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Morphometerical observations of intestine in Japanese quail

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ABSTRACT

The present study was conducted on duodenum, jejunum, ileum, caecum and colorectum of Japanease quail. The weight of the duodenum on day 7th and 42nd was 0.47±0.05 g and 1.45±0.09 g, respectively. The length of the duodenum was found to be 8.60±0.36 cm and 14.13±0.55 cm on the same observation days. The weight and length of the jejunum ranged from 0.47±0.07 g to 1.62±0.19 g and 11.99±0.33 cm to 23.70±1.10 cm on day 7th and 42nd old birds, respectively. The values for the weight and length of the ileum were 0.30±0.03 g to 1.32±0.12 g and 10.21±0.80 cm to 20.88±1.61 cm, respectively at 7th and 42nd old birds of age. The weight and length of caecum were ranged from 0.22±0.03 g to 1.13±0.18 g and 4.13±0.07 cm to 7.69±0.30 cm. The values for the weight and length of the colorectum were 0.10±0.01 g to 0.51±0.05 g and 3.36±0.16 cm to 6.93±0.33 cm. The total length and weight of the five constituents, i.e. duodenum, jejunum, ileum, caecum and colorectum together formed the entire weight and length of the intestine which ranged from 1.55±0.08 g to 6.02±0.43 g and 37.97±1.04 to 73.34±1.61 cm, respectively at 7th and 42nd old birds of age.

Keywords: Caecum, Colorectum, Duodenum, Ileum, Jejunum, Morphology, Quail

The quail (*Coturnix coturnix japonicum*) is most important type of bird after chicken from economical aspect (Sharma *et al.* 2000), as they not only provide additional income to the farmers, but also livelihood to millions of small marginal farmers and landless labours in rural India. Also, quail production has considerable potential to fulfill the requirement of animal protein.

The quail alimentary tract is constantly invaded by foreign antigenic or harmful substances and their lumens are also sites for the proliferation of both beneficial and pathogenic bacterial flora (Mead 1989, Kitagawa *et al*. 2000). Intestine of birds play a very important role in much of the digestion, absorption and productions of nutrients, i.e. fatty acids as well as the B vitamins (thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, biotin, folic acid and vitamin B_{12}). Alteration and impairment within the digestive system both in structure and function has a profound effect on the performance of birds (McLelland 1975).

The purpose of this study was to establish a normal data which is meager in available literatures of Japanese quail and to provide use of this data for consecutive study on small intestine of other avian species. This will be helpful for pathologists, physiologists and poultry researchers for disease control and production strategies.

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MATERIALS AND METHODS

The present study was conducted on 48 Japanese quail birds (*Coturnix coturnix japonica*) irrespective of sex, procured from local market sources and reared on poultry farm of College of Veterinary and Animal Science, Parbhani under standard managemental quail rearing practices. The intestine was collected from 12 birds each at end of 7th, 14th, 21st and 42nd day of age.

These birds were sacrificed by cranial subluxation. The intestine was observed *in situ* for its gross examination like location, colour, shape and relation with other viscera. The organ was then carefully dissected along with its entire gross morphology for recording biometrical values like weight, length and diameter of entire intestine. The intestine was separated into different segments to record length, weight and diameter of each segment. The whole intestine was removed and the mesenteric tissue trimmed off. The length of duodenum, jejunum, ileum, caecum and colorectum was recorded with the help of digital Vernier caliper. The recorded measurements were analyzed statistically as per methods suggested by Panse and Sukhatme (1967).

RESULT AND DISCUSSION

Weight of intestine: The mean values of weights of duodenum, jejunum, ileum, caeca and colorectum and total intestine were 0.47±0.05, 0.47±0.07, 0.30±0.03, 0.22±0.03 0.10±0.01 and 1.55±0.08 g; 0.72±0.08, 0.50±0.04, 0.40±0.03, 0.41±0.06, 0.12±0.01 and 2.14±0.14 g; 1.05±0.03, 1.31±0.10, 0.90±0.10, 0.80±0.08, 0.32±0.02

Table 1. Mean values of weight (g) of different segments of intestine in various age groups of quails

