect of moringa and garlic on carcass characteristics on boilers

Aderinola *et al.* (2013) led a trial on the use of *Moringa oleifera* leaf as feed supplement in oven diet. **Whiten** and **Grashorn (1995)**, **Naazie** and **Akoto (2011), Zanu *et al.*, (2012)** noticed yellow tinge of the bird's body parts, for example, mouth and knifes

when moringa leaf feast was taken care of to ovens. This could be credited to the presence of carotenoid and xanthophylls colors in MoLM. **Melesse *et al.* (2013)** the point of the current investigation was to assess Moringa stenopetala leaf dinner (MLM) as option modest wellspring of protein in the eating regimens of cultivator Koekoek chicken varieties. 200 15-day old chicks were haphazardly appointed to five dietary medicines comprising of a control diet (T1) and those containing MLM at the degrees of 50 g/kg (T2), 80 g/kg (T3), 110 g/kg (T4) and 140 g/kg (T5) supplanting the cooked soybean of the control diet. Chickens took care of T3, T4 and T5 abstains from food had higher ($p<0.01$) loads of dressed body, thighs, drumsticks and wings than those of the control diet (T1). Essentially ($p<0.01$) higher butcher weight was acquired from chickens took care of T3 and T4 eats less than those of T1. Chickens took care of T4 and T5 eats less carbs had the most noteworthy dressing and bosom yields which varied ($p<0.01$) from the other treatment consumes less calories. **Raeesi *et al.* (2010)** who revealed a huge impact on the remains portions of ovens took care of with garlic. Birds on T3 devoured more feed, trailed by birds on T2, T5, T4 and T1. **Oleforuh-Okoleh *et al.* (2014)** led an examination to assess that the consequence of the taking care of technique on the corpse nature of birds as displayed in table 2 demonstrates that the dressing rate was essentially ($p< 0.05$) expanded when ginger and garlic were taken care of in powder structure. **An *et al.* (2015)** this analysis was done to examine impacts of onion remove on development execution, meat quality and blood profiles of White little ovens. The general load of different organs, like liver, spleen, bursa of Fabricius, stomach fat, and the exercises of serum proteins were not influenced by dietary medicines. **Petričević *et al.* (2019)** the point of the examination was to consider the impact of the expansion of various convergences of garlic to take care of for oven chickens on the nature of the body. In the benchmark group (K) no garlic was added. Chickens in the primary (I) bunch devoured feed with the option of 0.2% garlic powder, in the

subsequent gathering (II) 0.4% was added while 0.6% of garlic was included the third gathering (III). The outcomes showed, that expanding the proportion of garlic fundamentally ($p < 0.01$) diminished the stomach fat substance.

Chapter-3 MATERIALS AND METHOD

The present study was carried out to evaluate the effect of supplementation of moringa and garlic on growth performance, blood biochemical parameters and carcass quality traits on one hundred eighty (180), day old broiler chicks divided into six treatment groups comprising of three replicates containing 10 birds in each replicate. The birds were reared in deep litter system.

3.1 Trial period and preparation of experimental diet

The experiment was conducted for 6 weeks. There were six dietary treatments as detailed below:

T1- Basal or Control diet

T2- Basal diet+ 0.5% garlic

T3- Basal diet + 1 % garlic

T4- Basal diet + 1 % Moringa leaves

T5- Basal diet + 2% Moringa leaves

T6- Basal diet+ 1% garlic+ 2% Moringa leaves

3.2 Management, feeding and watering of birds

Moringa oliefera leaves were harvested from the trees within university campus and garlic were harvested from the field. The branches were de-leafed and also the garlic stem was cut by the cutter. The leaves and garlic were air dried under shade for a period of 8-10 days. The leaves and garlic were then milled to produce the leaf and garlic meal for the birds. experimental diet contains 0% (control), 0.5% (garlic), 1.0% (garlic), 1.0% (moringa), 2.0% (moringa), 1%+2% (garlic+moringa) respectively.

3.3 Data collection procedure

Form the beginning to the end of the entire experiment, feeds supplied and

leftovers were recorded in each treatment's replicates using appropriate weighing scale. The differences between amount of feed given and the leftovers were used to calculate the feed intake of birds. The birds were also weighted every week ending throughout the 6-week experimental period which was used to calculate the weekly body weight and weight gain.

Table No 3.1 The nutrient compositions of the ingredients

S.No.	*Ingredient*	*CP%*
1	Fish Meal	60.3
2	Soyabean Meal	50.3
3	Groundnut cake	40.5
4	Maize	10.2
5	Rice polish	8.2

Table No. 3.2 Composition of the mixed ration of 100 kg

S.No.	**Ingredient**	**Kg/100kg m feed**	**Total CP (Kg)**
1	Fish Meal	10.346	6.239
2	Soybean Meal	10.856	5.461
3	Groundnut cake	10.857	4.397
4	Maize	32.2155	3.286
5	Rice polish	32.7265	2.618
6	Mineral Mixture	2	-
7	Salt	1	-
	Total	100	22.001

3.4 Housing and brooding

During the above time frame, every one of the multi day old chicks were initially kept in a single brooder utilizing 6100-watt electric bulbs to give both light and heat and

were adjusted according to the degree of warmth needed by the chicks. A solitary brooder room of 12 feet by 12 feet was utilized to brood the chicks. The room was furnished with sufficient liter of woods having which was covered with papers to keep the chicks from erroneously eating the litter. Channel was sprinkled on the papers and water was given in the small waterers of size 1 liter. Feeders were likewise loaded up with feed and spread evenly inside the brooder. The chicks were monitored for their reaction to heat and the warmth sources changed as needs be during the time frame. The floor was altogether cleaned, sanitized and dried before spreading the dry wood shavings as bedding material. The wood shavings were evenly spread to get 5-7 cm thickness. The racking of the litter was done frequently to prevent any cake formation.100-watt electric bulbs in each pen were place data appropriate statures to give uniform lighting. Two feed box and two watering tanks were set in each compartment for the replicates.

3.5 Growth Performance

3.5.1 Body Weight (BW)

Body weight of birds of each group was measured by the digital electronic balance at beginning of the experiment which was repeated weekly in morning hours before providing feed or water.

3.5.2 Body Weight Gain (BWG)

Weekly body weight gain was calculated by weekly differences of body weight. Body weight gain (BWG) was calculated by subtracting the final body form the initial body weight and divided by the number of days.

` Body weight gain = Final body weight – Initial body weight

3.5.3 Feed consumption

Feed consumption is the amount of feed consumed per day. Feed consumption was calculated for each treatment at weekly basis. Residual amount of feed was weighed and

subtracted from the known weight of offered feed.

Feed consumption = Total offered feed – Residual feed

3.5.4 Feed conversion Ratio

It was measured as the amount feed consumed to produce a kg of body weight. It was evaluated by dividing the amount of feed consumed from the 0-6 weeks by the gain in average weight of birds over the same period, thus; feed intake (g)/gain in weight (g).

FCR = FI (g)/BWG (g)

3. 6 Characteristics

Following 6 weeks of experimental trial, 6 birds selected randomly from every treatment gathering were slaughtered to examine the gastrointestinal advancement (proventriculus, gizzard, small intestine, large intestine &caeca) and different carcass attributes as follows:

- Live weight
- Dressing yield
- Eviscerated yield
- Giblet yield (heart, liver & gizzard)
- Yield of individual cut-up parts (thighs, drumsticks, breast, back, neck, wings) as % of live weight
- **3.6.1 Dressed weight**

  Dressed weight=Live weight–blood, feathers, head, shank and skin losses.

$$\text{Dressing (\%)} = \frac{\text{Dressed weight (deskinned)}}{\text{Live weight}} \text{X } 100$$

3.6.2 Eviscerated weight

Eviscerated carcass percentage was also calculated by dividing eviscerated carcass over live weights of a bird and multiplied by100:

Fig 1: Handling of birds during experimental trial

Fig 2: Birds allocated in different treatment groups

Eviscerated carcass weight =Dressed weight –weight of viscera.

$$\text{Evisce rated carcass (\%)} = \frac{\text{Eviscerated carcass weight of a bird}}{\text{Live weight of a bird}} \times 100$$

3.6.3 Internal organ weight

Separate weight of Heart, Gizzard, Spleen and Liver were recorded in grams and their percentages to the broiler's body weight calculated.

$$\text{Relative weights (percent)} = \frac{\text{bbWeight of organ in grams}}{\text{Live body weight in grams}} \times 100$$

3.7 Blood collection and analysis

At the end of 42 days of feeding trial, 2.0 ml of blood sample where collected form 2 birds each replicate and put into Ethylene Di-amine Tetra Acetic Acid treated test tubes for the hematological essay. Blood sample where analyzed within 3 hours of their collection Total Protein (TP), Uric Acid (UA), Alkaline Phosphatase (ALP), Glutamate Oxaloacetate Transaminase (SGOT), Glutamate Pyruvate Transaminase (SGPT) and Cholesterol using the procedure outline by lamb (1991).

3.7.1 Total Protein

Total protein in serum was determined by Total Protein Text Kit Modified Biuret, End Point Assay supplied by Span diagnostics Ltd. Surat, Gujrat (India).

Principle

The peptide obligations of proteins respond with cupric particles in basic solvent to shape a colored chelate, the absorbance of which is estimated at 578 nm. The biuret specialist contains sodium-potassium tartrate, which help sin keeping up solvency of this complex at soluble ph. The absorbance of definite shading is corresponding to the centralization of total protein in the example.

Alkaline pH

Protein+ Cu" ⟶ Cu-Protein complex

Reagent's composition

1. Biuretreagent-

Coppersulphate(7mM/L),sodiumhydroxide(200mM/L),sodium-PotassiumTartrate (20mM/L),

2. Protein Standard-BSA (6.5g/ld.),

Procedure

Pipette into tube marked	**Blank**	**Standard**	**Total**
Serum/Plasma	-	-	10µL
Reagent2	-	10µL	-
Reagent1	1000µL	1000µL	1000µ

Mix well. Incubate at 37^0C for 5-minute Programme the analyzer as pears says parameters

1. Blank the analyzer with reagent blank.
2. Measure absorbance of the standard followed by the test.
3. Calculate results as per the given calculation formula.

