
COMPARATIVE EFFICACY OF HEXANE EXTRACT OF GINGER OR/AND GARLIC ON GROWTH AND CARCASS CHARACTERISTICS OF *SALMONELLA TYPHIMURIUM* CHALLENGED BROILER CHICKEN

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ABSTRACT

A total of 120 1-day-old broiler chicks was used to study efficacy of hexane extract of ginger or/and garlic on growth performance of *Salmonella Typhimurium* challenged broiler chicken. The chicks were randomly allotted into 4 treatment groups (T1=control, T2=gallic; T3=ginger and T4= garlic and ginger extract) each of 3 replicates with 10 chicks per replicate. Except control group, each treatment group were administered garlic extract; ginger extract and extract of both garlic and ginger at 10 mL each/L of water, respectively for the period of the experiment (8 weeks). Data obtained were subjected to the analysis of Statistical Package for Social Science (SPSS version, 25.0) The results showed no significant different ($p>0.05$) in all the performance traits measured. However, birds on combination of garlic and ginger extracts recorded numerically higher values for final body weight (2833.33g); final weight gain (2827.93) and total feed intake (65496.00g). It was actually discovered from this study that broilers placed on combined extract of garlic (*Allium sativum*) and Ginger (*Zingiber officinale*) against *Salmonella typhimurium* showed higher growth performance.

Keywords: Gallic, ginger, *Salmonella typhimurium*, growth performance, carcass characteristics.

INTRODUCTION

Over the last decade, *Salmonella* and *Campylobacter* are the most frequently isolated foodborne pathogens, and are predominantly found in poultry, eggs and dairy products (Silva et al. 2011). Broiler chicken morbidity and mortality are more commonly caused by bacterium than viruses, and numerous kinds of infectious bacterial pathogens, including, *Salmonella*, *Campylobacter*, *Lactobacilli*, *Streptococcus* etc. In broiler chicken industry, Attia et al. (2012) affirmed *Salmonella* as amongst the most dangerous and virulent bacterial pathogens with significant public health implications. *Salmonella* is a rod shaped, gram-negative facultative anaerobe that belongs to the family Enterobacteriaceae (Barlow and Hall 2002). Shu-Kee et al. (2015) had shown pathogenic capability of all strains of *Salmonella* for having such ability to invade, replicate and survive in their host cells, resulting in potentially fatal disease. Salmonellosis is characterized by rapid, laborious breathing, shivering, lack of coordination, lethargy, fluffed up feathers, droopiness, diarrhea, and convulsions (Dar et al., 2017). Salmonellosis can make birds vomit food, water and drool saliva in severe cases. Shu-Kee et al. (2015) reported that *Salmonella typhimurium* may infect blood vessels and gain access to the circulatory system, causing lesions in a wide range of tissues all throughout the body (sepsis). More than 20 million humans and animals are infected with *Salmonella* each year. It decreases animal productivity and causes 150,000 human and animal fatalities each year, all around the world (Rahman, et. al. 2020).

In conventional management, *Salmonella* is prevented and regulated by in-feed (or water) administration of broad-spectrum or synthetic antibiotic. *Salmonella* spp. resistant towards these antibiotics is generally referred to as multi-drug resistant (MDR). The transmission of MDR *Salmonella* strains from animals to humans via the ingestion of contaminated food or water and infected animal products poses a high risk of zoonotic disease. Consequently, the MDR problem may cause hundreds of millions of human deaths along with severe financial crisis and severe damage in

livestock productions by 2050 (Islam, et. al., 2021). In other to overcome the challenges of MDR, Helen, et al. (2020) highlighted efficient and cost-effective of antibiotic alternatives, phyto-biotics (e.g. garlic bulbs and ginger rhizomes in poultry production).

There is dearth of information on the antimicrobial activities of these phyto-biotics on specific pathogen. In the present study therefore, we specifically examine the efficacy of garlic bulbs (*Allium sativum*) and ginger rhizomes (*Zingiber officinale*) against *Salmonella typhimurium* in broiler chicken.

MATERIALS AND METHODS

Source of *Salmonella typhimurium*, Treatment Drug and Spices

An isolate of *Salmonella typhimurium* was sourced from National Veterinary Research Institute (NVRI) Vom, Jos, Nigeria which was replicated by re-culturing *Salmonella Typhimurium* before administering it to the birds. Ciprofloxacin, Garlic bulbs (*Allium sativum*) and ginger rhizomes (*Zingiber officinale*) were respectively purchased from reputable veterinary drug shop and spices section of International Market, Abakaliki, Ebonyi state, Nigeria.

Preparation of Experimental Materials

With little modification, hexane extraction of Garlic bulbs and ginger rhizomes were carried out in line with a protocol described by Tchoupou-Tchoupou et al. (2022) at Animal Science Biochemistry Laboratory of Alex Ekwueme Federal University Ndufu-Alike, Ikwo. The hexane aqueous extract obtained was considered to be 100% concentrated.

Experimental Design and Procedures

A total of 120 1-day-old Agrited broiler chicks used for the study were purchased from Agric-international Technology Trade, Ibadan, Oyo-State, Nigeria. The birds were assigned into four formulated experimental treatments in completely randomized design. Birds on T₁ (control treatment) received 2.5mL of ciprofloxacin /4L of water without ginger or garlic. Those on T₂ were placed on ginger extract at 10 ml/L of water; T₃ were given garlic extract at 10 ml/litre of water, and those on T₄ received extract of both ginger and garlic at 10 ml each/litre of water. All experimental birds were respectively fed ad libitum on commercial starter mash and broiler finisher throughout the period of the experiment.

