EFFECT OF *ZINGIBER OFFICINALE* ON GROWTH AND BLOOD PROFILE OF BROILER CHICKEN

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ABSTRACT: The poultry sector plays a significant role in Pakistan's economic development and protein supply, contributing 1.3% to the economy and 26.8% of meat demand. However, excessive antibiotic use has raised issues for antibiotic-resistant bacteria and concerns over meat quality. Consequently, natural additives like ginger, known for its antimicrobial properties, are increasingly used to reduce antibiotic reliance in poultry. This study aimed to evaluate the effects of various concentrations of *Zingiber officinale* (ginger powder) at 1, 1.5, and 2% on the growth, carcass characteristics, and blood profile of broiler chickens during summer and winter. A five-day-old broiler chicken was divided into four groups (one control and three experimental) and observed for 42 days per season. Weekly feed intake and weight gain were recorded to determine the feed conversion ratio (FCR). Blood samples collected on day 42 were analyzed for glucose, lipid profile, and antibody titters. Results indicated that 2% ginger supplementation significantly increased body weight gain in winter ($p<0.05$). Carcass characteristics showed non-significant differences ($p>0.05$). The 2% ginger diet significantly improved lipid profiles and antibody titers, reducing cholesterol, LDL, triglycerides, and increasing HDL, ND, and IBD titers, especially in winter. Thus, 2% ginger supplementation enhances broiler growth and health, particularly in winter.

Keywords: Broiler chicken, Ginger, Seasons, Carcass characteristics, Blood parameters/

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INTRODUCTION

Poultry sector is playing an important role in the economic development of the Pakistan and to meet the protein requirements of the people. It is contributing almost 1.3% in country's economy and 26.8% in meat demand (Memon et al., 2021). Poultry meat and eggs are essential nutritious foods to fulfil the growing nutritional requirement of the global population (Mustafa et al., 2019). Due to its high concentration of selenium, iodine, phosphorus, potassium, iron and zinc, chicken meat stands a significant source of nutrition (Saha et al., 2021). The vitamins and minerals found in poultry meat support healthy bones, skin, growth, and repair of body tissues. They also aid in digestion and metabolism. However, intensive growth is subjected to a variety of stressful situations and diseases, which has a significant negative impact on the economy (Haben, 2019).

Botanical additives like herbs or plant extracts are a part of the new generation of growth promoters since they contain antibacterial, coccidiostat or anthelmintic properties (Mohamed et al., 2012; Shareef et al., 2014; Dhama et al., 2015; Alagawany et al., 2021). Herbs also affect appetite and intestinal bacteria, as well as the gizzard and gastrointestinal systems. The immune system, growth efficiency, and meat yield in birds are all improved because of the stimulation of pancreatic secretions (Vertiprakhov et al., 2023; Dhama et al., 2015). Many studies conducted thus far have concentrated on using ginger as non-antibiotic growth stimulants in unusual broiler species (Goodarzi and Landy, 2014; Elagib et al., 2013; Zomrawi et al., 2013).

Zingiber Officinale is a perennial herbaceous plant that belongs to the Zingiberaceae family (Najafi and Taherpour, 2014). Many countries use ginger (*Zingiber officinale*) as a popular food spice and pharmaceutical herb (Chrubasik et al., 2005). It is dried, and the dehydration process of gingerol produces shogaols (Dorman et al., 2000). Ginger is a naturally beneficial additive in poultry diets due to the dehydration reaction (Lin et al., 2008), which improves development and increased the activities of antioxidant enzymes. It is a rhizome that is frequently used as a spice or condiment and as medicine to treat animal ailments (Tapsell et al., 2006).

The three most significant chemicals in ginger are gingerol, gingerdiol, and gingerdione, which can influence microbial activity, stimulate digestive enzymes, and have antioxidant properties (Mohammed et al., 2014).

To maintain and enhance the health of human beings and chickens, a selection of natural feed additives has been used (Ahmed et al., 2015). Herbal remedies are commonly used due to their affordability, efficacy,

widespread inadequacy of current medical treatment, and cultural and religious desires (Dhama et al., 2015).

