EFFECT OF YEAST AND LACTOBACILLUS FED BROILER CHICKENS ON MEAT MICROBIAL COUNT AND SENSORY QUALITY

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ABSTRACT
Effects of yeast and lactobacillus fed broiler chickens on meat microbial count and sensory quality were evaluated. One hundred and eighty (180) day old broiler chicks were used in an 8-week feeding trial. The birds were randomly allotted to four experimental treatments using a completely randomized design (CRD) on the basis of equal live weight. Each treatment had three replicates of fifteen birds per replicate. Four experimental diets were prepared; the diet without yeast and Lactobacillus served as the control (T1), while diet with yeast only was designated as T2, diet with strains of Lactobacillus was the third treatment (T3) while diet with a combination of yeast and lactobacillus was assigned T4. At the end of the feeding trials the birds from the treatments were slaughtered. The thigh and breast muscles were selected and analyzed for microbial counts and sensory quality. The data obtained were subjected to one-way (ANOVA). Significant difference ($p< 0.05$) was found in the microbial counts across the treatments except in total bacterial count. Microbes such as coliform count, Escherichia coli and Proteus were isolated from the samples. Compared to other treatments, the control (T1) had the highest microbial count while the lowest count was found in T4. More so significant difference ($p<0.05$) was found in all the sensory score parameters analyzed in all the treatments except in overall appearance. Therefore the supplementation of yeast and lactobacillus as additives in broiler diets should be implemented for production of wholesome meat and better sensory quality.
Key words: Yeast, Lactobacillus, broiler meat, sensory, microbial

INTRODUCTION

Meat is the most common and most valued food of animal origin all over the world due to its nutritional composition, outstanding sensory and culinary properties. Globally, meat has been gaining importance due to its nutritious attributes. The global meat production was put at over 340 million tonnes each year and consumption in developing countries has grown from a modest average annual per caput consumption of 10 kg in the 1960s to 26 kg by 2000 and is expected to reach 37 kg by the year 2030 (FAO, 2006). The large increase in demand for animal source food over the last few decades has been largely met by the global increase in intensive livestock production, particularly poultry (Xiao *et al.,* 2021). According to Smith *et al.* (2019) efficient production methods and the use of feeding additives have become essential for meeting this increasing demand while maintaining animal health and optimizing meat safety quality. Feed additives are products used in animal nutrition for the purposes of improving the quality of feed and the quality of food from animal origin or to improve the animal's growth, performance and health (Adams and Jones, 2022). These additives can improve nutrient utilization, gut health, immune function, and disease resistance in poultry (Houshmand *et al.,* 2018). Yeast and lactobacillus have emerged as promising feed additives in the poultry industry, with profound effects on both microbial and sensory qualities of broiler chickens. Al-Fataftah and Abdelqader (2011) reported that yeast supplementation led to improved microbial balance in the gut of broilers, reducing the predominance of harmful pathogens such as *Salmonella* and *Escherichia coli.* In addition, Gadde *et al*. (2017) reported that the probiotic properties of yeast strains, contributed to the competitive exclusion of harmful bacteria in the gut. According to Bolder (2007), the microbial load on broiler meat significantly affects food safety and shelf-life. Pathogenic microbes like *Salmonella* and *Campylobacter* can pose health risks if not eliminated during cooking. The shelf-life of broiler meat is also influenced by microbial load, with increased bacteria accelerating spoilage. Modulation of microbial load through feed additives, such as a blend of multi-strain *Bacillus spp* probiotics and a *xylanase*, can improve broiler performance and gut health by reducing pathogen load (Rouger *et al.,* 2017). Therefore, reduction of microbial load is crucial for meat safety, shelf-life,

and broiler performance (Bolder, 2007). Therefore this study seek to evaluate effect of yeast and lactobacillus fed broiler chickens on meat microbial count and sensory quality

MATERIALS AND METHODS

Source and experimental diets

The experiment was carried out at Teaching and Research Farm of Animal Production and Health Federal University Wukari. A commercially available yeast (*Saccharomyces cerevisiae*) and mixed strain of *Lactobacillus* based probiotic were purchased. Four experimental diets were prepared; the diet without yeast and Lactobacillus served as the control (T_1), while diets with yeast (1kg/100kg of feed) only were designated as T_2, diet with strains of *Lactobacillus* (25g/100kg of feed) was the third treatment (T_3) while diet with a combination of 1kg of yeast and 25g of *lactobacillus*/100kg of feed was assigned T_4.. The Experimental diets are shown in Table 1.