Age group	Weight (g)					
	Duodenum (Mean with S.E.)	Jejunum (Mean with S.E.)	Ileum (Mean with S.E.)	Caecum (Mean with S.E.)	Colorectum (Mean with S.E.)	Intestine (Mean with S.E.)
7th day	0.47^{d}±0.05	0.47^{b}±0.07	0.30^{c}±0.03	0.22^{c}±0.03	0.10^{c}±0.01	1.55^{c}±0.08
14th day	0.72^{c}±0.08	0.50^{b}±0.04	0.40^{c}±0.03	0.41^{c}±0.06	0.12^{c}±0.01	2.14^{c}±0.14
21st day	1.05^{b}±0.03	1.31^{a}±0.10	0.90^{b}±0.10	0.80^{b}±0.08	0.32^{b}±0.02	4.38^{b}±0.20
42nd day	1.45^{a}±0.09	1.62^{a}±0.19	1.32^{a}±0.12	1.13^{a}±0.18	0.51^{a}±0.05	6.02^{a}±0.43
Stat	HS	HS	HS	HS	HS	HS
CD 5%	0.191	0.323	0.228	0.296	0.077	0.709
CD 1%	0.256	0.431	0.305	0.395	0.102	0.947

and 4.38±0.20 g and 1.45±0.09, 1.62±0.19, 1.32±0.12, 1.13±0.18, 0.51±0.05 and 6.02^{a}±0.43 g at D7, D14, D21 and D42 respectively (Table 1). The significantly higher values of weight were observed in quail birds at 42 days compared to other age group birds.

The mean of weight were significantly increased at 42 days age groups birds in all segments of intestine as well as total intestine. The mean of weight of jejunum were comparatively higher as compared to other segments of intestine in all age groups birds except duodenum of D14 age groups where values were higher compared with other segments of intestine. The higher weight of duodenum at D14 might be due to the accumulation of ingesta in duodenum and weight was taken including ingesta in duodenum.

Earlier studies carried out by Yamauchi (2002) reported the higher body weight and length of intestine in broilers than layer birds. Similarly, Wang and Peng (2008) suggested gradual development of small intestine and significant changes in digestive capacity such as weight, length, and surface area of the intestine up to postnatal 45 days.

In the present study, significantly higher weight of intestine and its different segments were observed in mature quail birds (42 days) compared to other age group. The comparatively higher weight was recorded in jejunum among segments of intestine except, duodenum of 14 days birds where values were higher. In other study by Nasrin *et al.* (2012) reported the significantly higher average weights of small and large intestine on 28 day than 1 and 14 days broiler chickens. However, Levi *et al.* (2013) observed the decreased mean weight of all the segments of the small intestine at 10 week age in anak 2000 and marshal broiler hybrids. Moreover, in accordance with our findings, Kalita (2009) and Nasrin *et al.* (2012) found the increased weight of duodenum, jejunum and ileum with advancement of age.

Length of different segments of intestine: The mean values of length of various segments of intestine were significantly higher at 42 days birds. The higher values of length were observed in jejunum as compared to other segments of intestine in all age groups birds. The recorded maximum length values of jejunum were 11.99±0.33, 13.69±0.58, 21.84±1.21 and 23.70±1.10 cm at D7, D14, D21 and D42 respectively as compared to other segments of intestine (Table 2).

It was suggested that the length of intestine increases with the advancement of age (Verma 1998 and Kalita 2009). The observations made in the present study are in collaboration with the findings of King and Mclelland (1975) also reported the higher average mean length of jejunum than other segments of intestine in avian and domestic birds respectively. Whereas, Partha *et al.* (2002) observed the varied length of duodenum in fowls, ducks and quails. Kadhim *et al.* (2010) noticed the constant rate of duodenal and jejunal length after 10th day while length of ileum and caecum was persistently increased.

Width of various segments of intestine: The maximum width of duodenum, jejunum and ileum in Japanese quail was found as 4.38±0.13, 4.15±0.29 and 2.92±0.09 mm respectively at D42 day's age groups birds. The higher width in large intestine for proximal, middle, distal caecum and colorectum was observed as 1.97±0.09, 4.54±0.20, 3.46±0.16 and 4.54±0.12 mm respectively at D42 day's age groups birds (Table 3).

