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Effect of Sole and Combined Herbal Leaf Meal as Feed Additives on Growth Performance and Morphological Indices of Sexed Pigs

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***Target audience**: pig farmers, researchers, animal scientists*

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Abstract

Thirty (30) growing pigs were used to determine the effect of sole or combined herbal leaf meal as in-feed antibiotics on growth performance and morphological indices of male and female pigs. The pigs were grouped on weight equalization into 10 treatments of 3 pigs per treatment with one pig serving as replicate. The experimental design is 5 by 2 factorial arrangement, factor A comprised of growing pigs on herbal-mix feed additives (diets without antibiotics or herbs, in-feed antibiotics, moringa leaf meal, neem leaf meal, moringa-neem leaf meal. Factor B is the sexes of pigs (male and female). Initial growth parameters of the pigs were taken at the beginning of the study and subsequent live weight and linear body measurements were taken weekly. Data were subjected to one-way ANOVA using SAS 2000. Results showed that the morphological indices of growing pigs were not affected by sex of the pigs. Body length, loin girth and face length of growing pigs were positively enhanced by sole or combined herbal leaf meal in the ration of growing pigs. The interaction between dietary inclusion of herbal leaf meal and sex had effects on loin girth, face length and thigh width. It can be concluded from this study that dietary inclusion of herbal leaf meal (sole or combined) can serve as an alternative to in-feed antibiotics as similar results were obtained in growth indices and morphological parameters of pigs on herbal and synthetic antibiotics.

***Key words:** Herbal leaf meal, Performance, pigs, morphology, neem*

Description of problem

In modern meat production, especially in pigs, the use of antibiotics improved the efficiency of feed conversion, resulting in faster weight gain and economic benefits (1). Nevertheless, the abuse and misuse of antibiotic agents in meat production have led to antibiotic resistance of zoonotic bacteria including *Salmonella enterica*, *Escherichia coli*, *Campylobacter jejuni*, and *Clostridium perfringens* in pig and poultry populations (2). The continuous use of antimicrobial agents may lead to a weakening of the immune system and to an imbalance of the intestinal microbiota. Furthermore, an animal with a weak immune system is susceptible to infection by pathogenic microorganisms including bacteria and viruses, which can reduce production performance. In order to maintain and enhance animal body weight, the scientific community and the industry are continuously searching for reliable and appropriate alternatives to antibiotics, for both growth promotion and therapeutic applications (3). There are numbers of agro-industrial by-products, farm wastes, or crop residues that have been exploited as alternative feed sources for high-energy cereals and protein sources. These have made a substantial contribution towards better and more economical feeding of non-ruminants. Efforts have been in the utilization of Moringa (*Moringa oleifera*) and Neem (*Azadirachta indica*) leaf meals as

protein sources in livestock production (4;5) in order to enhance the growth and improve the health of these animals, leading to efficient utilization of resources. Moringa (*Moringa oleifera*) is known as a miracle tree because of its numerous nutritional properties. Moringa leaves are valuable source of protein for ruminants. Its protein and organic matter is readily digestible in the rumen and/or in the intestine (6). Neem leaf contains approximately 20.69% crude protein and 4.1% fat after processing into neem meal via drying and milling (7). The neem tree contains more than 100 bioactive ingredients and the most important bioactive compound is azadirichtin (8). Neem leaf is one of the most researched trees in the world, having attracted worldwide prominence due to their vast range of medicinal properties like antibacterial, antifungal, antiprotozoal, hepatoprotective and various other properties without showing any adverse effects (9).

Plant extracts have been proposed as effective additives in swine production for potential beneficial effects on pig performance and health (10). The mechanism of the action of herbal feed additives will stimulate the pig's growth formation, and improved palatability, and productive performance (5). The aim of this experiment was to determine the influence of sole or combination of herbal leaf meal as alternative in-feed antibiotics on growth indices and morphological parameters of growing sexed pigs.

Material and Methods

Experimental site: The experiment was carried out at the Piggery Unit of the Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta, Nigeria.

Source and preparation of herbal leaf meal**:** Fresh matured neem and moringa leaves were harvested in and around the Federal University of Agriculture, Abeokuta. The leaves were air dried for 5 days without exposure to direct sunlight, being turned over at intervals to avoid fungal growth, until they became crispy while retaining their greenish coloration. The leaves were tightly packaged in sack bags, sealed, kept at room temperature, and later taken to the feed mill to be crushed into a meal.

