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MORPHOLOGICAL STUDIES ON MECKEL'S DIVERTICULUM IN TWO GENOTYPES OF NIGERIAN INDIGENOUS CHICKENS

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ABSTRACT

Morphological studies were carried out on the Gastrointestinal tracts (GIT) of two genotypes of Nigerian indigenous chickens with particular emphasis on Meckel's diverticulum (MD). Twenty adult male chickens of two genotypes (10 birds per genotype), all above one year of age, were used to determine the gross, morphometric and histological studies on the Meckel's diverticulum. The MD was found to be a small coma-shaped outgrowth in both genotypes, located on the beginning of the distal half of the Jejunum. Its tip was free and it had no fibrous or peritoneal attachments. The parameters measured were found to vary between the two genotypes, with only the MDC length been significantly ($p \leq 0.05$) different. Histologically, the MD in both genotypes was found to have all four layers of alimentary tract; mucosa, submucosa, muscularis externa and serosa. The mucosa had short villi. The lining epithelium was made up of low columnar cells. The lamina propria of mucosa as well as submucosa contained intestinal glands with plenty of parietal cells. The submucosa contains blood vessels. The muscularis externa was found to comprise only the circular musclularis layer. The MD in these two genotypes was found to be a small coma- shaped outgrowth located on the beginning of the distal half of the Jejunum. The morphometric parameters of the MD were found not to vary significantly except for the length from Meckel's diverticulum to Cecal opening (MDC). The observed glandular and lymphoid tissues reaffirmed the MD's role in immunological activities of the intestine.

Keywords: Morphology, Meckel's diverticulum, Genotype, Chickens

INTRODUCTION

In monogastric, gastrointestinal mucosa is the first line of defense mechanism to fight with pathogens. In the intestine of the monogastric animals, there has been a complex system of the submucosal and mucosal lymphatic tissue called "GALT"- gut-associated lymphoid tissue. GALT plays a pivotal role in controlling the incidence of poultry enteric disorders through its immunological functions (Reid and Friendship, 2002; Callaway *et al*., 2008) as it is exposed to the microflora from concomitant feed and the environment (Bar-Shira, 2003). The definable structures of GALT include lymphoid aggregates located within the lamina propria, Meckel's diverticulum, Peyer's patches and cecal tonsils (Muralidhar, 2019). Meckel's Diverticulum (MD) is a normal anatomical structure, which persists throughout life of some normal birds (Casteleyn *et al.*, 2010). It was previously considered as a congenital defect associated with some pathological conditions (Udoumoh *et al*., 2016). It is an embryonic remnant of the yolk duct and sac that continues to grow after hatching and persists throughout the life of domestic fowl as an appendage of the small intestine, and it occurs in both sexes (Muhammadpour, 2006). Meckel's diverticulum is found on the longest loop of Jejunum opposite to the distal parts of the cranial mesenteric artery and the corresponding vein (Getty, 1975), usually at the beginning of the distal half of the Jejunum (McLelland, 1990). Some researchers have described the morphology, morphometry, function and position of the MD in post-hatching period while others reported on the blood flow measurements, arterial blood supply and developmental changes in the yolk sac circulation of the avian embryo (Muhammadpour, 2006; Igbokwe and Abah, 2009). In Nigeria, Igbokwe and Abah (2009) compared the MD of normal genotype of local chickens to exotic broiler-type chickens. However, there is still paucity of information on the morphology of MD in other genotypes of Nigerian local chickens. Thus, this study is conducted with the aim of studying the morphology of MD in Necked-neck (NN) and Frizzle-feathered (FF) chickens of Nigerian.

MATERIALS AND METHODS

The present study was conducted in the Anatomy Laboratory, Department of Animal Health and Production Technology, Niger State College of Agriculture, Mokwa, North Central, Nigeria. Mokwa is located on latitude 9°17'38" North and longitude 5°3'16 East (Google maps, 2021). Twenty apparently healthy adult male local chickens (10 birds each of Naked -neck and Frizzle feathered chickens, all above one year of age) were purchased from local markets in Mokwa. They were

quarantined for two weeks and then stabilized for another two weeks in a pen at the poultry unit, livestock farm of the College. They were fed commercial layer diet (Animal Care® feed) within these periods and water was given *ad libitum* under a good management practice. At the end of these periods, all birds were fasted for 12 hours and then slaughtered using *Halal* method of slaughtering (Wilson, 2005). They were allowed to bleed for two (2) minutes before been de-feathered. The entire intestinal tract was removed, straightened and observed grossly. Intestinal length from gizzard to Meckel's diverticulum (GMD) and from Meckel's diverticulum to Cecal opening (MDC) were measured. Other parameters measured were the were length, width and thickness of Meckel's diverticulum. The results were analyzed and compared using Independent T-test. For histological examinations, the tissue samples from MD and junction of it to jejunum were fixed in 10% buffered formalin, dehydrated, cleared and embedded in paraffin blocks and cut in 5-micron thick sections. Sections of MD were stained with Haematoxylin and Eosin (H&E) and their histological features were then studied under light microscope.