Calculation

$$\text{Total Protein calculation (g/dl)} = \frac{\text{Absorbance of Test}}{\text{Absorbance of Standard}} 6.5$$

Globulins= Total Protein -Albumin

Conversion factor

Total Protein concentrationing /L= Total Protein concentrationing/dLx100

3.7.2 Cholesterol estimation

It is imperative to do a quantitative investigation of the cholesterol level in the blood of assessment of the crown ryarterialocclusion, arthrosclerosis, liver function, intestinal assimilation and adrenal illness.

Principle

Cholesterol was assessed in Serum tests by utilizing CHOD-POD strategy, endpoint units from med source Ozone Biomedicals Pvt Ltd, Milestone, Delhi Mathura Road, Faridabad-121003 (Haryana) India. Cholesterol esterase's (CHE) hydrolyze the cholesterol esters in to free cholesterol. Cholesterol oxidase (CHOD) oxidizes the cholesterol into cholest-4-en-3-one and hydrogen peroxide. Hydrogen peroxide responds with a mix. Of 4-aminoantipyrene and phenol within the sight of peroxidase protein (POD) and converts the reactants into a red quinine dye.

$$\text{Cholesterol Ester}_2\text{O} \xrightarrow{\text{CHE}} \text{Cholesterol Free Fatty Acids}$$

$$\text{Cholesterol} \xrightarrow{\text{CHOD}} \text{Cholest-4-ene-3-one}+\text{H}_2\text{O}_2$$

$$\text{H}_2\text{O}_2+4\text{ aninoan tipyrene+Phenol} \xrightarrow{\text{POD}} \text{Red Quinoneiminedye Complex}_2\text{O}$$

Absorbance of quinoneimine is directly proportional to the cholesterol concentration, when measured at 505 nm.

Reagent Composition

Reagent1:

1. Cholesterol Oxidase (0.1U/ml)
2. Cholesterol Esterase (0.15U/ml)
3. Peroxidase (0.5U/ml)
4. 4-Amino anti pyrine (0.5mm0l/l)

Reagent2*:*

1. Cholesterol Standard (200mg/dl)

Procedure:

One reagent blank and one standard are sufficient for each as say series.

Pipette in to test tubes:

S.No.	**Reagent**	**Procedure**		
		Blank	**Standard**	**Test**
1	Cholesterol Reagent (1)	1.0 ml	1.0 ml	1.0 ml
2	Cholesterol Standard (2) (Conc-200mg/dl)		10µl	-
3	Specimen	-	-	10µl

Mix well and incubate for 5 min. at 37^0C for 10 min at room temperature (25^0C±5^0C).

Mix and measure the absorbance of Standard (S) and Test (T) against the reagent blank (B) at 505 nm or with green filter (500-546 nm).

Calculation

Cholesterol concentration in the sample can be calculated using the following

Formula

$$\text{Total Cholesterol (mg/dl)} = \frac{\text{Absorbance of Test}}{\text{Absorbance of Standard}} \times \text{Conc. of Std.(mg/dl)}$$

3.7.3 Uric acid estimation

Uric acid is oxidized to Allantoin and hydrogen peroxide by the enzyme Uricase **(Schultz, 1984).** In presence of peroxidase, released hydrogen peroxide is coupled with Aniline derivative and 4-amino anti pyrine (4-AAP) to form colored chromogenic complex. Absorbance of colored dye is measured at 550nm and is proportional to uric acid concentration in the sample.

$$Uricacid\left(\frac{mg}{dl}\right) = \frac{Absorbanceoftest}{Absorbanceofstandard} \times 6$$

3.7.4 Estimation of Aspartate amino transferase SGOT

Principle:

Auto Zyme GOT is a reagent set for determination of SGOT (AST) activity in serum. The reaction based on UV-Kinetic method recommended by the International Federation of Clinical Chemistry (IFCC). This kit purchased from AGD Biomedicals (P) Ltd. Mehta Trade Centre, no. 1, Shivaji colony, Sir MathuradasVasanji Road, Andheri East, Mumbai-400099, (India)

$$\text{L- Asparate} + \alpha - \text{Keto glutarate} \xrightarrow[\text{MDH}]{\text{SGOT (AST)}} \text{Oxaloacetate} + \text{L - Glutamate}$$

$$\text{Oxaloacetate} + \text{NADH} + H^{+} \rightleftharpoons \text{L- Malate} + NAD^{+}$$

The concentration of NADH to NAD+ is proportional to the concentration of GOT in serum and is measured at 340nm as rate of decrease in absorbance.

Components and Concentration of Working Solution:

Components	**Concentration**
Tris buffer	80 mmol/L
L – Aspartate	200mmol/L
MDH	>500U/L
LDH	>1000U/L
α – Keto glutarate	12mmol/L
NADH	0.18mmol/L

Procedure:

Reaction type	UV – Kinetic

Working Reagent

Mix 4 volume of R1 with 1 Volume of R2

Working reagent is stable for 30 days at 2-8 ^{0}C

Calculation:

Calculate the average change in absorbance per minute.

(ΔAbs/30 seconds x 2)

Activity of GOT in IU/L = Δ Abs / min x 1746

3.7.5 Estimation of SGPT

Diagnostics reagent for quantitive in vetro determination of ALT/GPT (Alanine Aminotransferase) in human serum and plasma

Clinical significance

ALT/GPT is present in high concentration in liver a lasser extent in kidney, heart, skeletal muscle, pancreas, spleen and lung. Increased level of ALT/GPT however is generally a result of liver disease associated with some degree of hypatic necrosis

Principle

L- Alanine +2- Oxogulutrate $\xrightarrow{\text{ALT}}$ Pyruate + L − glutrate

Pyruvate + NADH $\xrightarrow{LDH}$ L − Lactate + NAD

ALT: Alanine Aminotransferase

LDH: Lactate Dehydrogenase

L- Alanine	500 mool/L
NDAH (yest)	0.18 mool/L
LDH	≥ 1820 IU/L
2- Oxoglutrate	12 mool/L
Tris Buffer (PH 7.5± 0.1 at 25 Ċ	82 mool/L

Calculation

Determine the mean absorbance change/min (ΔA /min) for every reading find the mean value

Formula

IU/L = (ΔA /min) × T.V × 10^3 / S.V × absorptivity × P

Where = Total reaction volume in µ L

T.V = sample volume in µ L

S.V = milimolar absorptivity of NADH at 340 nm = 6.22

P = cuvelte light path = 1 cm

Activity of ALT = (ΔA /min) × factor (1768)

Precision

Intra assy precision within run (n=20)	Mean(U/L)	SD(U/L)	CV %
Sample 1	24.3	0.37	1.52
Sample 2	105	0.67	0.64

3.7.6 Estimation of ALP

Alkaline phosphatase (ALP) catalyzes the hydrolysis of 4- nitrophenyl phosphate (4-NPP) with the formation of free 4 nitro phenol and inorganic phosphate, acting the alkaline buffer as a Phosphate-group acceptor. The reaction is monitored kinetically at 405 nm by the rate of formation of 4-nitrophenol, proportional to the activity of ALP present in the sample.

$$\text{4-Nitrophenylphosphate} + H_2O \xrightarrow{\text{ALP, } Mg^{++}} \text{4-Nitrophenol} + Pi$$

This test has been formulated according the standardized method described by DGKC.1

Reagent composition

R1 ALP buffer. DEA buffer 1.25 mool/L pH 10.2, magnesium chloride 0.6 mmol/L. Biocides.

R2 ALP substrate. 4-NPP 50 mmol/L. Biocides.

$$U/L = \Delta A/min \times 2764$$

Samples with ΔA/min exceeding 0.250 at 405 nm should be diluted 1:2 with saline and assayed again. Multiply the results by 2.

If results are to be expressed as SI units apply U/L x 0.01667 = μ kat/L

Materials required

-Photometer or spectrophotometer with a thermostatted cell

-compartment set at 25/30/37ºC, capable of reading at 405 nm.

-Stopwatch, strip-chart recorder or printer.

-Cuvettes with 1-cm path length.

- Pipettes to measure reagent and samples

Procedure

1. Preincubate working reagent, samples and controls to reaction temperature
2. Set the photometer to 0 absorbance with distilled water
3. Pipette into a cuvette
4. Working Reagent 1.0 mL
5. Sample or control 20µ L
6. Mix gently by inversion. Insert cuvette into the cell holder and start stopwatch
7. Incubate for 1 minute and record initial absorbance reading
8. Repeat the absorbance readings exactly after 1, 2 and 3 minutes
9. Calculate the difference between absorbance
10. Calculate the mean of the results to obtain the average change in absorbance per minute (ΔA/min)

Calculations

U/L = ΔA/min x 2764

Samples with ΔA/min exceeding 0.250 at 405 nm should be diluted 1:2 with saline and assayed again. Multiply the results by 2.

If results are to be expressed as SI units apply U/L x 0.01667 = µ kat/L

3.8 Statistical analysis

Data obtained was subjected to analysis completely randomized design with the simple analysis of variance technique **Snedecor** and **Cochran, (1994).** Homogenous subsets were separated by using Duncan's multiple range test described by (**Duncan. 1955)**. Differences among treatments were considered to be significant when $P \leq 0.05$.

The experiment conducted in complete randomized design (CRD).

The statistical model:

$$Yij = \mu + Ti + eij$$

Where:

Yij = represent the observation value which affected by i^{th}treatment (feed supplement) that found within j^{th} replicate.

μ = general mean of population.

Ti= represent the effect of i^{th} treatment. eij = represent the experimental error.