Experimental animals and management: A total of thirty (30) growing pigs of both sexes were bought from a reputable farm in Abeokuta, Ogun state. The pigs were raised under an intensive system of management. The pigs were grouped on weight equalization into 10 treatments of 3 pigs per treatment with one (1) pig serving as a replicate group. The housing floor was washed and disinfected and the pens were put in good condition before the arrival of the animals. On arrival of the pigs, they were injected with endoparasite and ectoparasites and were allowed to adjust to the environment for 7 days before the experiment commenced. Each pig was housed in a pen with a floor dimension of 2 m x 2 m, equipped with concrete feeding and watering troughs. The pens are half-walled of about 1.5 m high and the rest were opened for adequate ventilation. Daily routine management practices were carried out, clean water was supplied *ad libitum* throughout the experimental period.

Experimental design: the experiment was arranged in 5x2 factorial arrangements consisting of two factors (sex-male and female and different herbal mix feed additives-control without antibiotics or herbs, diet with in-feed antibiotics (oxytetracycline), diets with moringa leaf meal, diets with neem leaf meal, diets with moringa and neem leaf meal mix as shown in the feed formulation as contained in table i).

Table 1: Percentage Composition of Experimental Diets of Growing Pigs

Ingredients	Diet 1	*Diet 2	Diet 3	Diet 4	Diet 5
Maize	50	50	50	50	50
Palm kernel cake	10	10	3.5	0.3	2.2
Moringa leal meal	-	-	10	-	6
Neem leaf meal	-	-	-	10	4
Soya bean meal	18	18	18	18	18
Groundnut cake	10	10	6.5	9.7	7.8
Fish meal	1	1	1	1	1
Wheat offal	6.9	6.9	6.9	6.9	6.9
Bone meal	3	3	3	3	3
Lysine	0.3	0.3	0.3	0.3	0.3
Methionine	0.25	0.25	0.25	0.25	0.25
Premix	0.5	0.3	0.3	0.3	0.3
Salt	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
Digestible energy (Kcal/kg)	2832.77	2832.77	2567.02	2825.58	2670.41
Crude protein (%)	20.41	20.41	20.40	20.42	20.41
Ether extract (%)	4.55	4.55	4.13	3.96	4.06
Crude fibre (%)	4.78	4.78	5.94	4.99	5.56

*Feed grade antibiotics (Oxytetracycline) was added in the ration+

Data collection

Feed intake was determined by subtracting the feed left-over from the feed supplied on a daily basis. The initial body weight of pigs was taken on the first day of the study and documented while weekly records of change in body weight were subsequently taken and documented. The feed conversion ratio was calculated as the ratio of feed:gain. The protein efficiency ratio was calculated as weight gain /protein intake

Morphological parameters (body weight, body length, chest or hearth girth, loin girth, height at wither, ear length, face length and tail length) of the pigs were taken on a weekly basis following the procedure of (11).

Table ii: Effects of sex and sole or combined herbal leaf meal as alternative in-feed antibiotics on growth performance of growing pigs

	Herbal leaf meal					**Sex**	
Parameter (kg)	Control (-)	Control (+)	Neem	Moringa	Composite	Gilt	Boar
Initial weight	24.50±3.48	24.58±1.37	23.08±1.38	25.50±5.64	25.00±1.96	24.70±1.53	24.37±2.27
Final weight	53.83±5.90	52.00±3.08	53.17±3.84	51.50±7.55	54.00±3.15	52.80±2.75	53.00±3.25
Total Weight gain	29.33±2.68	27.42±2.33	30.08±2.85	26.00±2.11	29.00±2.39	28.10±1.56	28.63±1.51
Daily weight gain	0.35±0.03	0.33±0.03	0.36±0.03	0.31±0.03	0.35±0.03	0.33±0.02	0.34±0.02
Total feed intake	150.80±9.18	150.10±6.19	150.08±5.02	149.08±7.16	150.34±5.09	150.46±4.40	149.70±3.58
Daily feed intake	1.80±0.07	1.79±0.07	1.79±0.06	1.70±0.06	1.79±0.06	1.79±0.04	1.78±0.04
Feed conversion ratio	5.25±0.19	5.50±0.32	5.09±0.33	5.97±0.21	5.42±0.54	5.48±0.19	5.35±0.23

Statistical analysis

Data collected were subjected to a two-way analysis of variance in 5x2 factorial experimental layouts as outlined in the Statistical Analyst Software (12) package. Significantly ($P<0.05$) different means among variables were separated using New Duncan's Multiple Range Test as contained in SAS (12) package.