Due to a lack of available data, little research has been done on how to increase the meat production of native chickens utilizing natural growth promoters. Antibiotic overuse is harmful to both animal health and human health. Ginger (*Zingiber Officinale*) contains a variety of ingredients, all of which can stimulate intestinal enzymes and have a significant effect on microbial activity in broilers such as analgesic, anti-emetic, anti-ulcer, antipyretic, and heart calming characteristics. Therefore, the objectives of the current study are examining the effect of ginger on seasonal growth of broiler chickens.

MATERIALS AND METHODS

The experiment was performed on broiler chicken in the months of November and December in winter season and in months of May and June in summer season. Birds were fed with Ginger powder in varying doses. The following materials and methods were used during the experimental study in both seasons.

Selection, purchase of experimental birds and Preparation of Ginger Powder: For the present study, five days old broiler chickens were selected and purchased from a local market. A total of 120 broiler chicken were used in the experimental study. A total of 60 vaccinated broiler chicken were used in winter season and 60 in summer season. Fresh Ginger *(Zingiber Ofjicinale)* was purchased from the local market. Ginger was sliced, air dried and grinded with mortar and pestle then passed via 1 mm sieve to get fine ginger powder and placed in polythene zipper bags till future use.

Feed, Grouping and housing of experimental birds: Two types of broiler feed, namely starter (1-20 days) and grower (21-42 days) were used in the experiment by following the procedure of Raeesi et al. (2010). A total of 60 chicken were randomly divided into four different groups, each with 15 chicks. The groups were labeled as Control group (Poultry feed without ginger powder), Experimental group 1 (Poultry feed with 1% ginger powder), Experimental group 2 (Poultry feed with 1.5% ginger powder), Experimental group 3 (Poultry feed with 2% ginger powder).

Each bird was weighed individually at the start of the experiment. The room was equipped with pre-heating facilities and adjustable temperature and relative humidity setting. The light was continuously provided to them throughout the experiment. The same experiment setup was kept for the broiler chicken in winter and summer season.

Vaccination of broiler chicken: During the experiment, birds were vaccinated against Newcastle disease (ND) and Infectious bursal disease (IBD) on third and fourth week of the experiment.

Determination of growth performance traits: The feed and weight gain were used to assess growth performance and to determine FCR. FCR was calculated following the method of Contreras (2008)

FCR = Weight of Feed consumed by birds (g)

Weight gain by the birds (g)

To calculate the average increase in body weight, a weekly weight measurement of the live chicken was taken starting at first day of experiment and continued till 6^{th} week of the experiment.

Carcass characteristics and Collection of blood Samples: Blood samples were taken on the 42nd day of the experiment, three birds were selected, and 3 mL of blood samples were taken in EDTA containing vials. Blood samples were kept in refrigerator at 4℃ and then sent to laboratory. After taking blood three birds from each group were selected and slaughtered to obtain data on carcass characteristics such as Thigh, Breast, Gizzard and Liver. The weight of each organ was recorded.

Centrifugation of blood Samples: Blood vials without EDTA were centrifuged at 2000rmp for 10 minutes and serum was isolated. Later, used to determine the various parameters such as glucose level (God-Pod method), lipid profile (automatic biochemical analyzer along with relevant reagent kits) and antibody titers against ND and IBD.

Statistical analysis”" Data was analyzed for one way ANOVA and independent sample t-test by using SPSS version 22.0. One way ANOVA was applied among the groups to find the differences in lipid profile, ND, IBD titer production and carcass characteristics. While independent sample t-test was used to compare the data in winter and summer seasons.

RESULTS

Temperature was recorded during the winter and summer seasons; it fluctuates between 19°C to 25°C in the winter season and 34°C to 46°C in summer season. The weight gain of birds was measured on a weekly basis in control and experimental groups, and it was observed that the weight gain was highest in experimental group 3 compared to other groups in which birds were fed with highest concentration of ginger.

Carcass Characteristics: The weight of spleen, abdominal fat, gizzard, liver, thigh, and breast were measured in control and experimental groups and non-significant differences were noticed by one-way ANOVA in weight of different organs among the groups in winter and summer seasons (Table 1).