Associated with i^{th} treatment and j^{th} replication

The results on study entitled "Feeding effect of garlic (*Allium sativum*) and moringa (*Moringa oleifera*) leaves on growth and biochemical parameters in broilers" are presented in this chapter.

4.1 Growth performance

4.1.1 Body weight from 0 week to 6 week

The body weight of birds has been presented in Table 4.1. The body weight was altogether most elevated (P<0.05) in the treatment of T6 which was enhanced with garlic and moringa (1%+2%) when contrasted with control groups during 6 weeks. However, there was additionally better growth compared to control for treatment groups T3, T4 and T5 enhanced with garlic (1%), moringa (1%), and moringa (2%) for treatment groups fed separately in every one of the gatherings. Nonetheless, the effect of the all treatment on week-by-week body weight was likewise measurably improved (P<0.05) in the gatherings.

Table:4.1 Effect of garlic and moringa on body performance of Broiler chickens

Treatment	W0	W1	W2	W3	W4	W5	W6
T1	39.00	167.83^{a}	369.75^{a}	617.08^{a}	1025.25^{a}	1395.08^{a}	1769.16^{a}
T2	38.66	168.66^{a}	372.75^{ab}	627.00^{a}	1037.50^{ab}	1414.41^{ab}	1785.00^{a}
T3	38.83	169.50^{a}	375.58^{ab}	629.58^{ab}	1068.75^{bc}	1444.08^{b}	1862.83^{b}
T4	38.41	169.58^{a}	376.75^{ab}	646.66^{b}	1057.33^{abc}	1436.75^{b}	1876.83^{b}
T5	39.00	170.08^{a}	377.66^{b}	634.16^{ab}	1070.16^{c}	1428.16^{ab}	2047.00^{c}
T6	38.91	179.08^{a}	386.91^{c}	705.08^{c}	1142.58^{d}	1542.66^{c}	2172.41^{d}
SEM	0.67	1.48	1.77	4.28	7.86	9.30	11.48
P- Value	0.98	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

T1, feed with Basel diet; T2, feed with garlic 0.5%; T3, feed with 1% garlic; T4, feed with 1% moringa; T5, feed with 2% moringa; T6, feed with (1%+2%) garlic + moringa.
SEM, Standard error mean

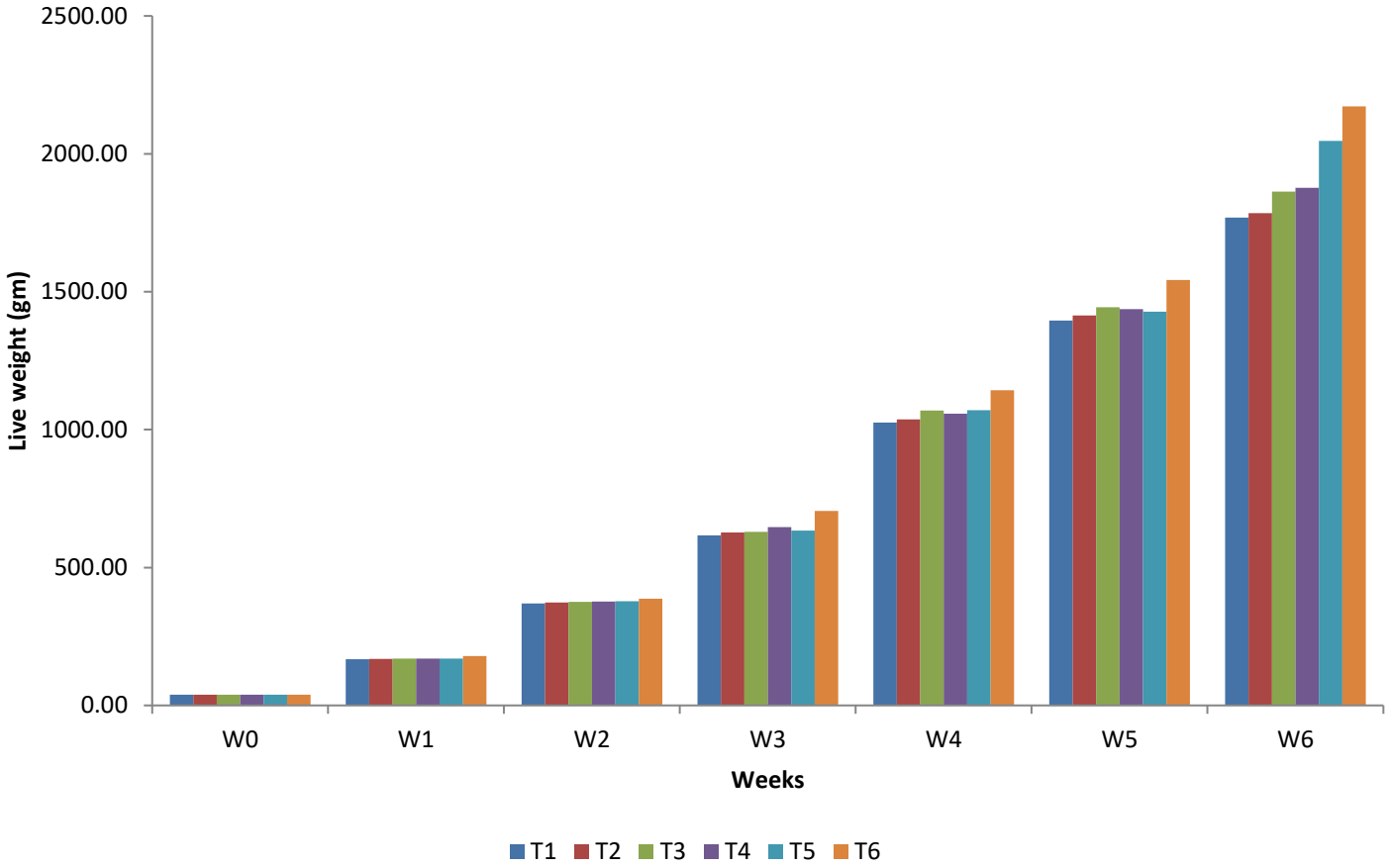

Fig4.1.The effects of feeding different levels of garlic and moringa on average body weight (gm) of broiler chicks

4.1.2 Body weight gain

The impact of garlic and moringa on body weight gain has been given in Table 4.2. The body weight gain was significantly higher (P<0.05) in the treatment group T6 which was enhanced with garlic and moringa (1%+2%) when contrasted with control groups during 6 weeks. However, there was additionally better growth compared to control for treatment groups T3, T4 and T5 enhanced with garlic (1%), moringa (1%), and moringa (2%) for treatment groups fed separately in every one of the gatherings.

Table: 4.2 Effect of garlic and moringa on body weight gain of Broiler chickens

Treatment	W0	W1	W2	W3	W4	W5
T1	128.83^{a}	201.83	247.33^{ab}	408.16	369.83	374.08^{a}
T2	130.00^{a}	204.08	254.25^{ab}	410.50	376.91	370.58^{a}
T3	130.66^{a}	206.08	254.00^{ab}	439.16	375.33	418.75^{ab}
T4	131.16^{a}	207.16	269.91^{b}	410.66	379.41	440.08^{b}
T5	131.08^{a}	207.58	256.50^{ab}	436.00	358.00	618.83^{c}
T6	140.16^{b}	207.83	318.16^{c}	437.50	400.08	629.75^{c}
SEM	1.58	2.35	4.62	9.43	12.00	15.45
P-Value	<0.01	0.43	<0.01	0.32	0.24	<0.01

Body weight in gram
T1, feed with Basel diet; T2, feed with garlic 0.5%; T3, feed with 1% garlic; T4, feed with 1% moringa; T5, feed with 2% moringa; T6, feed with (1%+2%) garlic + moringa.
SEM, Standard error mean

4.1.3 Feed consumption

The impact of garlic and moringa on feed utilization has been given in Table 4.3. The utilization of feed was higher in the control group T1 compared to treatment groups T2, T3. T4. T5 and T6. The analysis of variance for mean total feed consumption of broiler chicks for week 3-6 for the different groups was statistically significant (P<0.01).