Results and Discussion

The results from this study show that the growth performance of pigs fed diets containing herbal leaf meal as an alternative in-feed antibiotic was not significantly ($P>0.05$) affected. As shown in Table ii and iii, the results obtained from pigs on dietary inclusion of herbal leaf meals had similar result with those fed synthetic antibiotics with boar pigs fed the composite diet of neem and moringa having highest final weight values. This is contrary to the opinion of (13) who had reported that different bio-active components of leaf meal may be responsible for depression in nutrient utilization and growth in rabbits at higher levels. (14) observed that the replacement of fishmeal with moringa as a dietary protein source for Nile tilapia at an inclusion level of 10% had no negative effect on their growth performance. Similarly, (15) also reported that the inclusion of raw moringa at levels of 13%, 27%, and 40% in Nile tilapia diets resulted in lower growth rates. (16) also reported that increasing the inclusion level of moringa beyond 5% in broiler feed resulted in a reduction in growth performance. The non-significant ($P>0.05$) effect of total feed intake and daily feed intake in all the dietary treatments suggested that the feeds were palatable and the pigs showed total acceptability irrespective of the dietary treatments.

Table iii: Interactive effects of sex and dietary inclusion of herbal leaf meal on growth performance of growing pigs

Sex			Gilt					Boar			
Herbal leaf meal	Control (-)	Control (+)	Neem	Moringa	Composite	Control (-)	Control (+)	Neem	Moringa	Composite	
Parameter (kg)											SEM
Initial weight	25.50	25.88	22.83	23.17	26.17	23.50	23.33	23.33	27.83	23.83	2.33
Final weight	53.67	52.00	49.67	49.67	59.00	54.00	52.00	56.67	53.33	49.00	2.98
Weight gain	28.17	26.17	26.83	26.50	32.83	30.50	28.67	33.33	25.50	25.17	2.00
Daily weight gain	0.34	0.31	0.32	0.32	0.39	0.36	0.34	0.40	0.30	0.30	0.02
Total feed intake	1.62	1.64	1.64	1.63	1.64	1.65	1.63	1.63	1.62	1.62	5.26
Daily feed intake	136.17	137.67	137.50	137.10	137.82	138.37	136.67	136.96	136.03	135.87	0.05
Feed conversion ratio	4.96	5.47	5.11	5.23	4.23	4.55	4.67	4.23	5.41	5.63	0.26

Table iv: Effects of sex and sole or combined herbal leaf meal as alternative in-feed antibiotics on morphological indices of growing pigs

	herbal leaf meal					**Sex**	
Parameter (cm)	Control (-)	Control (+)	Neem	Moringa	Composite	Gilt	Boar
Body length	$1.47^{b}\pm0.24$	$1.94^{ab}\pm0.19$	$2.17^{a}\pm0.24$	$2.02^{ab}\pm0.19$	$1.93^{ab}\pm0.20$	1.90±0.14	1.91±0.15
Chest girth	0.09±0.02	0.13±0.02	0.15±0.02	0.14±0.02	0.13±0.02	0.13±0.01	0.13±0.01
Height at wither	1.15±0.14	1.15±0.09	1.32±0.03	1.25±0.12	1.06±0.19	1.17±0.08	1.20±0.17
Tail length	0.43±0.06	0.38±0.08	0.81±0.14	0.44±0.11	0.60±0.24	0.55±0.12	0.52±0.06
Ear length	0.03±0.06	0.31±0.5	0.33±0.04	0.26±0.05	0.29±0.05	0.27±0.02	0.33±0.03
Loin girth	$1.87^{a}\pm0.19$	$1.68^{ab}\pm0.12$	$1.56^{abc}\pm0.14$	$1.19^{c}\pm0.14$	$1.31^{bc}\pm0.06$	1.57±0.11	1.47±0.10
Neck circumference	1.05±0.15	1.36±0.11	1.18±0.10	1.03±0.06	1.24±0.14	1.12±0.18	1.23±0.06
Face length	$0.29^{b}\pm0.04$	$0.23^{b}\pm0.05$	$0.29^{b}\pm0.03$	$2.52^{a}\pm0.09$	$0.32^{b}\pm0.06$	0.28±0.04	0.38±0.04
Thigh width	0.72±0.11	0.92±0.10	0.97±0.12	0.95±0.13	1.19±0.23	1.02±0.10	0.88±0.08

