



### RESEARCH ARTICLE

## GROSS, HISTOMORPHOLOGICAL AND HISTOCHEMICAL STUDY OF JEJUNUM IN VANARAJA AND CARI SHYAMA.

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### Abstract

A study was conducted on jejunum of CARI Shyama and Vanaraja crossbreds of poultry developed to improve the livelihood of peoples in the tribal area with less availability of good quality feed. Jejunum is the part of intestine plays significant role in absorption of nutrients and improves the feed utilization. Grossly, length of jejunum was significantly more in chicks and pullets of Vanaraja, however, width was more in chicks and pullets of CARI Shyama. Histologically, height of villi decreased progressively from proximal to distal segment of jejunum. Height of villi was significantly more in pullets of CARI Shyama than Vanaraja. Density of collagen fibers was more in pullets of Vanaraja than CARI Shyama. PAS activity was comparatively more in all age group of CARI Shyama than Vanaraja.

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### Introduction:-

CARI Shyama and Vanaraja are two hybrids introduced by the central government in the tribal area to improve the livelihood of peoples as these breeds required less classified diet than exotic breeds in Indian climate and give production better than the desi breeds. Jejunum is the part of intestine plays significant role in absorption of nutrients and improves the feed utilization. Therefore this study was undertaken to explore the status of jejunum in different age group of these birds.

### Material and Methods:-

The present study was conducted on ten apparently healthy chicks (0 day old), growers (8 weeks old) and pullets (16 weeks old) of CARI Shyama and Vanaraja. Jejunum was collected, and preserved in 10% buffered formalin. The tissue samples were processed, cut and stained with H&E for normal histological structure, Van Gieson's for collagen fibers, Gomori's for reticular fibers, Periodic Acid Schiff (PAS) for mucopolysaccharides and AB-PAS for acid mucopolysaccharides (Singh and Sulochana, 1997).

### Result and Discussion:-

The jejunum was longest and coiled part of the intestine, suspended by the mesentery and arranged in the loops at the edge of dorsal mesentery confirmed the reports of McLelland(1975), Nickel *et al.* (1977) and Verma (1998). Well developed yolk sac was present in the day old chick. The remnant of yolk sac in the form of Meckel's diverticulum was also noticed in growers and pullets supported the findings of King and McLelland(1975) and Nasrin *et al.* (2012). Number of coils of jejunum also increased with age. In pullets, number of coils ranged between 11-13,

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similar to the observation of Nickel *et al.* (1977).

Significantly higher length of jejunum was noticed in chicks of Vanaraja (18.1 cm) than CARI Shyama (15.55 cm), however width was significantly more in chicks of CARI Shyama than Vanaraja with an average value 0.21 cm and 0.15 cm, respectively. Nasrin *et al.* measured 22.38 cm length of jejunum in day old broiler chicks and reported jejunum as longest part of the small intestine.

In growers, significantly higher width was noticed in Vanaraja with an average 0.60 cm than CARI Shyama (0.56cm); however length was comparatively less in Vanaraja.

In pullets, pattern of length and width was similar to chicks and significant difference was noticed in the length, as length was higher in Vanaraja with mean value 74.77cm than CARI Shyama (65.4 cm). In the present study, length and width of jejunum ranged as 65-75cm and 0.50-0.60 cm in growers and pullets, were lesser than the findings of McLelland (1975), Nickel *et al.* (1977) and Verma (1998).

**Table:-** gross morphometrical observations of jejunum

Group	Length of Intestine (cm)		Jejunum					
			Length (cm)		Diameter (cm)		% (out of total length of intestine)	
	CARI Shyama	Vanaraja	CARI Shyama	Vanaraja	CARI Shyama	Vanaraja	CARI Shyama	Vanaraja
Chicks	27.5 ± 1.02	31.4 ± 0.79*	15.55 ± 0.67	18.1 ± 0.51*	0.21 ± 0.006*	0.15 ± 0.004	56.71 ± 1.87	57.70 ± 1.12
Growers	113.3 ± 1.4	119 ± 2.62	73.5 ± 0.74	71.83 ± 2.57	0.56 ± 0.014	0.60 ± 0.014*	64.91 ± 0.50	60.35 ± 1.85
Pullets	108.4 ± 2.41	122.1 ± 1.40*	65.4 ± 2.14	74.77 ± 2.02*	0.57 ± 0.013	0.59 ± 0.012	60.38 ± 1.62	61.20 ± 1.40