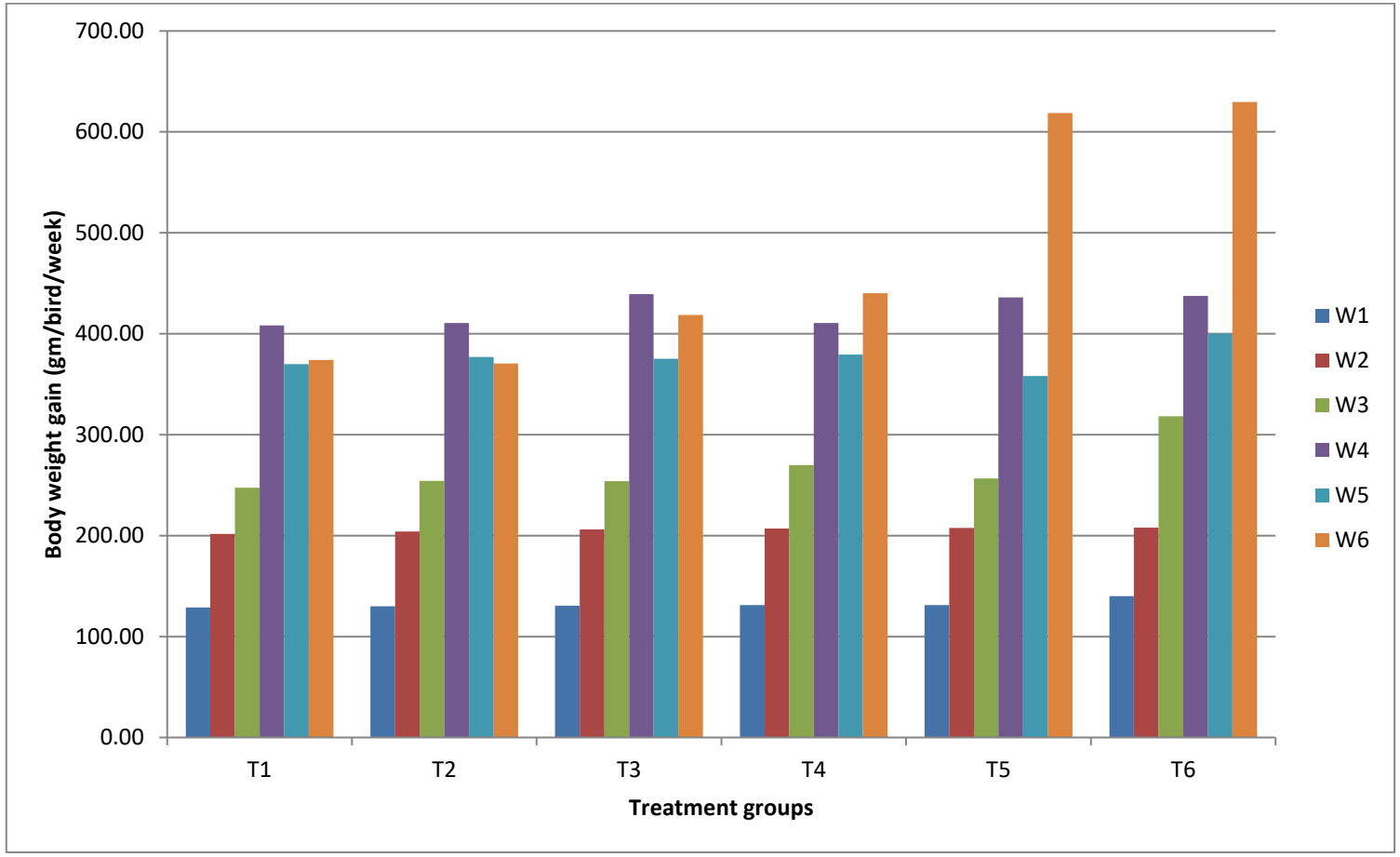

Fig 4.2.The effects of feeding different levels of garlic and moringa on average body weight gain of broiler chicks

Table: 4.3 Effect of garlic and moringa supplemented on feed consumption of broiler

Treatments	W0	W1	W2	W3	W4	W5
T1	182.33	319.41	421.16^{b}	714.33^{c}	922.00^{d}	998.00^{b}
T2	185.25	320.66	419.08^{b}	697.66^{bc}	869.41^{c}	983.41^{b}
T3	187.50	322.33	417.33^{b}	681.00^{b}	788.00^{b}	952.83^{a}
T4	186.33	321.91	417.83^{b}	646.50^{a}	785.41^{b}	947.16^{a}
T5	185.33	318.66	420.58^{b}	647.16^{a}	763.41a^{b}	949.08^{a}
T6	185.66	321.66	399.33^{a}	632.25^{a}	730.00^{a}	931.16^{a}
SEM	1.76	2.52	2.14	7.80	11.16	5.49
P-Value	0.42	0.88	<0.01	<0.01	<0.01	<0.01

T1, feed with Basel diet; T2, feed with garlic 0.5%; T3, feed with 1% garlic; T4, feed with 1% moringa; T5, feed with 2% moringa; T6, feed with (1%+2%) garlic + moringa.
SEM, Standard error mean

4.1.4 Feed conversion ratio (FCR)

The impact of garlic and moringa on the feed conversion ratio of the birds have been presented in Table 4.4. The birds fed on garlic and moringa supplemented diet showed significantly improved (P<0.05) feed transformation potential compared to other treatments. The FCR was compared among the gatherings and revealed higher value of FCR in control groups fed without supplementation.

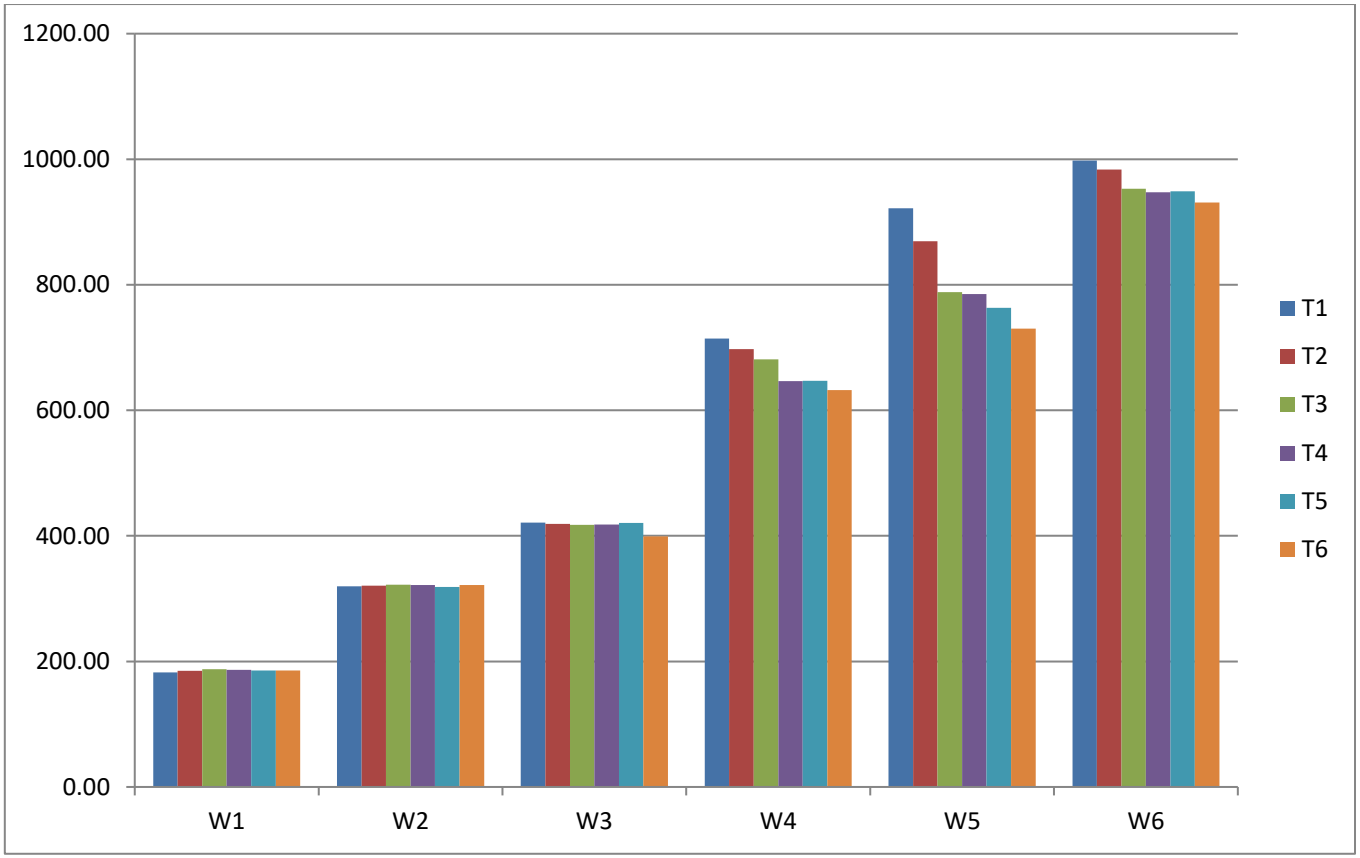

Fig 4.3. The effects of feeding different levels of garlic and moringa on average feed consumption (grams/bird/weeks) of broiler chick.

Table: 4.4 Effect of garlic and moringa supplemented on Feed Conversion Ratio in Broiler chickens

	Weeks					
Treatments	W0	W1	W2	W3	W4	W5
T1	1.41^{b}	1.58^{a}	1.70^{c}	1.75^{c}	2.50^{c}	2.69^{c}
T2	1.42^{b}	1.57^{a}	1.65^{bc}	1.70^{bc}	2.32^{bc}	2.67^{c}
T3	1.43^{b}	1.56^{a}	1.65^{bc}	1.56^{ab}	2.13^{ab}	2.29^{b}
T4	1.42^{b}	1.55^{a}	1.55^{b}	1.59^{abc}	2.10^{ab}	2.29^{b}
T5	1.42^{b}	1.53^{a}	1.64^{bc}	1.49^{a}	2.17^{abc}	2.18^{a}
T6	1.32^{a}	1.54^{a}	1.25^{a}	1.44^{a}	1.84^{a}	1.48^{a}
SEM	0.21	0.23	0.03	0.04	0.8	0.07
P-Value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

T1, feed with Basel diet; T2, feed with garlic 0.5%; T3, feed with 1% garlic; T4, feed with 1% moringa; T5, feed with 2% moringa; T6, feed with (1%+2%) garlic + moringa.
SEM, Standard error mean

4.1.5 Effect of supplementing different levels of garlic (*Allium sativum*) and moringa (*Moringa oleifera*) leaves on feed conversion ratio (FCR) of broiler chickens during the 6th weeks

The feed conversion ratio chickens during at the different periods of growth for all the six groups has given in Table 4.1.6 FCR was found higher in finisher phase in comparison to the starter phase which means feed efficiency decreased with increasing time period. The starter FCR of control to T6 were recorded to 1.59, 1.57, 1.57,1.52,1.55 and 1.36 respectively whereas finisher FCR were apperceived to be 2.28, 2.20, 1.96, 1.93,1.67 and 1.56. also, respectively and total FCR were observed to 2.05, 1.99, 1.83, 1.79, 1.63 and 1.50 respectively. The total FCR for all the treatment groups was found to be significantly different from each other.