Impact of Ginger Concentration on Blood Glucose Levels: The blood glucose level increased in experimental groups with the increase of ginger concentration compared to control groups in both winter and summer seasons. Overall, higher levels of glucose were recorded for winter as compared to summer season.

Impact of Ginger Concentration on Lipid Profile: Cholesterol: The effect of various amounts of ginger was observed on serum cholesterol level in control and experimental groups. A decreased levels of cholesterol were observed in experimental group 3 supplemented with 2% ginger powder. The decrease in Cholesterol levels were higher in summer season as compared to winter season.

Triglycerides: The effect of various amounts of ginger was observed on serum triglycerides level in control and experimental groups. A decreased level of triglycerides was observed in experimental groups as shown in Fig 3. The decrease was significantly different for summer and winter seasons.

Low Density Lipoproteins: The effect of various concentrations of ginger was observed in blood LDL level in control and experimental group. A significant reduction in LDL in the experimental groups was observed as compared to control group.

Table 1. Carcass characteristics of broiler chickens in winter and summer seasons.

Organs	Winter season				Summer season			
	Control group (g)	Exp G1 (g)	Exp G2 (g)	Exp G3 (g)	Control group (g)	Exp G1 (g)	Exp G2 (g)	Exp G3 (g)
Spleen	0.18±0.01	0.22±0.02	0.20±0.03	0.25±0.03	0.21±0.04	0.22±0.03	0.22±0.04	0.26±0.03
Abdominal Fat	2.52±0.01	3.23±0.05	2.25±0.03	1.30±0.06	3.48±0.24	2.25±0.03	2.04±0.02	1.23±0.02
Gizzard	3.59±0.06	3.56±0.07	3.86±0.02	3.57±0.01	3.30±0.16	3.30±0.07	3.35±0.09	3.43±0.34
Liver	3.66±0.12	3.46±0.18	3.48±0.14	3.16±0.03	3.86±0.04	3.35±0.03	3.35±0.02	3.24±0.04
Thigh	21.63±1.22	22.70±1.59	20.50±0.68	26.18±2.48	30.03±0.83	32.22±1.61	32.16±1.17	32.23±1.84
Breast	30.22±1.11	32.48±1.45	33.33±0.52	30.01±1.24	19.37±0.56	21.13±0.36	20.65±0.36	24.68±0.33