**Table:-** Histomorphometrical Observations Of Jejunum.

Group	Breed	Thickness of wall <sup>a</sup> (µm)		Thickness of tunica muscular (µm)		Thickness of propria submucosa <sup>a,b</sup> (µm)		Diameter of gland (µm)				Height of epithelium of villi/folds (µm)					
								Maximum		minimum		Base		middle		Apex	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Chicks	CARI Shyama	123.44	4.16	60.8	3.52	47.38	3.04	18.72	2.92	14.36	2.36	13.2	0.72	13.04	0.68	11.44	1.08
	Vanaraja	133.28	4.32	62.72	2.24	50.72	2.08	24.36	2.96	15.48	2.04	14.08	0.84	14.32	0.72	11.88	1.24
Growers	CARI Shyama	293.28	20.8	139.2	10.56	123.36	12.96	81.6	3.36	50.4	1.44	38.4	1.92	34.88	2.56	29.12	3.2
	Vanaraja	319.04	17.6	183.68*	11.2	128	8.96	90.56	5.52	52.8	1.92	41.6	1.76	36.16	2.72	25.28	1.44
Pullets	CARI Shyama	404.4*	20.8	188*	12.16	152	10.24	83*	1.34	60.64*	1.6	66.4	4.32	68.16	4	52	3.68
	Vanaraja	287.68	26.4	126.72	14.24	115.36	14.56	70.4	4	52.16	1.76	65.92	1.92	67.04	3.68	56.16	2.88

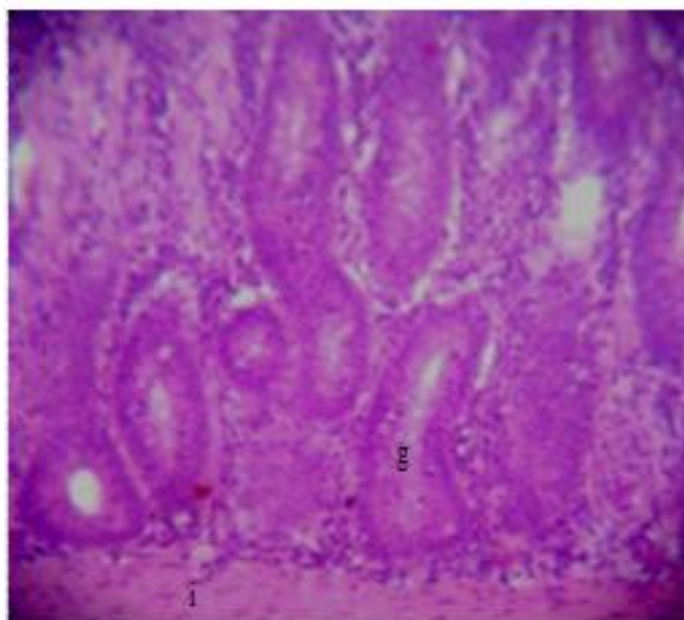
Thickness of wall from base of the villi to tunica serosa, b. Thickness of propria submucosa from base of the villi, - observations could not be taken. Mean values with \* are significant (P< 0.05)

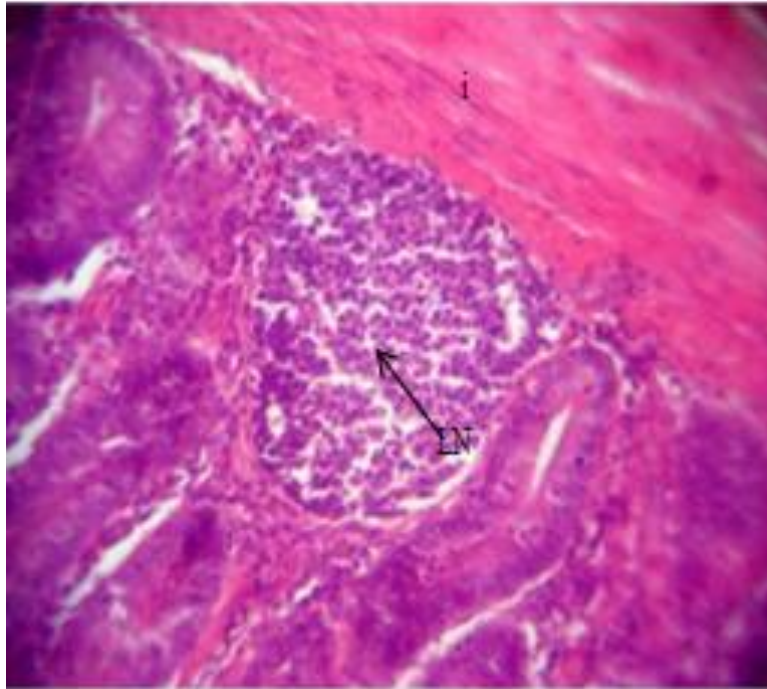
**Table:-** Histomorphometrical Observations Of Jejunum.