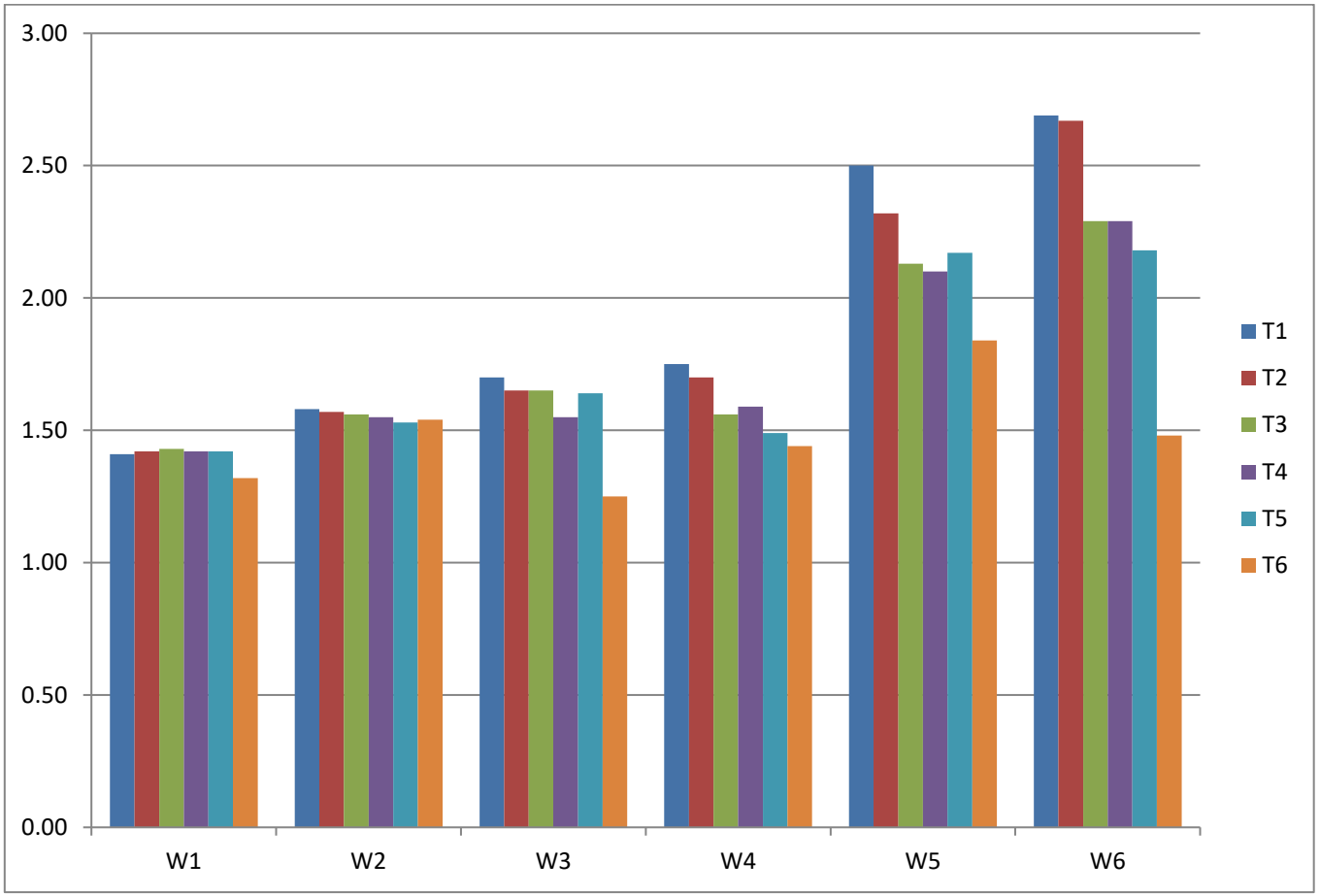

Fig4.4. The effects of feeding different levels of garlic and moringa on weekly Feed Conversion Ratio of broiler chicks

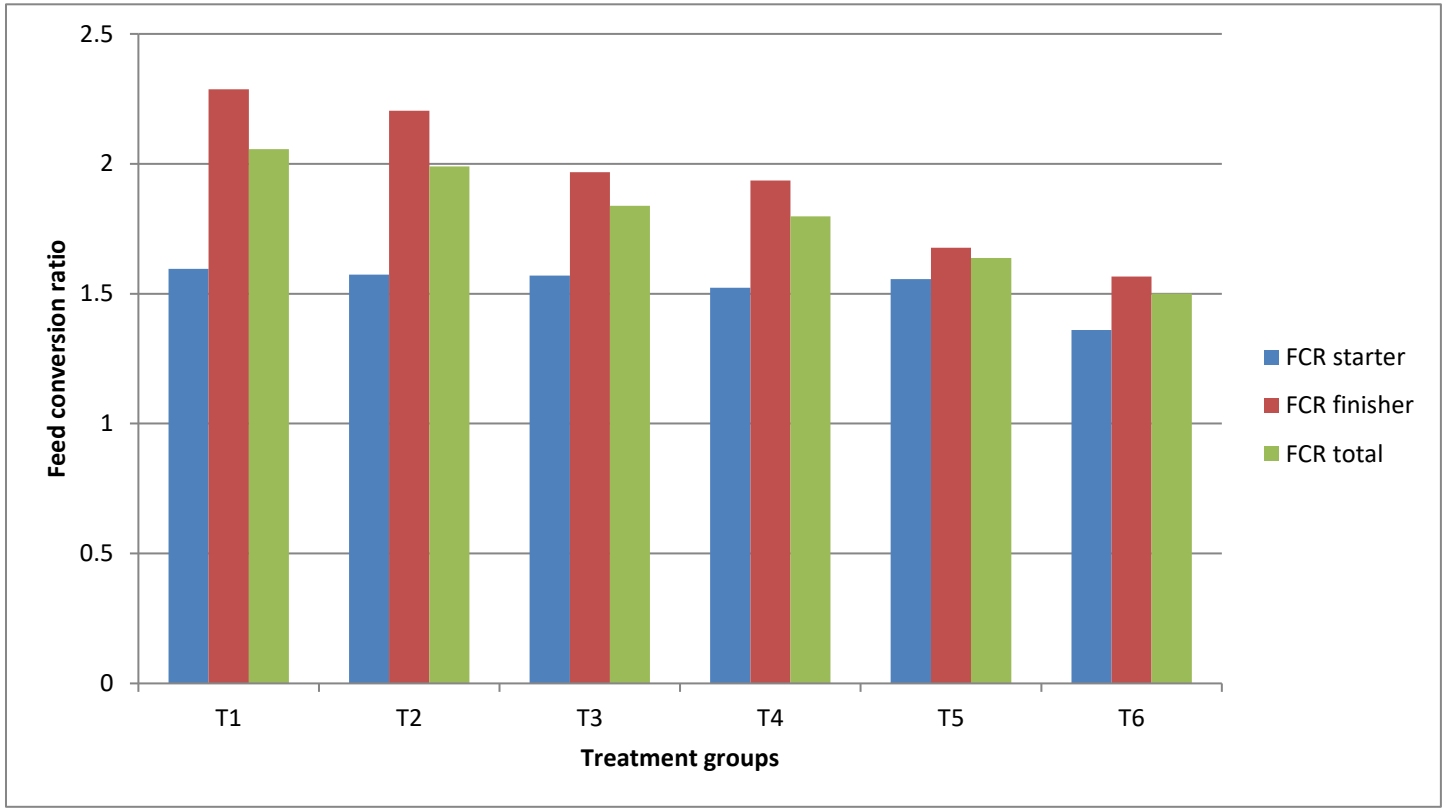

Fig 4.5 Average feed conversion ratio on starter & finisher of broiler chickens fed diet supplemented with garlic and moringa in basal diet of broiler chicks.

Table 4.5: Effect of supplementing different levels of garlic (*Allium sativum*) and moringa (*Moringa oleifera*) leaves on feed conversion ratio (FCR) of broiler chickens during of the 6th weeks

Treatment	FCR starter	FCR finisher	FCR total
T1	1.596^{c}	2.287^{d}	2.056^{e}
T2	1.574^{bc}	2.204^{d}	1.990^{d}
T3	1.570^{bc}	1.968^{c}	1.838^{c}
T4	1.523^{b}	1.936^{c}	1.798^{c}
T5	1.556^{bc}	1.677^{b}	1.638^{b}
T6	1.360^{a}	1.566^{a}	1.501^{a}
SEM	0.01	0.02	0.01
P- value	**<0.01**	**<0.01**	**<0.01**

Means bearing different superscript in a column differ significantly ($p<0.05$)

4.2 Effect of garlic and moringa supplementation on carcass characteristics

The impact of various degrees of moringa and garlic supplementation on carcass characteristics in broiler chickens has been presented in table 4.6. Pre fasting weight and post fasting weight in Control bunch (T1), 0.5 g/kg garlic supplemented gathering (T2), 1 g/kg garlic supplemented gathering (T3), 1 g/kg moringa supplemented gathering (T4), 2 g/kg moringa supplementation gatherings (T5) and (1+2) g/kg of (moringa+garlic) supplementation bunch (T6) were found be 1767.00, 1781.66, 1847.33, 1883.00, 1973.66, 2171.33 kg. Shrinkage (%) didn't differ among the treatment gatherings. Dressing (%) was seen to be 71.50, 72.74, 70.97, 73.58, 73.81 and 69.58 separately in T1, T2, T3, T4, T5 and T6. Pre fasting weight, post fasting weight were statistically significant ($P<0.01$) across all the treatment gatherings. Dressing yield, eviscerated yield and prepared to cook yield were also statistically significant ($P<0.01$) among the treatment bunch.