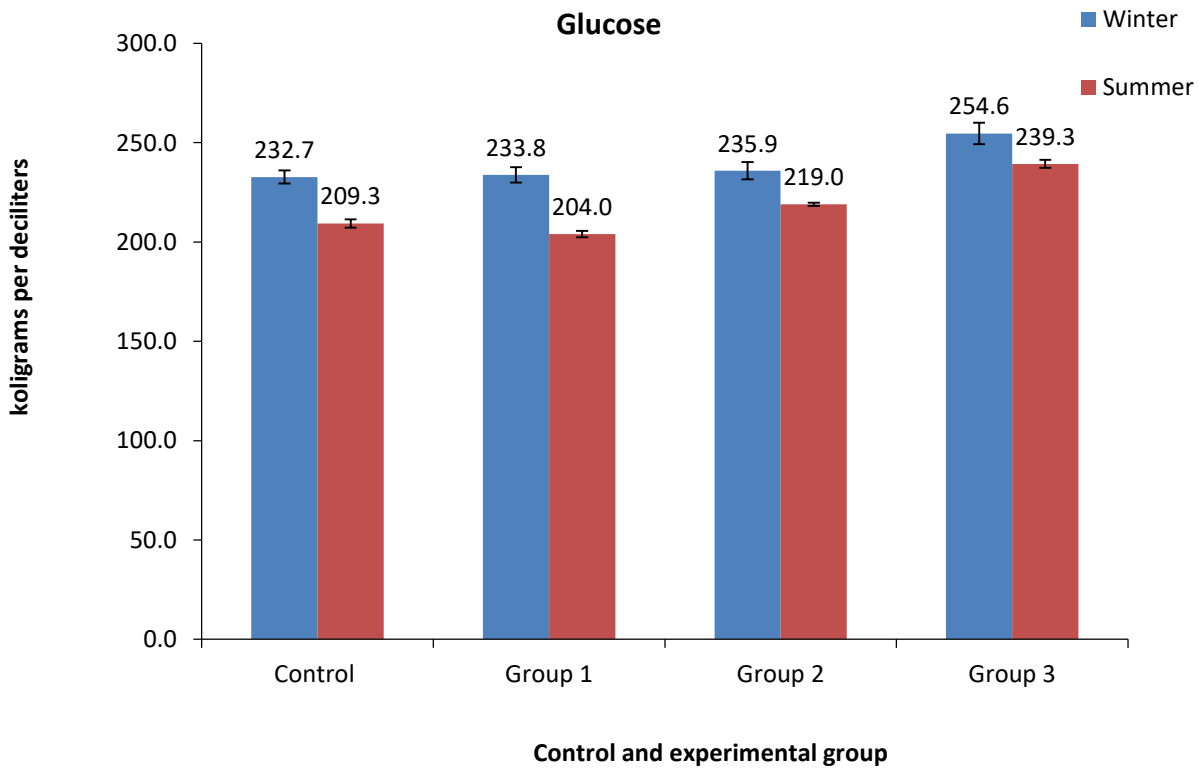

Figure 1. Level of Glucose (mg/dl) in control and experimental groups

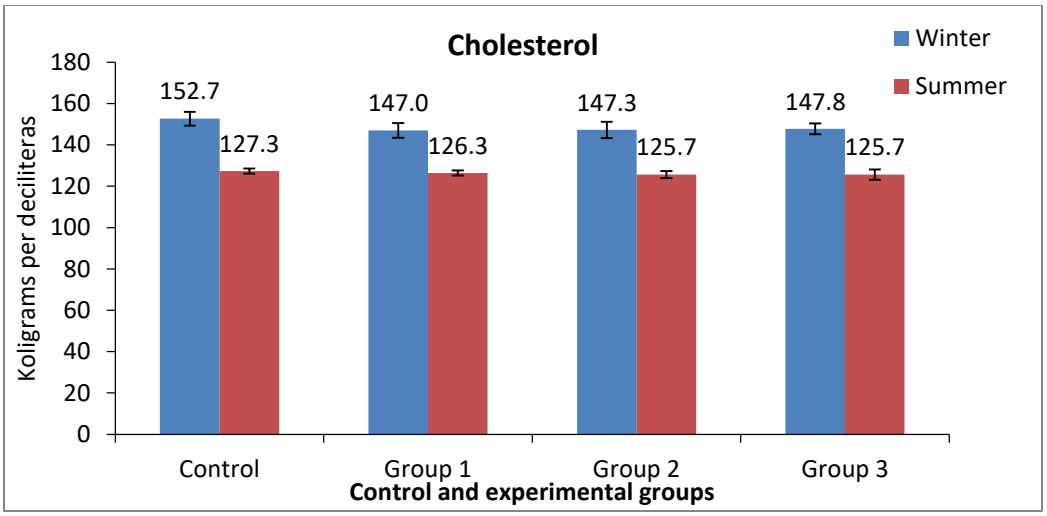

Figure 2. Level of cholesterol (mg/dl) in control and experimental groups

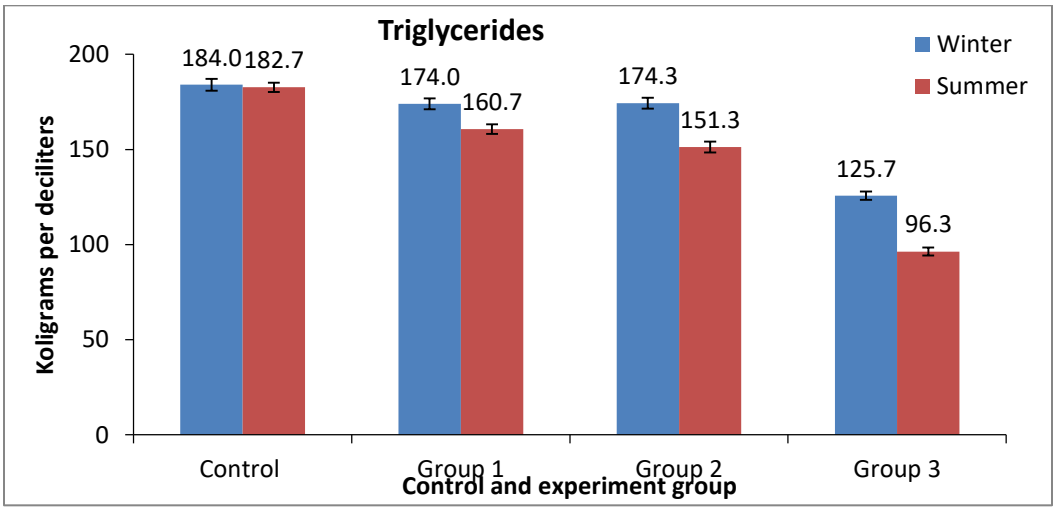

Figure 3. Level Triglycerides (mg/dl) in control and experimental groups

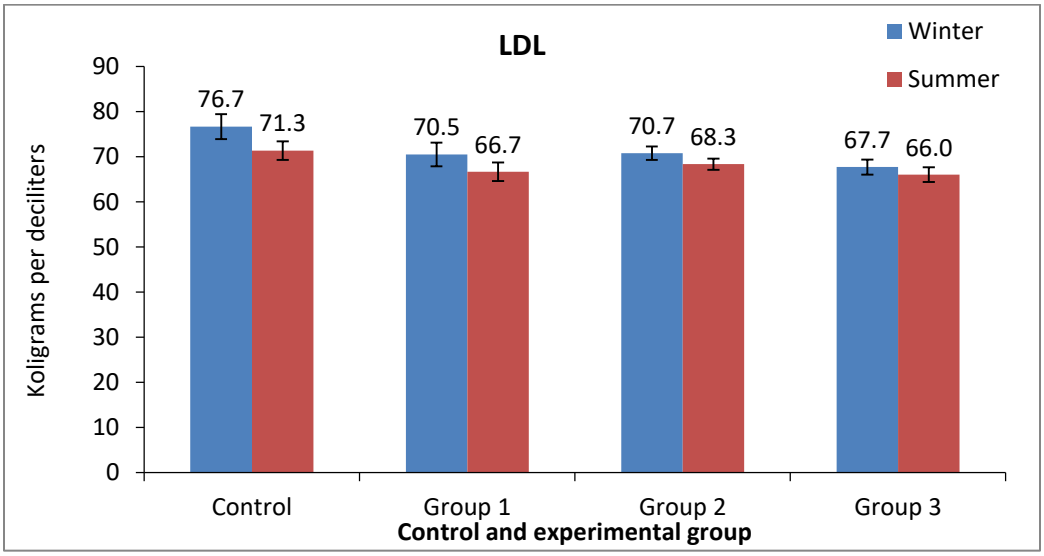

Figure 4. Level LDL (mg/dl) in control and experimental groups

High Density Lipoproteins: The effect of various concentrations of ginger was observed on serum HDL level in control and experimental groups. Significant increase HDL in the experimental groups (Fig. 5).

IBD titers: The impact of ginger against IBD titters in control and experimental groups.

The impact of ginger in antibody titers against ND in control and experimental groups.