Group	Breed	Average height of villi/ folds (µm)		Height of villi/ folds (µm)						Width of villi/ folds (µm)						No. of villi/ folds	
				Long (above 1000 µm)		Medium (500-1000 µm)		Small (0-500 µm)		Base		Middle		Apex			
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Chicks	CARI Shyama	198.4	22.4							65.28	3.68	63.68	3.2	51.2	2.4	28.8	1.05
	Vanaraja	164	12.16							60.32	2.08	61.76	2.08	51.52	2.24	28.8	1.6
Growers	CARI Shyama	759.28	79.52	1086.88	9.6	813.4	35.2	355.52	9.92	198.24*	4.48	126.72	8	94.72	8.32	45.4	2.44
	Vanaraja	682.4	53.44	1044.48	6.56	745.82	41.6	346.88	15.68	168	11.52	122.48	10.24	83.2	3.84	45.1	2.33
Pullets	CARI Shyama	922.4*	75.2	1215.36	16.64	779.68	26.56	412.16*	10.24	136.8	6.56	121.92	6.72	119.04	7.68	42.3	2.87
	Vanaraja	635.2	69.92	1220.48	21.6	709.12	31.04	346.4	7.84	123.36	13.12	105.6	7.68	100.8	6.24	42.8	2.24

Blank- Villi of these categories were not present

Mean values with \* are significant (P&lt; 0.05)

**Fig.1:-** Photomicrograph of jejunum of CARI Shyama (group 3) showing glandular unit (g) and tunica muscularis (i) (H&E, 400X).

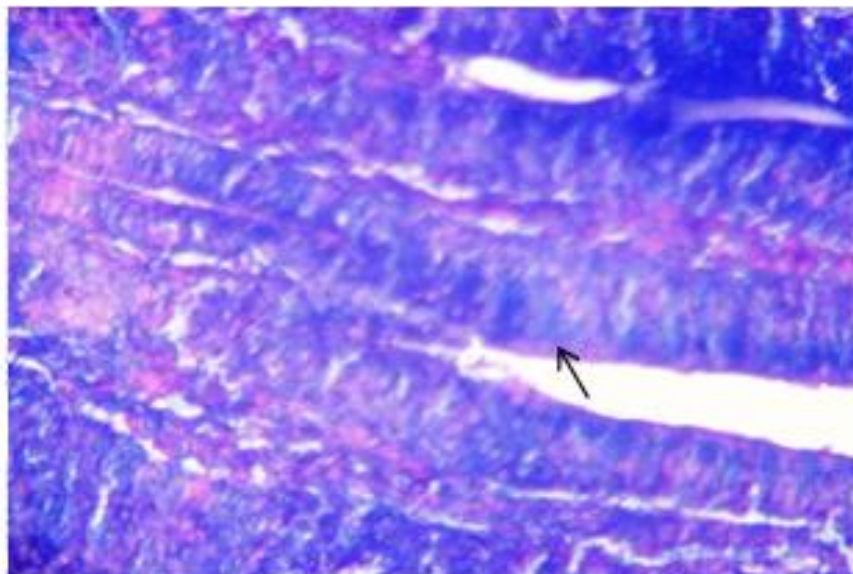


**Fig. 2:-** Photomicrograph of jejunum of Vannaraja (group 2) showing lymphatic nodule (LN) and tunica muscularis (i) (H&E, 400X)



**Fig.3:-** Photomicrograph of jejunum of Vanaraja (group 3) showing reticular fibers (arrow) in the core of villi (Gomori's, 100X)





**Fig.4:-** Photomicrograph of jejunum of CARI Shyama (group 2) showing AB-PAS activity (arrow) in mucosal epithelium (AB-PAS, 400X)

