QUALITY ASSESSMENT OF MEAT OBTAINED FROM BROILER CHICKENS GIVEN GARLIC (*ALLIUM SATIVUM*) AND GINGER (*ZINGIBER OFFICINALE*) IN DRINKING WATER

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ABSTRACT
This study was carried out to evaluate the meat quality obtained from broiler chickens offered garlic (Allium sativum), ginger (Zingiber officinale) and their mixture in drinking water. Two hundred and forty (240) one-day old Arbor Acre breed of broiler chickens were randomly grouped into ten (10) treatments of three (3) replicates and 4 males and 4 females per replicate. A 3 x 3 x 3 factorial arrangement in a completely randomized design was adopted. There were 3 sources of herbal supplement (garlic, ginger and 50:50 garlic and ginger) at 3 levels of supplementation (1.8, 2.3 and 2.8 g/l). The control treatment had no herbal supplement. At the end of the experiment, two birds (1 male and 1 female) were randomly selected per replicate for meat quality assessment. Moisture content, cooking loss, oxidative stability and palatability scores were determined. The moisture contents of the meat were not significantly ($p>0.05$) influenced by the herbal treatments but were highly influenced ($p<0.001$) by muscle type with drumstick having the highest significant value (74.58±1.92%). Oxidative stability was significantly ($p<0.05$) influenced by muscle type, thigh muscle had the highest MDA concentration (1.88±0.23mgMDA/kg meat). Result for ginger aroma showed that there were significant differences ($p<0.05$) due to herbal treatments. It was concluded that supplementation of garlic, ginger and their mixture in drinking water of broiler chickens up to 2.8g/L water had no adverse effect on their meat quality.
Keywords: Aromatic herbs, Broiler finishers, Cooking loss, Lipid Oxidation, Meat palatability

INTRODUCTION

Meat from broiler chickens is one of the most important animal protein source which could bridge the gap between demand and supply for quality protein. The growth of broilers is relatively fast with a shorter life cycle compared to other meat-producing livestock (Herawati and Marjuki, 2011). Increase in broiler meat production as well as increased storability would curb malnutrition which may arise due to increasing human population and their requirement for high quality food.

Garlic is well known for its medicinal benefits (Ou *et al*., 2003). Garlic supplements in diets of broiler chickens have been recognized for their strong immune stimulating effect and its rich aromatic oils enhance digestion in birds (Gardzielewska *et al*., 2003) and reduce abdominal fat (Onibi *et al*., 2009). Red ginger is also widely used in human food. It contains many bioactive compounds, minerals and vitamins which makes this plant a nutritious one. Garlic has a repulsive odour and taste while red ginger gives colouration to the mouth. Therefore, the supplementation of garlic and ginger in water for broiler chickens could mediate in getting the bioactive compounds in both herbs into the human food chain through broiler meat. Thus, this study evaluated the meat quality of broiler chickens offered garlic, ginger and a blend of both in drinking water.

MATERIALS AND METHODS

This study was conducted at the Poultry unit of the Teaching and Research Farm and Animal Production and Health Departmental meat laboratory of the Federal University of Technology, Akure, Ondo State, Nigeria. A total of two hundred and forty (240) broiler chickens (Arbor acre breed) were randomly assigned to 10 treatments with 3 replicates per treatment and 8 birds per replicate in a study that lasted 8 weeks. The birds were placed under good hygienic conditions throughout the experiment.

A 3 x 3 factorial arrangement in a Completely randomized design was adopted. There were 3 sources of herbal supplementation (garlic, ginger and 50:50 garlic and ginger blend) at 3 levels of supplementation (1.8, 2.3 and 2.8g/L). The control treatment had no herbal supplement. The garlic

and ginger used were processed before adding to the birds' drinking water. The chickens were fed and given water *ad libitum*.

At the end of the 8th week, 2 birds per replicate were selected for meat quality assessment. Cooking loss was done on thigh, drumstick and breast muscles. Sensory evaluation of garlic aroma, ginger aroma and general acceptability of cooked thigh meat was done using a 10-untrained member panel and oxidative stability was carried out using a modified method of (Pikul *et al*., 1989). Data collected were subjected to one-way and factorial analysis using Minitab statistical package (v10.2, Minitab Inc. USA).