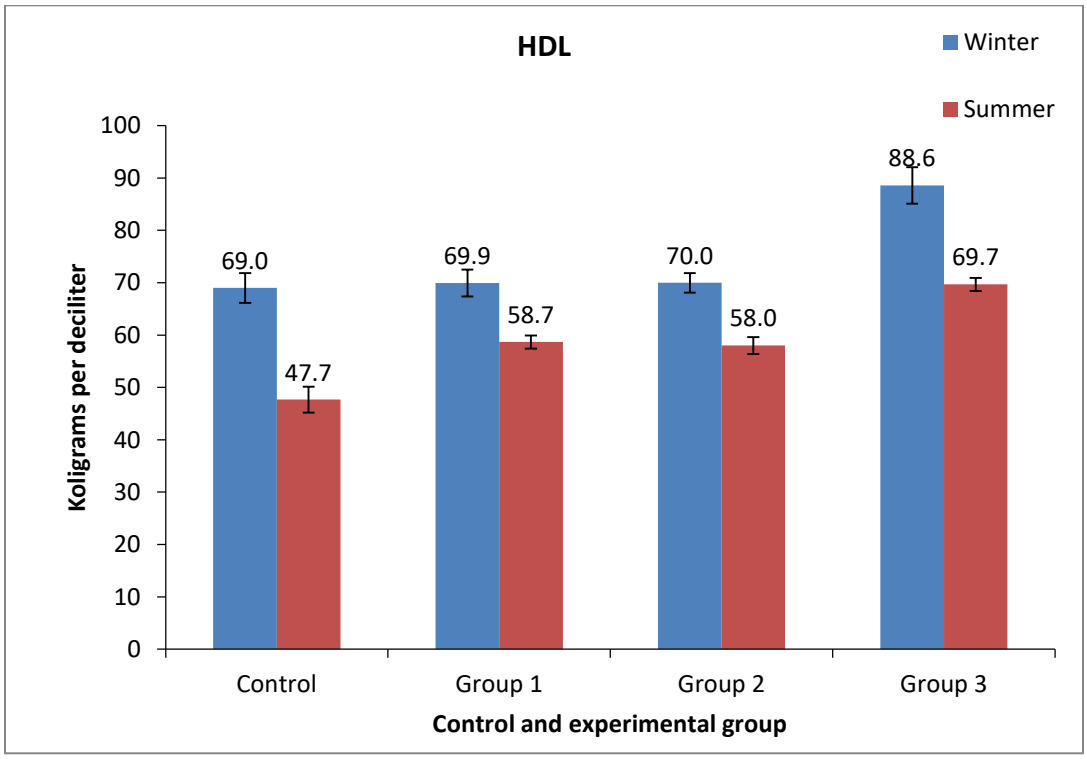

Figure 5. Level HDL (mg/dl) in control and experimental groups

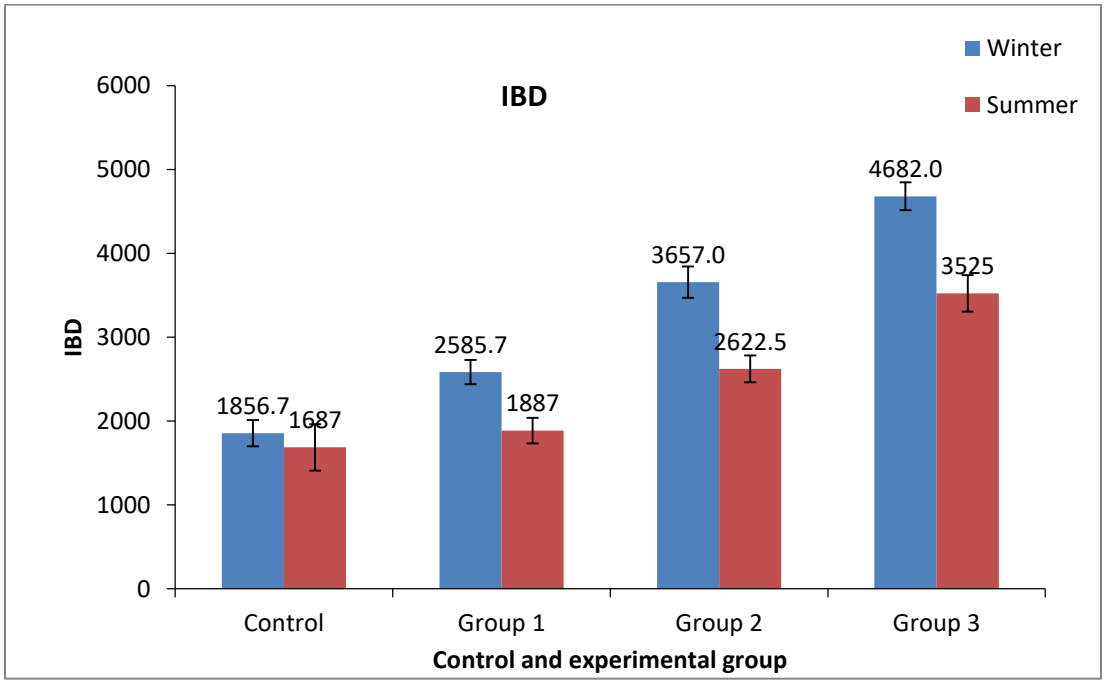

Figure 6. Level IBD in control and experimental groups

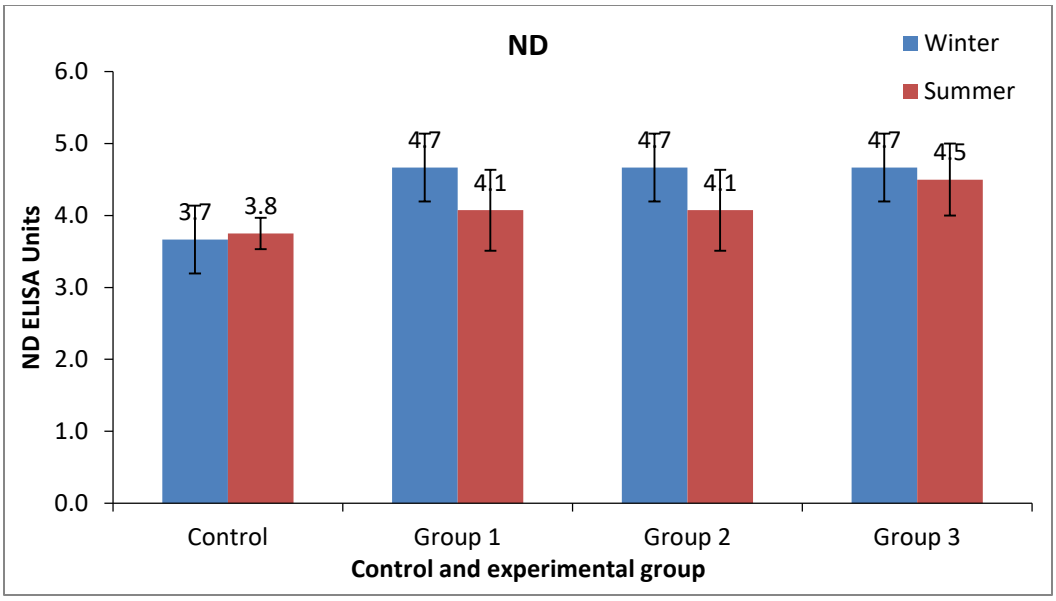

Figure 7. Level ND in control and experimental groups

DISCUSSION

Poultry meat is a popular diet item worldwide. Improving chicken nutrition is critical for generating high-quality broiler meat. Ginger may be beneficial and valuable as a natural feed additive in nutrition, due to its antibacterial, anti-inflammatory, antioxidant, antiseptic, antiparasitic, and immunomodulatory qualities, particularly for broilers (Alem, 2024; Al-Khalaifah et al., 2022). The inclusion of natural beneficial components, such as ginger, in poultry diets has no negative effects; instead, it enhances the oxidative state and production levels of broiler chickens (Dosu et al., 2023).

The present study was designed to examine the effects of higher concentrations of dietary ginger powder on chicken performance, carcass features, and serum parameters. During the 42-days of experiment, feed consumption and the feed conversion ratios were highly improved for the experimental groups particularly in the group where higher concentrations of ginger were included in the broiler diet. A Kehinde et al. (2011) conducted a study to examine the impact of varying levels of ginger in chick diets on feed consumption, found that adding ginger had a substantial impact on daily feed intake that was like our results.

In the summer season, the average temperature was 39°C and humidity was 24%. May et al. (2000) reported that when the temperature increases, broiler chicks' growth rate slows down because panting uses up energy from the limited amount of feed they received. Birds as a result had decreased final body weight.

Ginger did not significantly influence growth performance, but broilers fed on diet containing ginger tended to grow more quickly during the grower phase than those fed on control diet. Even though ginger is widely utilized as a spice and medicinal herb, little study has been done on its usage as an animal feed addition. El-Deek et al. (2002) found that ginger in the diet had no impact on growth, whereas Farinu et al. (2004) reported that ginger at different doses marginally enhanced broiler performance.