In chicks, more uniformity was observed in height and shape of villi in proximal part of jejunum than the distal part. Number of goblet cells was comparatively more in pullets of Vanaraja than CARI Shyama. Height of villi decreased progressively than the earlier segment; it is in accordance to the findings of Hodges (1974), McLelland (1975) and Verma *et al.* (1998). In chicks, villi were tongue or leaf shaped. The average height of villi was significantly more in pullets of CARI Shyama with mean value 922.4  $\mu\text{m}$  than Vanaraja (635.2  $\mu\text{m}$ ). Height of villi in pullets of CARI Shyama exceeded than in the duodenum and might be indicative of more active jejunum. Height of villi ranged between 150-200  $\mu\text{m}$  in chicks, 300-1100  $\mu\text{m}$  in growers and 300-1250  $\mu\text{m}$  in pullets. In growers, width of villi increased at all level in CARI Shyama, however in Vanaraja, width only increased at middle of villi. Observation in present study are in accordance to the reports of Hodges (1974), McLelland (1975), Verma *et al.* (1998) and Nasrin *et al.* (2012), that broad villi were observed in the jejunum. Significant difference in width was noticed only at base of villi in growers of CARI Shyama with mean value 198.24  $\mu\text{m}$  than Vanaraja (168  $\mu\text{m}$ ). Height of small sized villi was significantly less in pullets of Vanaraja (346.4  $\mu\text{m}$ ) than CARI Shyama (412.16  $\mu\text{m}$ ). In growers and pullets, distance between adjacent villi increased, which might be due to decrease in total number of villi. Cellularity of lamina propria decreased than earlier segment due to less infiltration of lymphocytes.

The glandular units in lamina propria were more in pullets of CARI Shyama than Vanaraja, however overall number of glandular units decreased than the earlier segment in all age groups (fig.1). Tubular glands were significantly larger in pullets of CARI Shyama than Vanaraja.

Lymphocytes infiltration was more marked in the pullets of CARI Shyama than Vanaraja. Less lymphocytic infiltration than the earlier region of intestine supported the finding of Bradley and Grahame (1960) and was not in agreement to McLelland (1975) who reported increased lymphatic infiltration in jejunum. Lymphatic nodule formation was noticed in the proximal segment of jejunum of growers and pullets (fig.2), however nodules were absent in chicks.

Significant differences were noticed in the thickness of tunica muscularis of growers of Vanaraja than CARI Shyama with the mean value 183.68  $\mu\text{m}$  and 139.2  $\mu\text{m}$ , respectively. In growers of Vanaraja, thickness of tunica muscularis was comparatively more than the duodenum, which is in agreement to the finding of Vaish (2005), however in other birds such pattern was not found. In pullets, total thickness of wall and tunica muscularis was significantly more in CARI Shyama with mean value 404.4  $\mu\text{m}$  and 188  $\mu\text{m}$  than 287.68  $\mu\text{m}$  and 126.72  $\mu\text{m}$  in Vanaraja, respectively.

Localization of collagen, elastic and reticular fibers was established in the core of the villi, inter glandular connective tissue, lamina muscularis, submucosa, inter muscular connective tissue and in subserosal connective

tissue. The density of the collagen fibers in the intestinal wall was more in comparison to elastic and reticular fibers which confirmed the findings of Verma *et al.* (1999) and Vaish (2005). In initial segment of jejunum, density of collagen fibers was more in chicks and growers of CARI Shyama, while in distal segment density was more in chicks and growers of Vanaraja.

Density of reticular fibers was more in chicks of CARI Shyama and growers of Vanaraja, while in pullets, density was more in Vanaraja (fig.3). Peculiar arrangement of fibers was seen in the jejunum as peripheral thick fibers were joined by thin fibers net in the core of villi. Crossing strands of reticular fibers in the circular muscle bundles were also noticed.

PAS positive material was noticed in the mucosal and glandular epithelium and in smooth muscles of lamina propria and tunica muscularis. In jejunum, activity was comparatively more in all age groups of CARI Shyama than Vanaraja. PAS activity was mild in chicks and growers of Vanaraja and mild to moderate in pullets; however activity was moderate to intense in chicks and pullets of CARI Shyama and moderate in growers. More activity was recorded in distal region of jejunum in chicks of CARI Shyama, which might be indicative of early maturity of these regions in the respective breed to digest the complex carbohydrate.

Droplet like AB-PAS positive material was noticed in the apical part of epithelium of villi and glandular units in chicks and pullet. Diffuse activity was noticed in growers (fig.4). In Jejunum, more activity was noticed in the initial two third segments, in chicks and pullets of Vanaraja and growers of CARI Shyama. However, in distal segment, activity was more pronounced in chicks and pullets of CARI Shyama and growers of Vanaraja.

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