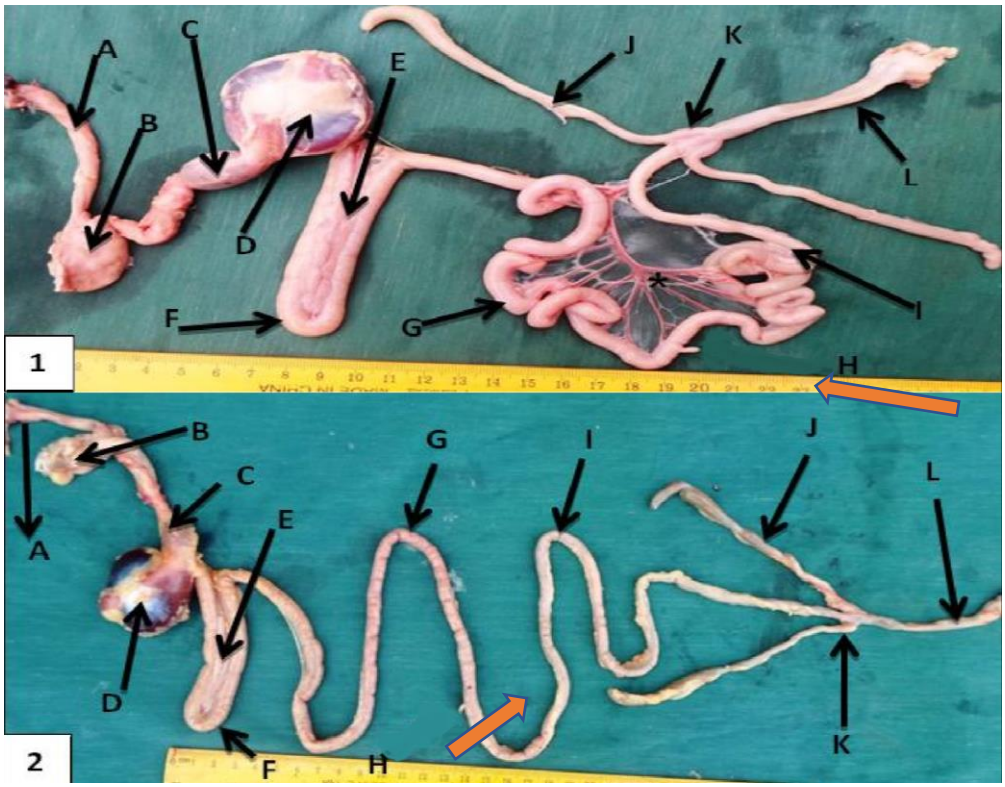
Result and Discussion

The MD was found to be a small coma- shaped outgrowth in both genotypes, located on the beginning of the distal half of the Jejunum. Its tip was free and it had no fibrous or peritoneal attachments (**Figures 1 & 2**). The measured parameters were found to vary between the two genotypes, with MDC length been significantly ($p \leq 0.05$) different (**Table 1**). The findings in the present study on the MD located at a point 65.66 cm from the gizzard to the jejunum (GMD) in NN is similar to the earlier report of (64.6 cm) by Igbokwe and Abah (2009) in normal Nigerian local chickens. However, the MD in FF located at a point 51.00 cm on the jejunum from the gizzard is lower than the 86.5 cm contrary to their findings as well as the report by Muhammadpour (2006) in Male ducks. This difference could be due to genetic or species variations.

Table 1: Mean ± SEM of morphometric parameters in Naked Neck and Frizzled Feather genotypes of Nigerian local chickens

Parameters	**Genotypes**		**Significant Level**
	NN	FF	
GMD (cm)	65.66±5.54	51.00±2.29	0.071
MDC (cm)	30.10±2.27	42.88±0.44	0.050
MD Length (mm)	53.50±4.27	56.66±4.52	0.845
MD Width (mm)	42.00±2.56	30.15±5.78	0.130
MD Thickness (mm)	1.57±0.12	1.33±0.08	0.193

GMD= length from gizzard to Meckel's Diverticulum, **MDC**= length from Meckel's Diverticulum to Cecal Opening, **MD**=Meckel's Diverticulum, NN=Naked Neck, FF= Frizzle Feather Chickens



Figures 1 and 2: Photographs of GIT of the naked neck (**1**) and frizzle feathered (**2**) chickens showing: **A** = Oesophagus, **B** = Crop, **C** = Proventriculus, **D**= Ventriculus, **E** = Pancreas, **F** = Duodenum, **G** = Jejunum, **H** = **Meckel's Diverticulum**, **I** = Ileum, **J** = Cecum, **K** = Cecal tonsil, **L** = Colorectum, ***** Mesentery.

