EFFECT OF COLD WATER NEEM (*Azadirachta indica)* LEAVES EXTRACT ON MEAT QUALITY OF BROILER CHICKENS

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ABSTRACT
This study was conducted to determine the effect of cold water neem leaf extract on meat quality of broiler chicken. One hundred and sixty broiler chicks (Cobb) were randomly divided into four groups of 40 birds per treatment. Each group was sub-divided into four replicates of 10 birds. The birds in group 1 served as control and antibiotics were administered to them while 0.1, 0.2 and 0.3% concentration of neem leaf extract were administered to bird on groups 2, 3 and 4, respectively. The period of experiment was six weeks. The birds were fed ad libitum. One bird close to average final weight was selected randomly in each replicate and was slaughter at 42nd day of the experiment. Meat samples from breast muscle of the bird were subjected to cooking weight loss, refrigeration weight loss and sensory evaluation. The data obtained were subjected to one-way Analysis of Variance in a completely randomized design (RCD). The cooking loss increased ($P<0.05$) with higher concentration of the extract while refrigeration weight loss percentages were similar ($P>0.05$) across the treatments. The result on Sensory evaluation showed that only colour, tenderness and overall flavour were significantly ($P<0.05$) influenced. The study concluded that aqueous Neem (Azadirachta indica) leaf extract (ANLE) administration in drinking water of broiler chicken as alternative to antibiotics did not pose any adverse threat on the meat quality.
Keywords: neem extract, refrigeration and cooking losses, sensory evaluation, broiler chicken

INTRODUCTION
Medicinal plants extracts were developed and proposed for use in food as natural antimicrobials (Hsieh and Mau, 2001). Beneficial effects of herbal extracts or active substances in animal nutrition includes the stimulation of appetite and feed intake, the improvement of endogenous digestive enzyme secretion, activation of immune response and antibacterial, anti-viral, antioxidant and anthelminthic actions. Generally, plant extracts have no problem of antimicrobial resistance (Tipu *et al*., 2006) and broilers fed on herbal feed additives were accepted well by consumers (Hernandez *et al.*, 2004).
Aqueous extract of Neem leaves has a good therapeutic potential as anti-hyperglycemic agent, antibacterial agent and could be used for controlling airborne bacterial contamination in the residential premise (Mishra *et al.,* 2013). It was shown that Neem leaves extract acts as a growth promoter (Landy *et al.,* 2011), improves performance and hematological parameters (Nayaka *et al.*, 2013) and immune response (Jawad *et al*., 2013) in broilers. Due to paucity of information on the effect of neem leaf extract on meat quality, this study was designed to investigated the effect of cold water extraction of neem leaves on eat quality of broiler chickens.

MATERIALS AND METHODS
Experimental site: The rearing of birds took place at the Poultry Units of the Teaching and Research Farm, while the meat quality section was carried out at the Meat Processing Laboratory, Department of Animal Production and Health, College of Animal Science and livestock Production, of Federal University of Agriculture Abeokuta (FUNAAB).
Source and preparation of the extract: Fresh neem (*Azadirachta indica*) leaves were harvested, rinsed thoroughly with water to remove all the dirt from it then pounded in a mortar with pestle to increase the surface area for better extraction. The pounded leaves were weighed on the sensitive scale at 1, 2 and 3g, which were needed for the experiment. The weighed freshly pounded neem leaves were added to clean cold water (at room temperature) at 1g of neem leaves to 1 litre of water, 2g of neem leaves to 1 litre of water, and 3g of neem leaves to 1 litre of water and thereafter was left for 12 hours at room temperature and was sieve before it was offered to the birds.
Experimental Design: A Completely Randomized Design (CRD) was adopted for this experiment. The one hundred and sixty 7 days old broiler chicks of Cobb strain were allocated into four treatments

with each treatment contains 40 birds. Each treatment was further sub-divided into four replicates of ten birds each. The period of the experiment lasted for six weeks. The treatment groups are; Treatment 1 (Control) was administered antibiotics (Enrofloxacin at the manufacture's recommendation), Treatment 2 (0.1%) of neem extract in drinking water, Treatment 3 (0.2%) of neem extract in drinking water and Treatment 4 (0.3%) of neem extract in drinking water. Starter broiler diet of 23% CP and 11.47 MJ/Kg was supplied *ad libitum* for the first three weeks while finisher broiler diet of 20.10%CP and 11.62 MJ/Kg was supplied during the last three weeks of the experiment.

Data Collection: At the 42nd day of the experiment, one broiler chicken close to average final weight was selected randomly from each replicate and was slaughtered. After dressing, breast meat sample of 54.13-54.80g from each broiler chicken was cooked separately at 70°C for 15 minutes in a water bath (Egbeyale *et al*., 2012). The difference between the weights before and after cooking gave the cooking weight loss of the meat samples. Meat samples of another set of 51.20-54.50g were cut from the breast muscles of the slaughtered broiler chicken. Each sample was weighed and labeled according to the treatment before being stored in a refrigerator at about 10°C for 24 hours (Egbeyale *et al*., 2012).

Sensory evaluation: For sensory evaluation, a uniform size of cooked chicken breast meat was sliced into cubes and the cooked chicken breast meat was labeled according to each treatment and samples were allowed to cool before serving the panel. Eight educated panelists were isolated from each other, so as to prevent communication and each panelist was asked to rinse his/her mouth with ordinary water after each sample testing to avoid any carry over effects. The panelist evaluated the meat colour, flavour, juiciness, aroma, texture, saltiness and overall acceptability. The evaluators were asked to score the sample on nine points scale according to Egbeyale *et al*. (2012)

Statistical analysis: Data collected were subjected to one-way Analysis of Variance (ANOVA) and differences in means were separated using Duncan Multiple Range Test (SAS 2012) at 5% significance level.