4.2.1 Cut-up parts

The impact of various levels moringa and garlic supplementation on cut-up pieces of broiler chickens has been introduced in Table 4.7. The accompanying boundaries for example thigh, drum stick, bosom, back, neck and wing (%) were noticed. Thigh (%) and drum stick (%) in charge (T1), 0.5 g/kg garlic enhanced gathering (T2), 1 g/kg g/kg garlic enhanced gathering (T3), 1 g/kg moringa enhanced gathering (T4), 2 g/kg moringa supplementation bunch (T5) and (1+2) g/kg of (moringa+garlic) supplementation bunch (T6) were discovered to be 14.97, 18.66, 16.46, 16.46, 16.29, 14.96 and 13.89 and 16.75, 16.59, 16.59, 14.85, 16.92 and 13.72 % individually. The impact of moringa and garlic is to increment fundamentally yet in T6 treatment bunch in lower among the other different gatherings. Bosom (%) was seen to be 19.20, 22.24, 25.77, 22.96, 24.55 and 18.92 % separately in T1, T2, T3, T4, T5 and T6 gatherings, it is likewise same occurred in the bosom rate it essentially decline in the T6 treatment bunch. Back (%) and Neck (%) changed from 26.12, 25.02, 27.50, 22.29, 28.83 and 27.46 % and 7.49, 6.45, 4.50, 4.26, 5.54 and 4.83 between exploratory gatherings. Wing (%) in T1, T2, T3, T4, T5 and T6 were recorded as 7.02, 11.91, 10.47, 8.96, 11.26 and 8.45%, separately. The whole cut-up parts (%) aside from back (%) were seen to be ($P<0.05$) fundamentally unique across the treatment gatherings.

Table: 4.6: Effect of garlic and moringa supplemented on carcass characteristics in broiler chickens

Parameter	T1	T2	T3	T4	T5	T6	SEM	P-Value
Prefasting wt	1767.00^{a}	1781.66^{ab}	1847.33^{ab}	1883.00^{bc}	1973.66^{c}	2171.33^{c}	24.14	<0.01
Post fasting wt	1659.33^{a}	1668.66^{ab}	1726.66^{ab}	1771.33^{bc}	1845.00^{c}	2027.00^{c}	23.09	<0.01
Shrinkage (%)	6.08	6.34	6.52	5.92	6.52	6.64	0.18	0.10
Dressing yield	1186.66^{a}	1214.00^{a}	1224.66^{ab}	1301.33^{bc}	1361.33^{cd}	1410.33^{c}	16.28	<0.01
Dressing yield (%)	71.50	72.74	70.97	73.58	73.81	69.58	1.03	0.08
Eviscerated yield	877.75^{a}	974.66^{ab}	980.21^{ab}	991.51^{b}	1029.11^{b}	990.18^{b}	21.67	<0.01
Eviscerated yield (%)	52.87^{ab}	58.41^{c}	56.81^{bc}	55.97^{bc}	55.18^{bc}	48.86^{a}	1.37	<0.01
Ready to cook yield (%)	60.79^{a}	66.763^{bc}	70.58^{c}	71.72^{c}	70.61^{c}	64.41^{ab}	1.06	<0.01

T1, feed with Basel diet; T2, feed with garlic 0.5%; T3, feed with 1% garlic; T4, feed with 1% moringa; T5, feed with 2% moringa; T6, feed with (1%+2%) garlic + moringa.

Table: 4.7: Cut-up parts of broiler chickens at 6 week of age fed a diet supplementation of moringa and garlic

Parameters	T1	T2	T3	T4	T5	T6	SEM	P-value
Thigh (gm)	142.68[a]	182.88[b]	163.77[ab]	162.69ab	152.65[ab]	137.02[a]	7.69	<0.01
Thigh (%)	14.97[ab]	18.66[b]	16.46[ab]	16.29ab	14.96[b]	13.89[a]	0.78	<0.01
Drum stick (gm)	161.07	164.80	161.33	144.30	167.30	127.54	13.81	0.34
Drum stick (%)	16.75	16.59	16.59	14.85	16.92	13.72	1.32	0.47
Breast (gm)	180.94[a]	218.86[a]	256.71[a]	222.25a	250.14[a]	186.80[a]	1.47	0.04
Breast (%)	19.20[a]	22.24[a]	25.77[a]	22.69a	24.55[a]	18.92[a]	1.69	0.07
Back (gm)	264.48	250.64	276.99	219.24	281.83	257.33	15.73	0.14
Back (%)	26.12[a]	25.02[a]	27.50[a]	22.29a	28.83[a]	27.46[a]	28.25	0.44
Neck (gm)	63.59	64.67	43.98	56.47	61.58	52.30	5.72	0.16
Neck (%)	7.49	6.45	4.50	4.26	5.54	4.83	0.86	0.13
Wing (gm)	74.67[a]	122.01[c]	107.97[c]	91.74abc	119.54[c]	82.20[ab]	6.84	<0.01
Wing (%)	7.02[a]	11.91[c]	10.47[c]	8.96abc	11.26[bc]	8.45[ab]	0.69	<0.01

T1, feed with Basel diet; T2, feed with garlic 0.5%; T3, feed with 1% garlic; T4, feed with 1% moringa; T5, feed with 2% moringa; T6, feed with (1%+2%) garlic + moringa.
SEM, Standard error mean

4.3 Development of giblets and spleen

The impact of various degrees of moringa and garlic supplementation on the advancement of giblets (heart, liver and gizzard) and spleen were noticed and recorded on table 4.8. The heart (%) and liver (%) varied from 0.43 to 0.45 and 1.84 to 1.55 between gatherings. The gizzard (%) and spleen (%) in Control group (T1), 0.5 g/kg garlic enhanced gathering (T2), 1 g/kg g/kg garlic enhanced gathering (T3), 1 g/kg moringa enhanced gathering (T4), 2 g/kg moringa supplemented group (T5) and (1+2) g/kg of (moringa+garlic) supplemented group (T6) were observed as 1.79, 1.47, 1.52, 1.64, 1.46 and 1.62 % and 0.13, 0.13, 0.14, 0.11, 0.14 and 0.12 separately. The giblets and spleen (%) in 1 g/kg garlic enhanced gathering (T3) and 1 g/kg moringa enhanced gathering (T4) were similar in all treatments compared to control group.

Table: 4.8 Development of giblets and spleen of broiler chicken at 6 weeks of age fed a diet supplementation with moringa and garlic

Parameters	T1	T2	T3	T4	T5	T6	SEM	P-value
Heart (gm)	7.25a	8.83a	8.13a	8.48a	8.74a	7.75a	0.72	0.62
Heart (%)	0.43a	0.54a	0.48a	0.48a	0.45a	0.45a	0.04	0.52
Liver (gm)	30.22a	34.89a	29.63a	29.85a	29.85a	26.63a	1.78	0.11
Liver (%)	1.84ab	2.08b	1.68ab	1.58ab	1.56ab	1.55a	0.11	0.03
Gizzard (gm)	29.47a	24.68a	26.86a	30.81a	27.87a	27.98a	2.50	0.62
Gizzard (%)	1.79a	1.47a	1.52a	1.64a	1.46a	1.62a	0.15	0.68
Spleen (gm)	2.24a	2.27a	2.54a	2.19a	2.78a	2.22a	0.27	0.59
Spleen (%)	0.13a	0.13a	0.14a	0.11a	0.14a	0.12a	0.01	0.81

T1, feed with Basel diet; T2, feed with garlic 0.5%; T3, feed with 1% garlic; T4, feed with 1% moringa; T5, feed with 2% moringa; T6, feed with (1%+2%) garlic + moringa.

4.3.1 Development of the digestive organs

The impacts of moringa and garlic supplementation on the stomach related organs of chicks are introduced in Table 4.9. The organ development for example proventricular weight (%), normal caecal length (cm/100g), caecal length.(%), spleen weight (%) small digestive tract weight (%), small digestive tract length (cm/100g), internal organ weight (%) and internal organ length (cm/100g) were noticed. Proventricular weight (%) in control bunch (T1), 0.5 g/kg garlic enhanced gathering (T2), 1 g/kg garlic enhanced gathering (T3), 1 g/kg moringa enhanced gathering (T4), 2 g/kg moringa supplementation bunch (T5) and (1+2) g/kg of (moringa+garlic) supplementation bunch (T6) were observed to be 0.43, 0.42, 0.36, 0.41, 0.34 and 0.34 %, separately.

Caecal length1 and caecal length2 (cm/100g) measured from 12.73 to 9.98 % and 11.83 to 9.66 % between treatments. Small digestive tract weight (%) and small digestive system length (%) (cm/100g) were recorded as 3.46, 2.34, 1.77, 3.17 2.90 and 2.35 % and 6.91, 6.59, 6.34, 6.38, 5.97 and 5.84 %, separately. Internal organ weight (%) & large digestive tract length (%) (cm/100g) in T1, T2, T3, T4, T5 and T6 were measured to be 0.15, 0.48, 0.12, 0.13, 0.16 and 0.16 and 0.40, 0.36, 0.34, 0.25, 0.40 and 0.24 individually.

Digestive organ weight (%) & digestive system length of large intestine (%) (cm/100g) in T1, T2, T3, T4, T5 and T6 were measured as 0.15, 0.48, 0.12, 0.13, 0.16 and 0.16 and 0.40, 0.36, 0.34, 0.25, 0.40 and 0.24 separately.