Al-Homidan (2005) determined ginger at 2 and 4% doses reduced the growth level of starting chicks. These findings indicate that ginger treatment may have a dose-dependent effect on broiler growth performance.

In winter season, the average temperature was 25°C and humidity was 60%. Room temperature was maintained through light and room heater. Blahova et al. (2007) reported that broiler chicken performance and blood system indices were negatively impacted by the drop in ambient temperature (cold stress) during the growing process.

In current study, chickens in experimental and control groups consumed diets equally, showing that the incorporation of ginger into the feed had no negative effects on the feed accessibility. The observation of current study of a significant rise in total body weight gain is consistent with some earlier findings of the same variable.

Zhang et al. (2009) studied the effect of adding 5 g/kg of ginger powder to the feed and discovered that the final weights of the control and treatment groups, respectively and concluded that adding ginger to chicken diet seemed to improve up broiler growth.

Ademola *et al.* (2009) determined that incorporating ginger into diet resulted in a rise of 2 percent in body weight (BW). Due to the intense bitter taste of the herbal plants used in excess, the increased body weight observed for the diet containing 6 grams of

ginger per kilograms feed may have been caused by a increase in feed intake, which in turn caused a gain in BW (Hosseini, 2011).

The effect of treatments, i.e. 2% of ginger on abdominal fat and thigh carcass indicated a positive impact compared with untreated group, but 2% of ginger reduced abdominal fat of experimental group 3. Additionally, in the experimental group 3 (2 percent ginger) weight of breast, spleen, and liver was greater than untreated group.

Moorthy et al. (2009) showed no impact of ginger supplementation on the relative weights of liver and abdominal fat in broilers. Zhang et al. (2009) found that in comparison to the control group, ginger considerably improved carcass characteristics, but abdominal fat was slightly lower.

When compared to birds in the control group, 1%, 1.5%, and 2% ginger fed birds had the lowest serum cholesterol, triglycerides, and LDL levels. Additionally, supplementing ginger powder caused the serum glucose and HDL level to rise significantly in experimental group 3 as compared to other groups.

These finding are similar those of Al-Homidan (2005) and Ademola et al. (2009) observed that giving chicks up to 6% ginger significantly reduced blood serum lipids and cholesterol.

Mohamed et al. (2012) showed that the serum cholesterol and triglyceride levels were significantly lowered by adding ginger to the diet at levels of 0.1 and 0.2%, respectively.

Infectious bursal disease (IBD) can impair nutrient absorption and digestion in affected chickens, leading to reduced feed conversion efficiency and slower growth rates. This can result in decreased body weight and economic losses for poultry producers. IBD leads to increased mortality rates among broiler chickens. The inflammation and damage to the intestinal tract can compromise the bird's overall health and make them more susceptible to secondary infections. Newcastle disease (ND) antibody production determined in the current study showed that ginger had no effect on immunological response in broilers; Hocking (2002) reported dietary restriction has no effect on immunological function in broiler producers.

Higher IBD and ND titers in broiler chickens during winter are due to reduced heat stress and improved feed intake, which enhance immune response and vaccine efficacy compared to summer. However, ginger has a good impact on performance and a reducing impact on serum, which can be attributed to significant anti-oxidative action and probable anti-stress action.

Conclusion: It was concluded in the study that ginger supplementation at 2% significantly ($p<0.05$) increased the body weight gain and reduced the feed intake and feed conversion ratio (FCR) in summer as well as in winter season. It also showed a significant effect ($p<0.05$) on carcass characteristics as it increased the weight of breast, thigh and liver in experimental groups for both seasons. The levels of glucose were measured that showed significant increase in experimental groups as compared to control groups. While HDL showed a significant increase in Experimental G3 (2%) but the remaining parameters such as cholesterol, triglycerides, and LDL showed a non-significant effect. There were no significant changes noticed in carcass characteristics and lipid profile with respect to varying seasons.

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Conflict of Interest: Authors declare there is no conflict of interest.

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