RESULTS AND DISCUSSION

The results of the moisture content, cooking loss and oxidative stability of meat from broiler chickens offered garlic, ginger and their mixture in water are shown in Table 1. Moisture content was significantly

Table 1: Moisture, cooking loss and oxidative stability of meat from broiler chickens offered garlic, ginger and their mixture in water

			Moisture content (%)	Cooking loss (%)	Oxidative stability (mgMDA/kg muscle)
Control		Thigh	74.30±1.14	25.05±1.78	1.73±0.24
		Drumstick	73.23±0.61	24.73±2.12	2.10±0.14
		Breast	70.43±1.47	26.92±4.51	1.14±0.26
Herb	Garlic		73.67±2.36	25.44±3.26	1.74±0.39
	Ginger		73.43±2.67	26.05±3.10	1.73±0.26
	Garlic + Ginger		73.38±2.37	25.84±4.34	1.74±0.30
Level of supplementation					
		1.8	73.36±2.55	25.02±2.53	1.78±0.22
		2.3	73.64±2.13	26.69±4.25	1.74±0.36
		2.8	73.46±2.70	25.61±3.64	1.70±0.36
Muscle type effect					
		Thigh	74.04±2.27[a]	26.28±4.29[b]	1.88±0.23[b]
		Drumstick	74.58±1.92[a]	23.30±1.97[a]	1.87±0.22[b]
		Breast	71.60±1.92[b]	27.49±2.55[b]	1.47±0.32[a]
Herb x Level of supplementation					
	Garlic	1.8	72.60±3.09[b]	25.57±3.01	1.84±0.21
		2.3	74.01±1.31[a]	25.11±3.18	1.68±0.50
		2.8	74.39±2.18[a]	25.63±3.88	1.71±0.41
	Ginger	1.8	74.00±2.59[a]	24.29±2.75	1.65±0.24
		2.3	74.23±2.70[a]	26.34±2.55	1.72±0.34
		2.8	72.04±2.42[b]	27.53±3.32	1.82±0.19
	Garlic + Ginger	1.8	73.49±1.94[ab]	25.20±1.76	1.84±0.17
		2.3	72.69±2.03[b]	26.62±5.92	1.81±0.23
		2.8	73.96±3.08[a]	23.69±2.96	1.58±0.41
Herb x Muscle type					
	Garlic	Thigh	74.24±2.39	24.91±3.84	1.99±0.13
		Drumstick	74.68±1.83	23.36±1.85	1.84±0.24
		Breast	72.08±2.15	28.04±1.88	1.40±0.45
	Ginger	Thigh	73.98±2.34	26.44±3.19	1.91±0.14
		Drumstick	75.07±2.57	23.68±2.39	1.78±0.24
		Breast	71.81±1.66	28.04±2.08	1.51±0.24
	Garlic + Ginger	Thigh	73.81±2.73	27.90±5.94	1.81±0.35
		Drumstick	74.43±1.55	23.04±1.72	1.89±0.15
		Breast	71.89±2.12	26.58±2.97	1.52±0.26
Level of supplementation x Muscle					
	1.8	Thigh	74.27±2.54	25.17±3.29	1.87±0.17
		Drumstick	74.49±2.01	23.45±1.76	1.88±0.20
		Breast	71.33±1.94	26.43±1.33	1.58±0.18
	2.3	Thigh	74.16±1.13	28.77±5.41	1.98±0.12
		Drumstick	75.17±1.57	23.23±2.68	1.82±0.19
		Breast	71.61±1.85	28.08±1.34	1.41±0.44
	2.8	Thigh	73.61±3.21	25.30±3.97	1.86±0.35
		Drumstick	74.52±2.40	23.40±1.42	1.82±0.26
		Breast	72.26±2.16	28.13±3.55	1.44±0.32

Mean± Standard deviation

[ab]Means with different superscripts (ab) along the same column for the same parameter are significant (P<0.05)

(P<0.05) influenced by muscle type with drumstick having the highest value (74.04±2.27%), followed by thigh (74.58±1.92%) and then breast (71.60±1.92%). The moisture content values obtained across the herbal treatments were similar to those reported by (4) and they ranged between 72.04±2.42 and 74.39±2.18%. Cooking loss was significantly influenced by muscle type. The breast muscle recorded

the highest cooking loss (27.49±2.55%), followed by thigh (26.28±4.29%) and drumstick (23.30±1.97%). Ginger at 2.8g/L supplementation had the highest cooking loss (27.53±3.32%). This is in contrast with (2) which reported that adding red ginger to chicken ration increased cooking loss. Oxidative stability of the meat was measured as concentration of malondialdehyde (MDA) in meat. In agreement with (4), the thigh muscle had the highest MDA concentration (1.88±0.23 mg MDA/ kg meat), followed by drumstick (1.87±0.22 mg MDA/ kg meat) and the lowest value was reported for the breast muscle (1.47±0.32 mg MDA/ kg meat). The high MDA concentration in thigh could be attributed to the high fat content in the thigh area of the chicken.