Table: 4.9 Development of the digestive organs of broiler chickens at 6 weeks of age fed dietary supplementation of moringa and garlic

Parameters	T1	T2	T3	T4	T5	T6	SEM	P-value
Proventricular (gm)	7.27a	7.12a	6.33a	7.69a	7.69a	6.56a	0.43	0.25
Proventricular (%)	0.43b	0.42ab	0.36ab	0.41ab	0.34a	0.34ab	0.02	<0.01
Small Intestine (gm)	58.66b	58.00a	39.33a	63.33b	62.66b	45.33ab	4.02	<0.01
Small Intestine (cm)	118.00a	113.33a	111.66a	122.00a	117.66a	105.66a	4.90	0.30
Small Intestine (gm %)	3.46a	2.34a	1.77a	3.17a	2.90a	2.35a	0.38	0.08
Small Intestine (cm %)	6.91a	6.59a	6.34a	6.38a	5.97a	5.84a	0.33	0.27
Large Intestine (gm)	2.56a	2.35a	2.11a	2.12a	2.93a	2.26a	0.33	0.52
Large Intestine (cm)	6.50a	5.93a	5.62a	4.79a	7.22a	5.23a	1.43	0.85
Large Intestine (gm %)	0.15a	0.48a	0.12a	0.13a	0.16a	0.16a	0.13	0.45
Large Intestine (cm %)	0.40a	0.36a	0.34a	0.25a	0.40a	0.24a	0.07	0.50
Ceacal L1	12.73a	9.75a	10.63a	11.76a	11.16a	9.98a	0.78	0.14
Ceacal L2	11.83a	9.33a	10.08a	25a	10.33a	9.66a	0.62	0.10

4.4 Effect of garlic and moringa leaves on blood biochemical parameters of broilers

The effect of supplementation of basal diet with different levels of garlic (Allium sativum) and moringa (Moringa oleifera) leaves on some blood biochemical parameters viz. Total protein, Uric acid, ALP, SGOT, SGPT and Cholesterol of the treatment groups were measured at 6 weeks of age in 3 representative broiler chickens from each treatment group are presented in Table 4.10. The cholesterol concentration in T1, T2, T3, T4, T5 and T6 groups were 195.87, 192.09, 178.52, 188.82, 173.63 and 166.62 mg/dl, respectively; the total protein was 2.89, 3.18, 3.48, 3.56, 3.24 and 3.96 (g/dl), respectively; uric acid concentration was 9.84, 10.71, 10.96, 10.60, 10.53 and 11.14 (mg/dl), respectively. Plasma alkaline phosphatase (ALP) was 258.73, 260.61, 266.08, 259.48, 256.59, and 258.37 (IU/L), respectively., Plasma glutamate Pyruvate Transaminase (SGPT) concentration was 48.41, 53.84, 54.95, 55.52, 54.78, and 54.87, Plasma glutamate Oxaloacetate Transaminase (SGOT) Concentration was 154.95, 136.22, 146.13, 148.46, 144.07, and 154.50, respectively. All blood biochemical parameters in garlic (Allium sativum) and moringa (Moringa oleifera) supplemented groups were found similar between different treatment and control groups.

Table: 4.10 Effect of garlic and moringa on Blood Biochemical in broilers chicken

Treatments	Cholesterol (mg/dl)	Protein (g/dl)	Uric acid (mg/dl)	ALP (IU/L)	SGPT (IU/L)	SGOT (IU/L)
T1	195.87^{c}	2.89	9.84	258.73	48.41	154.95
T2	192.09^{bc}	3.18	10.71	260.61	53.84	136.22
T3	178.52^{abc}	3.48	10.96	266.08	54.95	146.13
T4	188.82^{bc}	3.56	10.60	259.48	55.52	148.46
T5	173.63^{ab}	3.24	10.53	256.59	54.78	144.07
T6	166.62^{a}	3.96	11.14	258.37	54.87	154.50
SEM	6.34	0.29	0.32	1.99	2.41	6.14
P value	0.09	0.23	0.15	0.07	0.36	0.32

Means bearing different superscript in a column differ significantly (P<0.05)

Chapter-5 DISCUSSION

5.1 Effect of Garlic and Moringa on the performance of broiler chickens

The Weekly Body Weight (WBW), Body weight gain (BWG), Feed Consumption (FC), Feed change Ratio (FCR), were studied at different levels of supplementation of garlic and moringa leaves in basal diet. The comparative outcomes acquired for these treatments showed that incorporation of garlic and moringa in birds affected the utilization of feed in birds but had no unfavorable impact on the weight gain and FCR of the test birds. In line with our data, **Nkukwana *et al* (2014)** and **Mousa *et al.* (2017)** reported beneficial effects of feeding Moringa oleifera leaf to improve the growth performance of broilers. **Divya *et al* (2014)** studied the effect of feeding Moringa oleifera leaf powder (at the levels of 0.5, 1.0, 1.5 and 2.0% in basal diet) and found no change in BW gain and FCR in broilers as compared to control groups. In another study, **Khan *et al.* (2017)** reported dietary supplementation of Moringa oleifera leaf powder causes increased body weight gain of broilers, however, the treatment did not change feed consumption and FCR of broilers at marketable age. The levels of supplementation included in the basal diet was 0.6, 0.9, 1.2 and 1.5%, among which it was found that *Moringa oleifera* leaf powder at the level of 1.2% only showed increase in the body weight gain, whereas the other levels did not exert any effect. The results of present study also suggested similar trend for Moringa supplementation in broiler birds. From the above mentioned studies, it may therefore be suggested that the use of *Moringa oleifera* leaf powder in broilers have less consistent growth promoting effect.

With regard to garlic supplementation, there was significant reduction in feed intake, with improvement in body wight gain and FCR of broilers in the present study. Similar results were reported in studies by **Karangiya *et al* (2016)** who found that feeding 1% garlic powder increased final BW of broilers. In contrary with our finding, **Toghyani *et al* (2011)**

did not observe any effect of garlic powder (included at the levels of 2 and 4% in the diets) on final BW, feed intake and FCR of broilers. Likewise, **Milošević *et al*. (2013)** reported feeding 1.5% and 3% garlic powder had no effect on final live weight, feed consumption and FCR of broiler chickens in their study. The difference in result may be due to type of bird, managemental conditions and feeding frequencies. In the present study, the combination of Moringa oleifera leaf powder and garlic had substantially effect on the BW gain and FCR, though decreased feed intake of broilers. In this respect, there was synergistic effect of both phytobiotic compounds (garlic and moringa) which helped in improving the growth performance of broilers.

5.2 Effect of Garlic and Moringa on the carcass characteristics of broiler chickens

The effects of dietary treatments on carcass characteristics at 6 weeks broiler showed that supplementation of garlic (05-1%) and MOLM (1-2%) to broiler diets had significant effects on carcass weights and dressing yield (%) percentage of birds. However, the relative weights of the heart, liver, gizzard, and spleen did not differ significantly (P>0.01). The results were in agreements with those of **Raeesi *et al*. (2010)** and **El-Tazi (2014)** who reported increased mean values of hot and cold eviscerated carcass weight, dressing percentage and meat quality in birds fed garlic and Moringa oleifera leaf meal-supplemented diets compared with those of the control diets. In a similar study, **Ademola *et al*. (2004)** found significant (P<0.05) differences in weights of cut up parts such as wing, thighs and drumstick among different treatment groups supplemented with 0.5, 1.0 and 1.5% of garlic powder in experimental groups T0, T1, T2 and T3, respectively. **Raeesi *et al*. (2010)** also found significant (P<0.05) differences in per cent yield of thigh and breast among the control and garlic treated groups. In contrary, **Borgohain *et al.* (2019).** reported that the per cent yield of cut-up parts like neck, wing, back, breast, thigh and drumstick did not differ significantly (P>0.05) among different treatment groups (Table 5). Similar observations were

also reported by **Amouzmehr *et al*. (2013)** and **Milosevic *et al*. (2013)** who found no significant differences in the per cent yield of drumstick, breast and thigh among the control and garlic fed treated groups.

Karthivashan *et al*. (2015) reported that supplementation of 0, 0.5, 1.0 and 1.5% of Moringa oleifera leaf meal extracts in broiler feeds yielded significantly increased dressing percentage compared with the control diets, whereas, 1.0% *Moringa oleifera* leaf meal exhibited the highest dressing percentage among the treatments. The result of the internal organs (gizzard, heart and liver) and carcass cuts (breast, thigh, back, wing and neck) in the present study were consistent with the findings of **Onunkwo and George (2015)** who reported that utilization of Moringa oleifera leaf meal in broilers diets does not influence the organ proportion of poultry bird. Similar results were also reported by **Alabi *et al.* (2017)** who studied the effect of Moringa oleifera leaf extracts in broiler chicken and did not observe significant differences in the weights of the breast meat, thighs, wings and drumsticks among the treatments. Contrary to the present findings, **Ologhobo *et al.* (2014)** reported that supplementaion of Moringa oleifera leaf meal to the diets of broiler chickens had no significant effect on the carcass qualities of the birds. **Ayssiwede *et al.* (2011)** reported that inclusion of moringa leaf meal had no significant effect on the dressing percentage of indigenous chicken. **Nkukwana *et al.* (2014)** found that addition of MOLM (0.1-2.5%) to broiler diets have no significant effects on carcass weight, dressing percentage and the relative weights of the liver, gizzard, heart and spleen. **Nuhu (2010)** reported that no significant differences among treatments in carcass characteristics of weaned rabbits fed MOLM.

5.3 Effect of garlic and moringa of blood biochemical parameters in broiler chicken

The effect of supplementation of basal diet with different levels of garlic (Allium sativum) and moringa (Moringa oleifera) leaves on some blood biochemical parameters viz.

cholesterol, total protein, uric acid, ALP, SGOT and SGPT of the treatment groups were measured at 6 weeks of age in 3 representative broiler chickens from each treatment group. There was least variability in the serum biochemical values except cholesterol concentration after garlic and Moringa oleifera consumption in broiler chickens. The consumption of increasing amounts of garlic and M. oleifera leaf powder did influence cholesterol values ($P<0.05$) in treatment group compared to control groups. These results agree with those of several authors who, incorporating leaves of other plants such as moringa, garlic and neem (Azadirachta indica) in broilers and rabbit's feed observed their hypocholesterolemic effects. They attributed these effects to the presence of several compounds such as polyphenols in these phytobiotics. A significant decrease in serum total cholesterol compared to the control was noted following the consumption of Moringa leaf powder. This can be explained on one hand by the presence in M. oleifera leaves of phytochemical compounds such as alkaloids and saponins which have anticholesterolemic activities and on the other hand by its high content of fibres which bind to cholesterol and prevent its intestinal absorption resulting in a decrease in the levels of total cholesterol and LDL cholesterol. Indeed, insoluble fibres have the ability to bind to bile acids reducing the absorption of fats and cholesterol. Similar results were obtained by **Abdel-Azeem, Mohamed, El-Shiekh & Hessin (2017)** who showed that the cholesterol and LDL cholesterol levels decreased following consumption of Moringa leaf powder. The total protein concentration did not vary between the treatment and control groups. The results were in agreement to **Djouhou *et al.* (2020)** who showed least variation in protein in broiler birds fed with the four types of grower diet formulated as F0 (Moringa 0%), F1 (Moringa 2%), F2 (Moringa 4%) and F3 (Moringa 8%).