Table 1: Experimental diets

Ingredients	Broiler starter diet	Broiler finisher diet
Maize	51.00	56.00
Soya bean meal	38.00	33.00
Maize offal	3.00	3.00
Fish meal	3.00	3.00
Bone meal	3.00	3.00
Limestone	0.30	0.30
Premix	0.20	0.20
Methionine	0.20	0.20
Lysine	0.20	0.20
Common salt	0.30	0.30
Total	**100**	**100**
Nutrients composition		
M.E (Kcal/Kg)	2834.00	2952.00
Crude protein	22.79	19.14
Calcium	1.23	1.21
Phosphorus	0.79	0.79
Lysine	1.08	0.93
Methionine	0.58	0.53
Crude fibre	3.50	4.00
Ether extract	3.00	3.50

Experimental design and animal management

An eight weeks feeding trial was carried out using one hundred and eighty (180) day old chicks broilers, which was allotted to four experimental treatments in a completely randomized design (CRD) which was based on equal live weight. Each treatment had three replicates of fifteen birds per replicate. Maize/soybean-based broiler starter and finisher diets were formulated according to NRC (1994) nutrient requirements for broiler chickens. Feed and water were given ad-libitum.

Microbial analysis

Microbial analysis was done according to (Vasavada *et al*., 2020). A the end of the feeding trial , three birds per replicate were selected and fasted but were given access to water overnight. The birds were slaughtered, dressed, and eviscerated. Breast and thigh muscles were collected for analysis. The samples were transported in an insulated ice bag to the laboratory. Bacteria isolation was conducted using media to culture the various populations of microbes present in the samples. The number of grown colonies was determined, and the obtained colonies were examined. Bacteria were identified, followed by isolation and enumeration using the conventional method of microbial culture and suspected colonies were sub-cultured and further identified.

Sensory evaluation of broiler meat

Sensory evaluation was conducted according to the methods described by Nasiru *et al*. (2011). Forty broiler meat samples were selected from the breast and thigh muscles across the treatments. Visible fat, skin, or bones were removed from the meat samples to ensure a consistent appearance. Afterward, they were cut into pieces and washed thoroughly with clean water, and salt was added to taste. The meat was cooked by boiling for 20 – 30 minutes until it was fully cooked (with an inner temperature of about 165°F (74°C) (AOAC, 2005), thereafter removed and evaluated by 30 trained panelists, drawn from the Department of Animal Production and Health Federal University Wukari. Sensory parameters such as overall appearance, colour, flavour, juiciness, tenderness and overall acceptability of the samples were analyzed. The sequence of the samples was randomized using a 9-point Hedonic scale, ranging from "like extremely" to "dislike extremely," as described by Ranganna (2001). The average mean scores obtained from the panel were statistically analyzed.

Statistical Analysis

The data obtainedfrom microbial count and sensory panel score were subjected to one-way (ANOVA) in completely randomized design (CRD) and means were separated using the least significant difference (LSD) and SPSS software 20 version was used.

RESULTS AND DISCUSSION

Microbial counts of the broiler meat seen in table 2 shows no significant difference ($p>0.05$) in all the parameters analyzed across the treatments except in total bacterial count where significant difference was found between treatment 1 (control) and other treatments. The microbes that were isolated on the samples are Total coliform, *Escherichia coli* and *Proteus while Lactobacillus*, *Saccharomyces*, *Corynebacterium*, *Clostridium*, *Salmonella* and *Shigella* were not found. Total bacterial count ranged from $1.35x10^4$ - $1.09x10^5$ (CFU/g). The control (T_1) had the highest total bacterial count (TBC), Coliform count, *Escherichia coli* and Proteus count compared to other treatments. This indicates that supplementation of yeast and lactobacillus in the diet of broiler help in the reduction of microbial load in the meat ensuring safety and wholesomeness of the meat. This is in agreement with Chen *et al.* (2017), who reported that yeast and Lactobacillus culture supplementation decreased the TBC in broiler chickens. Moreso Hoque *et al.* (2021) reported that yeast supplementation can lower the total viable microbial count and improve meat quality. Zhu *et al.* (2000) also reported that *Lactobacillus* supplementation reduced pathogen colonization and lowered the incidence of diseases such as *salmonellosis* and *colibacillosis* in poultry.

