Paper presentation on:

ASSESSMENT OF THE OXIDATIVE AND BACTERIOLOGICAL STATUSES OF PORK FROM PIGS FED DIETS SUPPLEMENTED WITH GARLIC

by

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Main Captions

- ❑ **Introduction**
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- ❑ **Materials and Methods**
- ❑ **Results and Discussion**
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Introduction

- ✓ Huge Demand for Meat (Adebambo, 1995; Warriss, 2010)
- ✓ Recent concern over use of synthetic growth promoters (Marisol, 2010; Onyimonyi and Omeje, 2013)
- ✓ Current Legal Issues (Peter, 2010)
- ✓ Public Health Attention (Wenk, 2000; Oliver *et al.,* 2011)

Literature Assay

Brief History of Garlic

Garlic is a perennial plant in the family Alliaceae and genus Allium, closely related to the onion, shallot and leek. Garlic consists primarily of alliin which, by means of enzyme allinase, is converted into allicin, a powerful antibiotic and anti-fungal compound (Hogea, 2009).

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Other constituents of garlic are ajoene (which contributes to the anticoagulant action of garlic), enzymes, vitamin B, E and C, folic acid, panthothenic acid and niacin, minerals (Mn, K, Ca, P, Mg, Se, Na, Fe, Zn, Cu), amino acids (glutamic acid, arginine, aspartic acid, leucine, lysine, valine etc), essential oil with many sulphur-containing components (allyl disulfide, allyl trisulfide, etc), flavonoids (particularly quercetin which is present abundantly in onion) etc (MacIntosh, 1995). Some nutritional properties of garlic are as shown in Table 1.0.

Table 1.0: Nutritional value and properties of garlic (per 100g of raw garlic)

Properties	Values
Energy (kcal)	119.00
Moisture (%)	70.00
Protein (g)	4.30
Carbohydrate (g)	24.30
Minerals (mg)	643.21
Vitamins (mg)	15.53
Fiber (g)	1.20
Fat (g)	0.23
Alcohol (g)	0.00
Ash (%)	2.30

Source: Alejandra *et al.* (2010)

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Allicin is the key constituent of garlic that gives it its antibiotic properties and is responsible for its sharp pungent odour. The allicin contained in garlic has a fibrinolytic activity which reduces platelet aggregation by inhibiting prostaglandin E2 (MacIntosh, 1995). S-allyl cysteine, present in crushed garlic, is found to inhibit tumor metabolism and enhance immune response (Sumiyoshi, 1997).

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The allyl sulfides enhance the glutathione S-transferase enzyme systems, which through their dependent biochemical pathways enhance the liver's detoxification of carcinogenic substances (Sumiyoshi, 1997). The allium species show immune enhancing activities that include promotion of lymphocyte synthesis, cytokine release, phagocytosis and natural killer cell activity (Kyo *et al.*, 1998).

Materials and Methods

- Study Location
- Experimental Animals
- Experimental Treatments
- Experimental Design and Feeding Trial
- Data Analysis

Study Location

The experiment was carried out at the Piggery Unit of the Teaching and Research Farm, Federal University of Technology, Akure, Ondo State, Nigeria. The location is on 7°15'N/5°12'E.

Experimental Animals

Sixteen (16) growing pigs of mixed breeds (Large White, Landrace and Duroc) weighing between 24.5 and 27.5 kg, comprising eight boars and eight gilts were used.

Experimental Treatments

The garlic bulbs were purchased at Oja Oba market in Akure, peeled, chopped, sun-dried, ground and supplemented in the basal diet (0, 1, 2.5 and 5 g garlic/kg). The basal grower-finisher diet (Table 2.0) was formulated to contain 17.71% CP and 2653.21 kcal/kg DE. The four dietary treatments were designated T1 (0g garlic/Kg), T2 (1.0g garlic/Kg), T3 (2.5g garlic/Kg) and T4 (5.0g garlic/Kg).