Data Collection

Final weight gain of the birds for individual treatments were obtained by subtracting the initial live body weight from final live body weight. Weekly feed intake was taken as total feed served/week/treatment minus left over at the end of the week. Values obtained were subsequently used to compute feed efficiency as $FE = \text{total feed intake} \div \text{final body weight gain}$. On 56th day, one bird from each replicate were randomly selected and sacrificed for carcass evaluation. Carcass parameters, such as dressing yield, breast meat yield, and weight of visceral organs (heart, gizzard and liver) were recorded.

Statistical analysis

All data obtained were analyzed using the statistical package for social science (SPSS version 25.0). Mean and its standard error were measured using one-way analysis of variance (ANOVA). Differences between means were compared using Duncan's New Multiple Range Test at ($p < 0.05$) as adapted in the package.

Table 1: Performance characteristics for *Salmonella typhimurium* challenged broiler chicken

Parameters	T ₁	T ₂	T ₃	T ₄	SEM
Initial body weight (g)	5.44	5.45	5.42	5.40	±0.33
Final body weight (g)	2816.67	2750.00	2766.67	2833.33	±144.33
Final weight gain(g)	2811.23	2744.55	2761.25	2827.93	±124.45
Total feed intake(g)	64717.00	65430.00	63350.00	65496.00	±96.63
Feed efficiency	23.02	23.84	22.94	23.16	±0.55

orally administer ginger or/and garlic extract.

Means along the row shows no-significant difference (P -values > 0.05) T₁=birds administer 2.5ml of ciprofloxacin /4L of water without ginger or garlic; T₂= birds on garlic extract at 10 ml/litre of water;

T_3 = birds given ginger extract at 10 ml/L of water, and those on T_4 received extract of both garlic ginger at 10 ml each/litre of water. SEM=standard error of the means.

Table 2: Carcass characteristics for *Salmonella typhimurium* challenged broiler chicken orally administer ginger or/and garlic extract (Mean $\pm$ SEM)

Parameters	T ₁	T ₂	T ₃	T ₄	SEM
Live Weight(g)	1711.1 ^a	1514.8 ^b	1075.3 ^c	1433.7 ^b	$\pm$ 132.91
Carcass Weight(g)	1511.1 ^a	1348.1 ^b	953.1 ^c	1270.8 ^b	$\pm$ 117.14
Dressing percent (%)	1338.9 ^a	1185.2 ^b	841.4 ^c	1121.8 ^b	$\pm$ 103.99
Gizzard Weight(g)	166.7 ^a	155.6 ^b	107.4 ^c	143.2 ^b	$\pm$ 12.87
Intestine Weight(g)	188.9 ^a	185.2 ^b	124.7 ^c	166.3 ^b	$\pm$ 14.72
Liver Weight(g)	180 ^a	156.7 ^b	112.2 ^c	149.6 ^b	$\pm$ 14.06
Head Weight(g)	222.2 ^a	196.3 ^b	139.5 ^c	186 ^b	$\pm$ 17.27
Body Length(cm)	21.2 ^a	18.3 ^b	13.2 ^c	17.6 ^b	$\pm$ 1.65
Wing Length(cm)	12.7 ^a	10.9 ^b	7.9 ^c	10.5 ^b	$\pm$ 0.99
Shank Length(cm)	10.1 ^a	8.5 ^b	6.2 ^c	8.3 ^b	$\pm$ 0.80
Head Circumference (cm)	8.1 ^a	6.8 ^b	5.0 ^c	6.6 ^b	$\pm$ 0.64
Breast Weight(g)	566.7 ^a	488.9 ^b	351.9 ^c	469.1 ^b	$\pm$ 44.40
Thigh Circumference(cm)	8.7 ^a	7.6 ^b	5.4 ^c	7.2 ^b	$\pm$ 0.69
Thigh Weight(g)	250 ^a	233.3 ^b	161.1 ^c	214.8 ^b	$\pm$ 19.29

^{a,b,c} = Means on the same row with different superscripts are significantly different (P -value < 0.05)

T_1 =birds administer 2.5ml of ciprofloxacin /4l of water without ginger or garlic; T_2 = birds on garlic extract at 10 ml/l of water; T_3 = birds given ginger extract at 10 ml/l of water, and those on T_4 received extract of both garlic ginger at 10 ml each/l of water. SEM=standard error of the means.

RESULTS AND DISCUSSION

Birds on treatment 4 (with garlic and ginger extract at 10 ml each/litre of water) recorded highest performance (though not significantly different) for all growth parameters measured among treatment means (**Table 1**) The present trend in growth parameters is similar to the findings of Bamidele and Adejumo (2012) in which broiler birds were placed on mixture gallic and ginger-based diets. Bandna (2013) also reported and recommended combination effectiveness of garlic and ginger extract rather than single usage as antibacterial agent in broiler production.

In **Table 2**, the carcass characteristics for *Salmonella typhimurium* challenged broiler chicken orally administer ginger or/and garlic extract are shown. Significant ($p < 0.05$) differences among the treatment means were observed in all parameters measured. As expected, carcass characteristics of birds on control treatment showed highest significant values for all parameters. Birds on T_2 (gallic extract) and that of T_4 (gallic + ginger extract) recorded better similar characteristics above T_3 (ginger extract). Significant difference ($p < 0.05$) among treatment means was in contrary to the findings of Odunowo and Olumide (2019). They discovered that garlic supplementation has no significant effect on organ weight and carcass characteristics. Such discrepancies may be due to method of extraction and administration of the test ingredients in the present study.

CONCLUSION

In conclusion, it was actually discovered from this study that broilers placed on combined extract of garlic (*Allium sativum*) and Ginger (*Zingiber officinale*) against *Salmonella typhimurium* showed higher performance (though not significant) in all parameter measured. Further studies may be required for optimum usage of these spices as growth promoters in broiler production.

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