Table 2: Microbial counts of broiler meat

Parameters (CFU/g)	**T_1(Comtrol)**	**T_2**	**T_3**	**T_4**	**SEM**	**LOS**
Toial bacterial count	$1.09x10^{5a}$	$5.35x10^{4b}$	$1.35x10^{4b}$	$1.50x10^{4b}$	15447.42	*
Total coliform count	$4.55x10^4$	$2.65x10^4$	$1.05x10^4$	$7.50x10^3$	7218.53	NS
TotalEscherichia coli Count	$1.00x10^4$	$1.00x10^4$	$2.50x10^3$	0	2095.38	NS
Total Proteus Count	$1.95x10^4$	$6.00x10^3$	$3.00x10^3$	$3.00x10^3$	2887.40	NS
Total Lactobacillus Count	0	0	0	0	0	
Total Saccharomyces Count	0	0	0	0	0	
Total Corynebacterium Count	0	0	0	0	0	
Total Clostridium Count	0	0	0	0	0	
Total Salmonella Count	0	0	0	0	0	
Total Shigella Count	0	0	0	0	0	

ab Means in the same row with different superscripts are significantly different, SEM: Standard Error of Mean, T2 = (Meat from broiler fed diet supplemented with yeast), T3 = (Meat from broiler fed diet supplemented with Lactobacillus), T4 = (Meat from broiler fed diet supplemented with combination of yeast and Lactobacillus), LOS: Level of Significance, NS: Non significance, Colony Forming Unit per gram,

The sensory qualities of broiler meats attributes such as flavor, tenderness, colour and juiciness play crucial roles in consumer preference and overall likeness of the product (Jayasena *et al*., 2013). Panel sensory score presentedin Table 3 shows significant difference ($p< 0.05$) on all the parameters analyzed except forthe overall appearance where there was no significant difference across the treatments (Table 3). There was no significant difference ($p>0.05$) in the colour, flavour, tenderness, juiciness and overall acceptability of the broiler meat samples for T_1,T_2 and T_3 except in T_4 where significant difference ($p<0.05$) was observed which implies that T_1, T_2 and T_3 have similar sensory

qualities and preferred by the panelists than T_4 which differs in sensory qualities and had the lowest sensory score across the treatments. This could be as a result of the combination of yeast and lactobacillus in the broiler diet (T_4) which brought about the poor sensory meat quality. This result agrees with the report of Mountzouris *et al*. (2007) that yeast-derived products enhanced the flavor and tenderness of broiler meat. The alteration in the microbial profile can have a direct impact on the sensory qualities of the meat, as the type and quantity of microbes present in meat products are known to affect factors such as color, flavor, and texture (Zhu *et al*., 2022). The acceptable range of microbial load on broiler meat can vary depending on the specific type of microorganism and the standards set by different organizations. Food and Agricultural Organization (FAO) states that total viable plate count numbers must not 100,000 CFU/cm² (>5.0log10CFU/cm²). Therefore the broiler meat from T_1, T_2 and T_3 are safe for consumption compare to the control.

Table 3: Panel sensory score

Parameters	T_1	T_2	T_3	T_4	SEM	LOS
Overall appearance	6.80	6.50	5.90	6.10	0.29	NS
Colour	5.90[a]	6.20[a]	6.60[a]	3.60[b]	0.35	*
Flavor	6.70[a]	6.30[a]	6.70[a]	4.40[b]	0.33	*
Tenderness	5.90[a]	7.00[a]	5.70[a]	2.80[b]	0.36	*
Juiciness	6.60[a]	6.50[a]	6.10[a]	3.70[b]	0.31	*
Overall acceptability	6.40[a]	7.50[a]	6.30[a]	3.80[b]	0.29	*

ab Means in the same row with different superscripts are significantly different, SEM: Standard Error of Mean; T1 = (Control), T2 = (Meat from broiler fed diet supplemented with yeast), T3 = (Meat from broiler fed diet supplemented with Lactobacillus), T4 = (Meat from broiler fed diet supplemented with combination of yeast and Lactobacillus), LOS: Level of Significance, NS: Non significance

CONCLUSION AND RECOMMENDATION

In the evaluation of the effect of yeast and lactobacillus on fed broiler chickens on meat microbial count and sensory quality, low microbial count and better sensory quality was achieved. Therefore the supplementation of yeast and lactobacillus as additives in broiler diets should be implemented for production of wholesome meat and better sensory quality

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