Histologically, the MD in both genotypes was found to have all four layers of alimentary tract namely mucosa, submucosa, muscularis externa and serosa (**Figure 3**: **A** & **B**). The mucosa had short villi. The lining epithelium was made up of low columnar cells. The lamina propria of mucosa as well as submucosa contained intestinal glands with plenty of parietal cells interposed among lymphoid follicles (**Figure 3**: **C** & **D**). The submucosa contains blood vessels. The muscularis externa was found to comprise only the circular musclularis layer (**Figure 3**: **E** & **F**). Similar histological results were previously reported in chickens, by Olah *et al*. (1984) geese (Besoluk *et al*., 2002) and Normal feathered Nigerian chickens (Igbokwe and Abah, 2009).

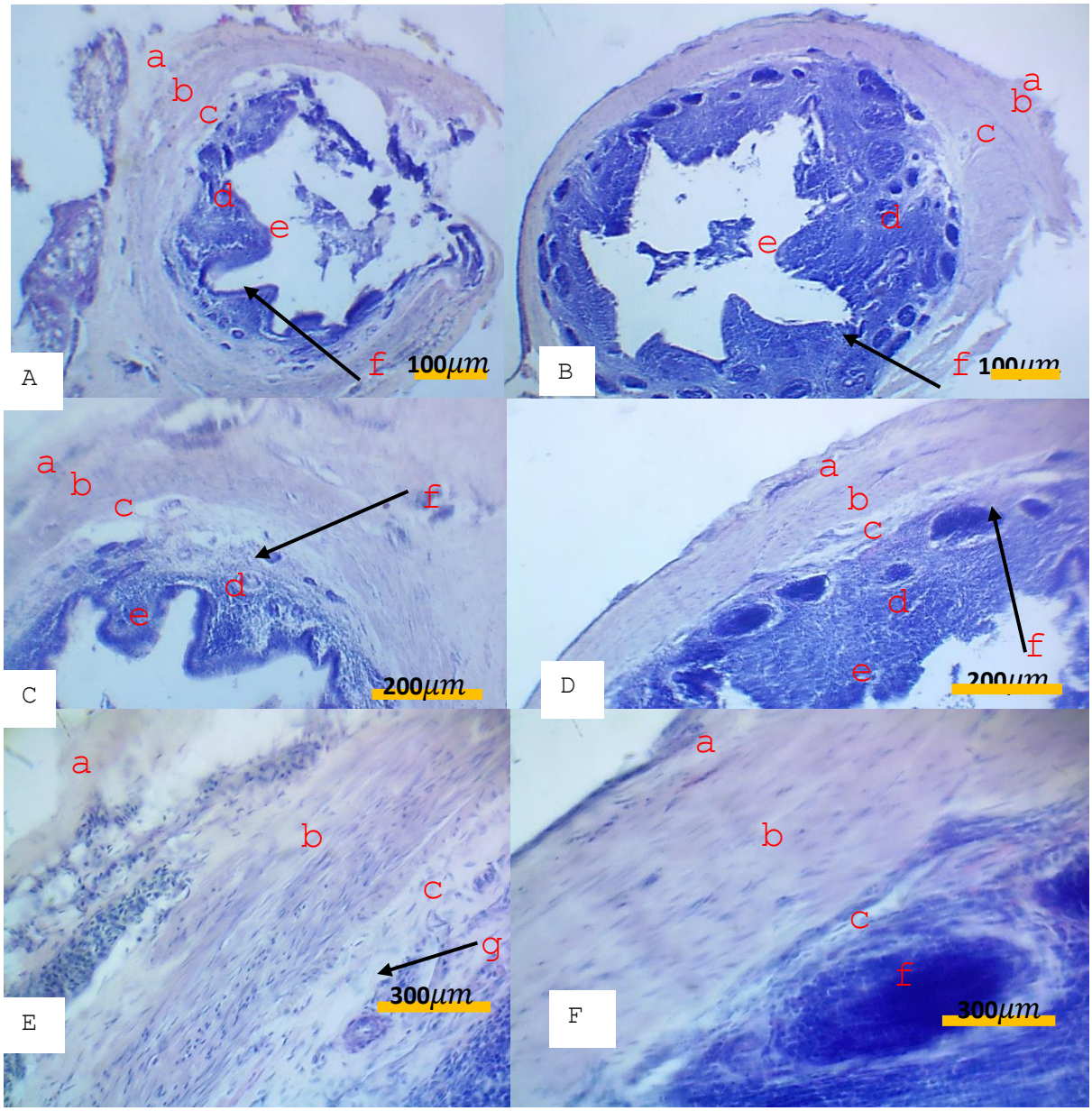


Figure 3: Photomicrographs of MD in Naked neck (**A**, **C** & **D**) & Frizzle feathered (**B**, **D** & **F**) genotypes showing: Serosa (a), Muscularis externa (b), submucosa (c), Mucosa (d), short villus (e), Intestinal gland (f) and blood vessel (g) in submucosa (H & E).

CONCLUSION

The MD in these two genotypes was found to be a small coma- shaped outgrowth located on the beginning of the distal half of the Jejunum. The morphometric parameters of the MD in the two genotypes were found not to vary significantly except for the length from Meckel's diverticulum to Cecal opening (MDC). The observed glandular and lymphoid tissues reaffirmed the MD's role in immunological activities of the intestine.

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