Feeding rations containing Moringa leaf powder had no negative effect on liver function as all values were within the normal range established by **Harr (2002).** Between the groups there was no significant differences in the values of transaminase (ALT and AST)

levels. This may be suggested that feeding of garlic and moringa leaves either individually or in combination had no deterioration of liver function in birds.

The uric acid concentration in blood was similar for control group serum and treatment group chickens fed with garlic and M. oleifera leaf powder, the values indicating normal kidney function. Urea or uric acid is a nitrogenous waste product of protein degradation in the liver, filtered by the kidneys. Elevated blood urea levels may indicate renal impairment or protein hyper catabolism. The uric acid values in this study are within the normal range of 4.80 to 19.80 mg/dL reported by **Kaneko, Harvey & Bruss (1997)** for birds.

Chapter-6 SUMMARY AND CONCLUSION

The present investigation, "Feeding effect of garlic (*Allium sativum*) and moringa (*Moringa oleifera*) leaves on growth and biochemical parameters in broilers" was carried out. For the current investigation, 180 days old broiler were chosen for 6 weeks. Trial were impeded into 6 treatment each has 30 birds on body weight. Treatment 1 was carried as control and took care of with Basal diet. Treatment 2 was supplementation of basal diet with garlic @ 0.5%. Treatment 3 was supplementation of basal diet with garlic @ 1%. Treatment 4 was supplementation of basal diet with moringa @ 1%. Treatment 5 was supplementation of basal diet with moringa @ 2%. Treatment 6 was supplementation of basal diet with garlic+moringa @ 1%+2% for 6 weeks duation. For blood biochemical blood tests, samples were collected at the end of trial from jugular vein cut aseptically. Blood tests (1.5 ml) were gathered in clean test-tube from jugular vein cut, presenting least aggravation to birds. Ethylene diamine tetra acetic acid derivation (EDTA) was utilized as anticoagulant. Tests were brought to the research facility in chilled coolers and centrifuged at 3000 rpm for 30 minutes to isolate the plasma from pressed cells and were put away at - 20°C fill further examination of blood biochemical boundary. The results are summarized as under:

1. The body weight was altogether most elevated ($P<0.05$) in the treatment of T6 which was enhanced with garlic and moringa (1%+2%) when contrasted with control groups during 6 weeks. However, there was additionally better growth compared to control for treatment groups T3, T4 and T5 enhanced with garlic (1%), moringa (1%), and moringa (2%) for treatment groups fed separately in every one of the gatherings. The body weight gain was significantly higher ($P<0.05$) in the treatment group T6 which was enhanced with garlic and moringa (1%+2%) when contrasted with control groups during 6 weeks.

2. The utilization of feed was higher in the control group T1 compared to treatment groups T2, T3. T4. T5 and T6. The analysis of variance for mean total feed consumption of broiler chicks for week 3-6 for the different groups was statistically significant ($P<0.01$). The birds fed on garlic and moringa supplemented diet showed significantly improved ($P<0.05$) feed transformation potential compared to other treatments. The FCR was compared among the gatherings and revealed higher value of FCR in control groups fed without supplementation.

3. FCR was found higher in finisher phase in comparison to the starter phase which means feed efficiency decreased with increasing time period. The starter FCR of control to T6 were recorded to 1.59, 1.57, 1.57,1.52,1.55 and 1.36 respectively whereas finisher FCR were apperceived to be 2.28, 2.20, 1.96, 1.93,1.67 and 1.56. also, respectively and total FCR were observed to 2.05, 1.99, 1.83, 1.79, 1.63 and 1.50 respectively. The total FCR for all the treatment groups was found to be significantly different from each other.
4. The impact of various degrees of moringa and garlic supplementation on carcass characteristics in broiler chickens showed that pre fasting weight and post fasting weight in control bunch (T1), 0.5 g/kg garlic supplemented gathering (T2), 1 g/kg garlic supplemented gathering (T3), 1 g/kg moringa supplemented gathering (T4), 2 g/kg moringa supplementation gatherings (T5) and (1+2) g/kg of (moringa+garlic) supplementation bunch (T6) were found be 1767.00, 1781.66, 1847.33, 1883.00, 1973.66, 2171.33 kg. Shrinkage (%) didn't differ among the treatment gatherings. Dressing (%) was seen to be 71.50, 72.74, 70.97, 73.58, 73.81 and 69.58 separately in T1, T2, T3, T4, T5 and T6. Pre fasting weight, post fasting weight were statistically significant ($P<0.01$) across all the treatment gatherings. Dressing yield, eviscerated yield

and prepared to cook yield were also statistically significant (P<0.01) among the treatment bunch.

5. The heart (%) and liver (%) varied from 0.43 to 0.45 and 1.84 to 1.55 between different treatment groups. The gizzard (%) and spleen (%) in control group (T1), 0.5 g/kg garlic enhanced gathering (T2), 1 g/kg g/kg garlic enhanced gathering (T3), 1 g/kg moringa enhanced gathering (T4), 2 g/kg moringa supplemented group (T5) and (1+2) g/kg of (moringa+garlic) supplemented group (T6) were observed as 1.79, 1.47, 1.52, 1.64, 1.46 and 1.62 % and 0.13, 0.13, 0.14, 0.11, 0.14 and 0.12 separately. The giblets and spleen (%) in 1 g/kg garlic enhanced gathering (T3) and 1 g/kg moringa enhanced gathering (T4) were similar in all treatments compared to control group.
6. The cholesterol concentration in T1, T2, T3, T4, T5 and T6 groups were 187.59, 178.12, 183.54, 177.75, 183.44, 185.10 mg/dl, respectively; the total protein was 3.65, 3.83, 2.97, 3.58, 2.91 and 3.35 (g/dl), respectively; uric acid concentration was 9.27, 10.59, 9.85, 10.96, 9.39 and 10.70 (mg/dl), respectively. Plasma alkaline phosphatase (ALP) was 262.98, 259.62, 260.42, 254.59, 262.02, and 260.22 (IU/L), respectively. Plasma glutamate Oxaloacetate Transaminase (SGOT) Concentration was 129.61, 153.70, 133.69, 150.43, 130.65, and 142.9, respectively, and Plasma glutamate Pyruvate Transaminase (SGPT) concentration was 51.24, 54.89, 54.14, 55.50, 51.8, and 54.77, respectively. All blood biochemical parameters in garlic (Allium sativum) and moringa (Moringa oleifera) supplemented groups were found similar between different treatment and control groups.

6.1 CONCLUSIONS

Efficiency of garlic and moringa on growth performance, blood bio chemical and carcass characteristics in commercial broiler may be concluded as:

1) Supplementations of garlic and moringa up to the level of 1 and 2 %, either separately or

in combination in basal feed improved the growth performance and feed utilization in commercial broiler.

2) Similar blood biochemical parameters and liver enzyme activity in the supplemented groups indicated no adverse effect of garlic and moringa supplementation. Carcass characteristics and slaughter traits of commercial broiler were not adversely affected by supplementation.

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Thesis title: Feeding effect of garlic (*Allium sativum*) and moringa (*Moringa oleifera*) leaves on growth and biochemical parameters in broilers

The present study was conducted to investigate the effect of supplementing garlic and moringa on growth performance, blood bio chemical and carcass characteristics in commercial broiler production. 180 day-old Cobb 400 chicks were purchased from Venky's India Limited. Chicks were divided into 6 treatment groups comprising of 3 replicates containing ten birds in each replicate. T_1 group of bird was fed with basal or control diet; T_2 and T_3 groups were given basal diet along with supplementation of garlic @ 0.5% and 1%, respectively; T_4 and T_5 group birds were given basal diet with moringa @ 1% and 2%, respectively; Treatment 6 was supplementation of basal diet with garlic and moringa @ 1%+2% for 6 weeks duration. It was observed that supplementation of garlic and moringa improved the average body weight of birds in all the treated groups. T_6 groups of birds with combined supplementation of garlic and moringa showed the highest body weight almost in all the weeks. There was additionally better growth compared to control for treatment groups T3, T4 and T5 enhanced with garlic (1%), moringa (1%), and moringa (2%) for treatment groups. The body weight gain was significantly higher ($P<0.05$) in the treatment group T6 which was enhanced with garlic and moringa (1%+2%) when contrasted with control groups during 6 weeks. The birds fed on garlic and moringa supplemented diet showed significantly improved ($P<0.05$) feed utilization efficiency compared to other treatments. The FCR was compared among the treatments and revealed higher value in control groups fed without supplementation. At the end of feeding trail, blood samples were collected randomly from one bird from each replicate. Blood biochemical parameters like total serum protein, uric acid, cholesterol, ALP, SGOT and SGPT was estimated in collected blood serum. All the blood biochemical parameters were found to be within normal range. After 6 weeks of age, 4 representative birds from each treatment group were randomly selected and slaughtered to study carcass characteristics traits. Eviscerated weight % and ready to cook yield % varied significantly ($P<0.05$) among different treatment groups. Back, neck and wing, except thigh% were found similar ($P>0.05$) in the treatment groups. For internal organs, heart, gizzard and spleen except liver % remained similar. Periventricular wt. (%) varied significantly among treatments. It was concluded from the study that supplementations of garlic and moringa up to the level of 1 and 2 %, either separately or in combination in basal feed of broiler diet improved the growth performance and feed utilization in commercial broiler without affecting blood biochemical and carcass quality traits.

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