^{abc} Means on the same row with different superscripts are significantly ($P<0.05$)

Table v: Interactive effect of sex and herbal leaf meal on morphological indices of Growing Pigs

Sex			Gilt					Boar			
Herbal leaf meal	Control (-)	Control (+)	Neem	Moringa	Composite	Control (-)	Control (+)	Neem	Moringa	Composite	
Parameter (cm)											SEM
Body length	1.47	1.84	2.19	2.10	1.89	1.46	2.03	2.15	1.94	1.97	0.13
Chest girth	0.09	0.13	0.17	0.15	0.12	0.09	0.14	0.15	0.14	0.14	0.01
Height at wither	1.14	1.08	1.31	1.08	1.23	1.17	1.21	1.34	1.42	0.89	0.11
Tail length	0.31	0.39	0.92	0.46	0.67	0.55	0.37	0.71	0.43	0.54	0.20
Ear length	0.26	0.28	0.26	0.20	0.32	0.34	0.34	0.39	0.31	0.26	0.03
Loin girth	2.06^{a}	1.70^{ab}	1.47^{ab}	1.28b	1.36^{b}	1.68^{ab}	1.66^{ab}	1.65^{ab}	1.11^{b}	1.25^{b}	0.11
Neck circumference	0.94	1.26	1.08	0.94	1.32	1.12	1.46	1.28	1.11	1.67	0.17
Face length	0.27^{bc}	0.14^{c}	0.26^{bc}	0.48^{ab}	0.25^{bc}	0.31^{abc}	0.31^{abc}	0.31^{abc}	0.56^{a}	0.38^{abc}	0.15
Thigh width	0.62^{b}	0.85^{b}	1.06^{b}	0.94^{b}	1.63^{a}	0.82^{b}	0.98^{b}	0.88^{b}	0.96^{b}	0.75^{b}	0.11

^{abc} Means on the same row with different superscripts are significantly ($P<0.05$)

It is also suggested that the pigs were not motivated to consume more feed with the addition of herbal leaf meals. Voluntary feed intake has been used by (17) as a function of acceptability, palatability, and utilization.

No significant ($P>0.05$) differences were recorded in Table iv while Loin girth, face length and thigh width had significant differences between values as shown in Table v. (18) opined that morphological indices provide information on the growth rate and feed utilization of boar and that the morphological indices increase as animals grow over time. Also, (19); (18); (20) and (11) asserted that morphological parameters indicate the growth of tissue, and tend to increase positively with the growth of the animal. Face length was highest in pigs fed moringa leaves. The increased body length and face length of pigs fed herbal diet could have resulted from the better conformation of the pigs on herbal leaf meal (21; 22; 23) as well as the extra nutrients it supplies since neem leaves contain appreciable amounts of proteins, minerals, carotene and adequate amount of trace minerals (13). The decrease in the loin girth of pigs fed on herbal leaf meal diet might be a result of phytochemicals in the herbal leaf meal ration. Leaf meals are known to contain some chemical compounds such as phenols, tannins, oxalates, phytates, saponins, alkaloids, hydrocyanide etc (24). Even though these chemical substances may have some health benefits, they are reported to contain antinutrients (25). These feed additives have been reported to reduce nutrient digestibility and efficiency of feed utilization. (26) reported that the presence of phytates and other antinutrients can reduce the bioavailability of certain nutrients, thus depressing growth. (13) reported that different bioactive components of leaf meal may be irreplaceable for depression in nutrient utilization and growth of pigs at a higher level (27) reported that feed deterrents and depressants reduce palatability and acceptability index.

Conclusions and Applications

The study established that:

1. Sex had no visible effect on growth performance and morphological indices of growing pigs.
2. Sole or combined herbal leaf meal as an alternative in-feed antibiotic had no influence on the growth parameters of growing pigs.
3. Body length, loin girth and face length of growing pigs were positively enhanced by sole or combined herbal leaf meal in the ration of growing pigs.
4. The interaction between sex and sole or combined herbal leaf meal greatly impacted the loin girth, face length, and thigh width of growing pigs.
5. Hence, it can be recommended that sole/combined herbal leaf meals can

serve the purpose of replacing in-feed synthetic antibiotics and can be used to enhance the body length and face length of growing pigs.

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