Table 2.0: Gross composition of grower-finisher basal diet

Feed Ingredients	% Composition
Maize	41.00
Wheat offal	10.00
Brewer's Dry Grain	10.00
Groundnut Cake	10.00
Soybean Meal	6.00
Palm Kernel Cake	20.00
Bone meal	2.00
Limestone	0.50
Premix	0.25
Salt	0.25
Total	**100.00**

Chemical composition	Calculated	Proximate
Digestible Energy (Kcal/kg)	2653.12	-
Moisture (%)	-	14.31
Crude Protein (%)	17.71	18.11
Ether Extract (%)	-	3.53
Crude Fiber (%)	-	4.88
Ash (%)	-	10.21
Nitrogen Free Extract (%)	-	48.96

Experimental Design and Feeding Trial

The pigs were fed the basal diet *ad libitum* for a two-week adaptation period after which they were randomly assigned to the four experimental treatments for a nine-week feeding period in a **completely randomized design (CRD).**

There were four replicates per treatment with each pig serving as a replicate as the pigs were individually penned and fed. Each treatment had two growing boars and gilts. The diets were offered at 5% of pig's weekly average body weight and fed twice (morning and evening) daily while clean water was provided *ad-libitum* throughout the experimental period.

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At the end of the feeding trial, the pigs were starved overnight, stunned and slaughtered. Meat from the left thighs of each of the carcasses were then refrigerated for up to five (5) days for determination of oxidative stability using the aqueous extraction 2-thiobarbituric acid (TBA) method described by Pikul *et al.* (1989) and Onibi (2003) and bacteriological status according to Lamb (1981).

Data Analysis

The data collected were subjected to factorial analysis using the Minitab Statistical Package (v.17.1, Minitab Inc. USA).

Results and Discussion

Table 3.0: Oxidative stability and bacterial load of meat from pigs fed diets supplemented with garlic

Level of dietary garlic supplementation (g/kg diet)	Length of refrigerated storage (days)	Extent of oxidation (mg MDA/kg meat)	Bacteria Load ($\times 10^{-4}$cfu/g)
0	1	0.13±0.06	3.15±0.21
	5	0.34±0.13	4.05±0.07
1.0	1	0.13±0.01	2.10±0.14
	5	0.28±0.20	2.65±0.21
2.5	1	0.12±0.08	1.80±0.28
	5	0.24±0.10	2.05±0.35
5.0	1	0.13±0.01	1.55±0.21
	5	0.24±0.06	1.30±0.01
Statistical Significance			
Level of supplementation		NS	***
Length of refrigeration		***	**
Level x Length		NS	*
Mean Separation			
Effect of level of supplementation (g/kg diet)	0	0.24±0.14	3.60 ± 0.54^{c}
	1.0	0.20±0.15	2.38 ± 0.35^{b}
	2.5	0.18±0.10	1.93 ± 0.24^{ab}
	5.0	0.19±0.09	1.43 ± 0.19^{a}
Effect of length of refrigerated storage (days)	1	0.13±0.05	2.15±0.67
	5	0.27±0.13	2.51±1.09

Mean±standard deviation; n=4; NS = Not significant (P>0.05); ***= P<0.001; **=P<0.01; *=P<0.05; MDA = Malondialdehyde.
Means with different superscripts within the column for the same parameter are significant (P<0.05)

Table 3.0 shows the extent of oxidation of pork refrigerated for a day and five days as well as the bacterial load of the meat. The results showed that the level of garlic supplementation had no significant ($P>0.05$) effect on oxidative stability of refrigerated pork but malondialdehyde (MDA) concentration decreased due to dietary garlic supplementation.

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The MDA concentration of the refrigerated pork significantly ($P<0.001$) increased from 0.13 ± 0.05 mg/kg meat on day 1 to 0.27 ± 0.13 mg/kg at 5 days of refrigeration showing that oxidation of meat continues even during refrigerated storage.

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The reduction in MDA concentration of meat due to dietary garlic supplementation suggests the antioxidant ability of garlic due to activities of *allicin* and other compounds. This agrees with the reports of Onibi *et al.* (2009) on improved oxidative stability of meat of broiler chickens fed diets supplemented with garlic. The interaction between the level of supplementation and length of storage showed no significant ($P>0.05$) effect on the extent of oxidation.

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There was a significant ($P<0.001$) reduction in bacteriological load of the refrigerated meat with increasing levels of dietary garlic. This could be attributed to the inhibitory action of sulphur containing compound in garlic against certain bacteria as reported by Carson (1987).

Conclusion

Garlic supplementation at up to 5 g/kg diet for pigs improved oxidative stability and reduced bacterial load of meat during refrigerated storage. Thus, this could be a strategy for improving storability of pork.


Thanks for listening!