On comparison of different parts of small and large

Table 2. Mean values of length (cm) of different segments of intestine in various age groups

Age group	Length (cm)					
	Duodenum (Mean with S.E.)	Jejunum (Mean with S.E.)	Ileum (Mean with S.E.)	Caecum (Mean with S.E.)	Colorectum (Mean with S.E.)	Intestine (Mean with S.E.)
7th day	8.60^{b}±0.36	11.99^{b}±0.33	10.21^{d}±0.80	4.13^{c}±0.07	3.36^{c}±0.16	37.97^{d}±1.04
14th day	9.25^{b}±0.36	13.69^{b}±0.58	13.73^{c}±0.62	4.69^{c}±0.15	3.64^{c}±0.16	45.01^{c}±1.46
21st day	11.05^{c}±0.42	21.84^{a}±1.21	17.33^{b}±1.37	6.45^{b}±0.21	4.71^{b}±0.14	61.38^{b}±1.37
42nd day	14.13^{a}±0.55	23.70^{a}±1.10	20.88^{a}±1.61	7.69^{a}±0.30	6.93^{a}±0.33	73.34^{a}±1.61
Stat	HS	HS	HS	HS	HS	HS
CD 5%	1.066	2.512	2.407	0.571	0.607	3.951
CD 1%	1.424	3.356	3.216	0.763	0.811	5.278

Table 3. Mean values of width (mm) of different segments of intestine in various age groups

Age group	Width (mm) of different segments of intestine						
	Duodenum (Mean with S.E.)	Jejunum (Mean with S.E.)	Ileum (Mean with S.E.)	Caecum			Colorectum (Mean with S.E.)
				Proximal (Mean with S.E.)	Middle (Mean with S.E.)	Distal (Mean with S.E.)	
7th day	2.85^{c}±0.24	2.36^{c}±0.17	2.09^{b}±0.11	1.44^{c}±0.23	2.70^{c}±0.23	2.32^{b}±0.20	1.84^{c}±0.09
14th day	3.11^{c}±0.11	2.62^{c}±0.09	2.29^{b}±0.10	1.63^{bc}±0.07	3.42^{b}±0.24	2.58^{b}±0.19	2.10^{c}±0.18
21st day	3.94^{b}±0.18	3.45^{b}±0.14	2.66^{a}±0.12	1.75^{ab}±0.14	4.07^{a}±0.25	3.06^{a}±0.13	2.59^{b}±0.09
42nd day	4.38^{a}±0.13	4.15^{a}±0.29	2.92^{a}±0.09	1.97^{a}±0.09	4.54^{a}±0.20	3.46^{a}±0.16	4.54^{a}±0.12
Stat	HS	HS	HS	HS	HS	HS	HS
CD 5%	0.425	0.549	0.302	0.278	0.599	0.477	0.394
CD 1%	0.568	0.733	0.404	0.372	0.800	0.637	0.527

intestine, higher width was observed in duodenum and middle caecum in all age groups of birds in Japanese quail.

These findings were similar to the reports of Kalita *et al.* (2012) who recorded the increased width of segments of small intestine with the advancement of age and maximum width was reported on 112 days compared to 1, 7, 14, 28 and 56 days of Kadaknath fowl. McLelland (1975) found the more width of duodenum among the parts of small intestine and Bailey *et al.* (1997) noticed the equal width of jejunum and duodenum in Houbara, Kori, Rufous-crested and White-bellied bustards. The smallest diameter of ileum was observed by Verma (1998) and Partha *et al.* (2002) noticed the varied diameter of duodenum in fowls, ducks and quails. Similarly, Mahmud *et al.* (2015) reported the non-significant mean width of small intestine and large intestine in three Nigerian indigenous genotypes of chicken irrespective of sex.

In conclusion, mean of weight were significantly increased at 42 days age quail birds in all segments of intestine as well as total intestine. The mean weight of jejunum were comparatively higher as compared to other segments of intestine in all age groups birds except duodenum of D14 age groups. The mean values of length of various segments of intestine were significantly higher at 42 days birds. The higher of length were observed in jejunum as compared to other segments of intestine in all age groups birds. On comparison of different parts of small and large intestine, higher width was observed in duodenum and middle caecum in all age groups of birds in Japanese quail.

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