RESULTS

The effect of aqueous neem leaf extract (ANLE) on cooking and refrigeration weight losses of broiler chicken is present in Table 1. Cooking weight loss (CWL) was significantly ($p<0.05$) influenced. The CWL of meat from birds on 0.3%ANLE were significantly higher than the control. However, the meat from birds that drank water containing 0.1 and 0.2% ANLE recorded values similar to both control and 0.3%ANLE group. The refrigeration weight loss and percentage refrigeration loss did not show any significant ($p>0.05$) different among the treatments.

Table 1: Effect of cold water neem (A*zadirachta indica*) leave extract on cooking and refrigeration loss of broiler chicken

	Inclusion level of NLE (%)			
Parameters	0	0.1	0.2	0.3
Cooking				
Weight before cooking (g)	54.80±0.47	54.13±0.78	55.33±1.36	54.30±1.11
Weight after cooking (g)	49. 15±0.37	47. 13±0.95	48. 90±1.26	46.98±1.36
Cooking weight loss (g)	5.65±0.37^{b}	7.00±0.61^{ab}	6.43±0.18^{ab}	7.33±0.55^{a}
Percentage weight loss (%)	10.30±0.61^{b}	12.94±1.12^{ab}	11.62±0.27^{ab}	13.52±1.11^{a}
Refrigeration				
Weight before refrigeration (g)	53.80±1.35	51.20±0.58	54.08±0.91	54.50±0.55
Weight after refrigeration (g)	52.75±1.18^{a}	48.75±1.03^{b}	51.50±1.19^{a}	52.50±0.87^{a}
Refrigeration weight loss (g)	1.05±0.35	2.45±0.73	2.58±1.52	2.00±0.34
Percentage weight loss (%)	1.93±0.62	4.80±1.45	4.68±2.79	3.69±0.68

$^{a,b;}$ Means on the same row with different superscripts are significantly ($p<0.05$) different

*the initial weight of the refrigeration was used as co-variate

The effect of aqueous neem leaf extract (ANLE) on sensory characteristics of broiler chicken meat is present in Table 2. The juiciness, meaty flavour, saltiness and overall acceptability were not significantly ($p>0.05$) influenced across parameters measured, while colour, tenderness and overall flavour were significantly ($p<0.05$) influenced.

Table 2: Effect of cold water neem (A*zadirachta indica*) leaves extract on sensory quality of broiler chicken

	Inclusion level of NLE (%)			
Parameters	0	0.1	0.2	0.3
Colour	5. 14±0.22^{ab}	4.79±0.31^{ab}	5.50±0.23^{a}	4.32±0.35^{b}
Juiciness	5. 39±0.30	6. 04±0.34	6. 11±0.24	5.93±0.38
Tenderness	5.14±0.38^{b}	5.71±0.35^{ab}	6.39±0.34^{a}	5.18±0.35^{b}
Overall Flavour	5.18±0.26^{ab}	4.86±0.30^{b}	5.75±0.28^{a}	5.07±0.33^{ab}
Meaty Flavour	6.14±0.29	6.36±0.31	6.50±0.20	6.17±0.30
Saltiness	5.04±0.28	5.04±0.26	4.54±0.20	4.75±0.40
Overall acceptability	5.18±0.33	4.96±0.36	5.68±0.32	4.79±0.34

$^{a,b;}$ Means on the same row with different superscripts are significantly ($p<0.05$) different

DISCUSSION

The cooking loss values reported in this study are lower than the values reported by Gohar *et al*. (2012) who compared cooking loss in broiler and layer meat and reported that cooking loss in broiler meat was in the range of 15.55 to 36.00%. The increase in the cooking weight losses with increasing levels of ANLE obtained in this study is in accordance with the results of the work of Ncube *et al*. (2018) who studied the effect of *Acacia angustissima* leaf meal on yield of carcass components and meat quality of broilers and reported that increasing levels of the leaf meal resulted in drier meat. High cooking loss also implies the less ability of the meat to hold water during processing and storage (Abu *et al*., 2015). According to Michalczuk *et al*. (2014), high meat cooking loss has an adverse effect on sensory perception as it reduces juiciness. The influence of ANLE on tenderness and overall flavour is consistent with results published by Jang *et al.* (2008) on the enhancement of flavour after feeding a mixture of herbal tree extracts to broilers. Similarly, the result agrees with Aderinola *et al.* (2013) who reported enhanced flavour of meat from *Moringa oleifera*-fed broilers. These similarities in juiciness and meaty flavour are in agreement with findings of Bonsu *et al*. (2012) who studied the medicinal response of broiler chickens to diets containing neem (*Azadirachta indica*) leaf meal. Egbeyale *et al*. (2012) in their study of meat qualities characteristics of broiler chicken fed varying levels of *Ocimum gratissimum* reported that parameters such as juiciness, saltiness and overall acceptability were not significantly influenced. However, the authors reported that overall flavour were significantly influenced which is in accordance with the results of this study.

CONCLUSION AND RECOMMENDATION

Aqueous extracts of neem (*Azadirachta indica*) leaf at 0.3% could be administered in the drinking water of broiler since it does not compromise the quality of meat.

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