Table 2 shows the results of garlic aroma, ginger aroma and palatability of thigh meat samples from broiler chickens offered garlic, ginger and their mixture in water. The result for ginger aroma showed significant ($P<0.05$) differences with the highest value of 2.13±0.87 at 2.3g/L level of supplementation. The general palatability assessment, although not significant, had numerically higher values for the thigh muscle with herbal supplementation. Hence, the acceptability of meat with garlic and ginger aroma would not be resisted by consumers.

Table 2: Garlic aroma, ginger aroma and palatability of meat from broiler chickens offered garlic, ginger and their mixture in water

		Garlic aroma	Ginger aroma	Palatability
Control		1.25±0.46	1.67±0.87	5.09±1.10
Herb	Garlic	2.26±1.02	1.73±0.83^{b}	6.07±1.34
	Ginger	2.04±0.86	2.21±0.98^{a}	6.57±1.25
	Garlic + Ginger	1.79±0.88	1.77±0.71^{b}	6.63±1.03
Level of supplementation				
	1.8	2.21±1.10	1.63±0.82^{b}	6.23±1.22
	2.3	2.00±0.80	2.13±0.87^{a}	6.73±1.02
	2.8	1.92±0.91	1.96±0.84^{ab}	6.30±1.39

Mean± Standard deviation

^{ab}Means with different superscripts along the same column for the same parameter are significant ($P<0.05$)

CONCLUSION

The inclusion of garlic and ginger in drinking water of broiler chickens had no adverse influence on meat quality of the chickens. The thigh muscle was the most susceptible to oxidation, followed by the drumstick muscle and then the breast muscle. Palatability of meat was improved by the herbal supplements. It is recommended that garlic and ginger can be used in rearing broiler chickens at up to 2.8g/L water.

REFERENCES

Gardzielewska, J., Pudyszak, K., Majewska, T., Jakubowska, M. and Pomianowski, J. (2003). Effect of plant-supplemented feeding on fresh and frozen storage quality of broiler chicken meat. Electronic Journal of Polish Agricultural Universities, 6(2): #12.

Herawati, L. and Marjuki, K. (2011). The effect of feeding red ginger (*Zingiber officinale* rosc) as phytobiotic on broiler slaughter and meat quality. *International Journal of Poultry Science*, 10(12): 983- 985.

Ojo, M.O., Adesua, A.A., Noah, O.H., Akinade, A.J., Oloruntobi, O.T., Agbi, B.M. and Onibi, G.E. (2013). Performance of broiler finisher chickens offered a blend of garlic (*Allium sativum*) and ginger (*Zingiber officinale*) through water. In: Akpa, G.N., Dairo, F.A.S., Bawa, G.S., Solomon, I.P., Amaefuele, K.U., Odunsi, A.A. and Ladokun, A.O. (Editors). Industry standards and regulations: A tool for improved productivity in animal husbandry. Proceedings of 18th Annual Conf. and 2nd ASAN-NIAS Joint Annual Meeting held at the National Centre for Women Development, Tafawa Balewa Street, Central Business District, Garki, Abuja, Nigeria. 8-12 September, 2013. pp 205-208.

Onibi, G.E., Adebisi, O.E., Fajemisin, A.N. and Adetunji, A.V. (2009). Response of broiler chickens in terms of performance and meat quality to garlic (*Allium sativum*) supplementation. *African Journal of Agricultural Research*, 4 (5): 511- 517.

Ou, C.C., Tsao, S.M., Lin, M.C. and Yin, M.C. (2003). Protective action on human LDL against oxidation and glycation by four organosulphur compounds derived from garlic. *Lipids*, 38(3): 219- 224.

Pikul. J., Leszezynski, D.E. and Kummerow, F.A. (1989). Evaluation of three modified TBA methods for measuring lipid oxidation in chicken meat. *Journal of Agriculture and Food Chemistry*, 37: 1309- 1313.