

VILLI MORPHOMETRIC TRAITS OF BROILER CHICKENS FED DIETS CONTAINING RATIOS OF *Piper guineense* AND *Gnetum africanum*

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Abstract

The study evaluated the effects of dietary inclusion ratios of *Piper guineense* and *Gnetum africanum* on villi morphometric traits of broiler chickens. Two hundred and fifty-five (255) day-old Ross 308 broiler chicks were allotted to five dietary treatments with three replicates of seventeen birds each in a completely randomized design. The diets contained combinations of *P. guineense* and *G. africanum* at ratios of 0, 25:75, 50:50, and 75:25, with oxytetracycline serving as a reference control, with 25:75, 50:50, and 75:25 representing *P. guineense* and *G. africanum* at 62.5g+375g, 125g+250g and 187.5g+125g, respectively. Intestinal samples were collected and analyzed for villi height, width, crypt depth, surface area, and perimeter. Results revealed significant ($p < 0.05$) differences in all villi morphometric parameters except villi height to crypt depth ratio. Birds fed the 75:25 ratio of *P. guineense* to *G. africanum* exhibited superior villi area, perimeter, and height, indicating improved intestinal morphology and absorptive capacity. The enhanced villi development suggests a synergistic effect of the phytochemicals and essential oils present in the plant combination, promoting gut health and nutrient utilization.

Keywords: *Piper guineense*, *Gnetum africanum*, Broiler chickens, Villi morphology, Phytogetic feed additives

Description of Problem

The morphology of the intestinal villi plays a crucial role in nutrient absorption and overall growth performance of broiler chickens. The structure and integrity of villi are influenced by several dietary factors, including the inclusion of phytogetic feed additives. Phytogetic plants such as *Piper guineense* (West African black pepper) and *Gnetum africanum* (African bush spinach) are rich in bioactive compounds including alkaloids, flavonoids, tannins, and essential oils, which possess antioxidant, antimicrobial, and gut-modulating properties [1].

These properties have been reported to improve intestinal health, enhance nutrient utilization, and stimulate villi development in poultry [2]. However, the combined use of *Piper guineense* and *Gnetum africanum* in varying dietary ratios and their effects on villi morphometric traits such as villi height, crypt depth, and surface area remain underexplored. Hence, the study evaluate the combinations of *Piper guineense*

and *Gnetum africanum* in varying dietary ratios on intestinal morphology.

Materials and Methods

The experiment was conducted at the Poultry Unit of the Division of Agricultural College (DAC) Farm, Ahmadu Bello University, Zaria, Kaduna State. Zaria is in the Northern Guinea Savannah zone, located on longitude 11° 09' 01.78" N and 7° 39' 14.79" E 671m above sea level. The climate is characterized by a well-defined dry and wet seasons. The climate is relatively dry with a mean annual rainfall of 700-1400mm [3].

Two hundred and fifty-five day-old Ross 308 broiler chicks were allocated to five (5) dietary treatments with three (3) replicates of seventeen (17) birds each in a completely randomized design (CRD). The birds were housed in deep litter pens and managed with all necessary routine management practices. Feed and water were provided *ad libitum* for the 7 weeks period of the experiment. Five experimental diets were formulated containing mixtures of *Piper*

guineense (250g) and *Gnetum africanum* (500g) at a ratio of 0, 25:75 (62.5g+375g), 50:50 (125g+250g) and 75:25 (187.5g+125g) and oxytetracycline, respectively.

Intestinal segment samples (approximately 2cm in length) were taken from birds to ascertain villi morphometric parameters. The morphometric indices that were evaluated included villi height, villi width, crypt depth, surface area, perimeter and the ratio of villi height to villi depth at the Histology Laboratory, Department of Human Anatomy, Ahmadu Bello University, Zaria. All data obtained were statistically analysed using the General Linear Model Procedure of Statistical Analysis Systems software package version 9.0. Significant ($p < 0.05$) differences between treatments means were separated using Tukey Test [4].

Results and Discussion

Table 1 shows the villi morphometric of broiler chickens fed diets containing ratios of *P. guineense* and *G. africanum*. Significant ($p < 0.05$) differences were observed in all parameters measured except for villi height/crypt depth. Villi area was higher ($p < 0.05$) for birds fed ratio of *P. guineense* and *G. africanum* at a ratio of 75:25. Villi perimeter, height and crypt depth were the same and higher for all treatment groups containing ratios of the *P. guineense* and *G. africanum*. A large crypt indicates a fast tissue turnover and a high demand for new tissue [5]. Presence of longer villi has been reported to increase crypt depth of the mucosa of the small intestine resulting in better feed conversion [6]. The morphology of intestinal villi and crypts has been associated with intestinal function and growth in chickens. Higher intestinal villi are associated with increased absorptive surface area of the intestine and thus, an increased absorptive capacity with resultant higher body weight gain [7].

Table 1: Villi morphometry of broiler chickens fed diets containing the ratios of *P. guineense* and *G. africanum*

Parameters	Control	Ratios of PG:GA			Oxytet	SEM
		75:25	50:50	25:75		
Villi Area (μm^2)	13225.64 ^c	30710.24 ^a	19787.76 ^b	23630.77 ^b	12466.53 ^c	3436.25
Villi Perimeter (μm)	874.16 ^{ab}	922.99 ^a	901.82 ^a	982.86 ^a	652.44 ^b	110.11
Villi Height (μm)	397.86 ^a	400.25 ^a	410.23 ^a	437.38 ^a	273.59 ^b	56.00
Villi Width (μm)	73.33 ^b	137.91 ^a	80.58 ^b	133.22 ^a	113.27 ^{ab}	23.18
Crypt Depth (μm)	108.62 ^a	93.33 ^{ab}	95.64 ^{ab}	94.97 ^{ab}	79.14 ^b	10.81
V. Height /C. Depth	3.79	4.32	4.42	4.51	3.54	0.62

^{abc}Means with the same superscripts along the rows are not significantly different ($p > 0.05$), SEM: standard error of means, V: Villi, C: Crypt, PG: *Piper guineense*, GA: *Gnetum africanum*.

Conclusion and Application

The inclusion of *Piper guineense* and *Gnetum africanum* in broiler diets, particularly at a ratio of 75:25, improved villi morphometric traits, indicating enhanced intestinal development and potential for better nutrient absorption and growth performance. It is recommended that *Piper guineense* and *Gnetum africanum* be incorporated into broiler diets at a 75:25 ratio as a natural phytogenic additive to enhance intestinal morphology and support efficient feed utilization.

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