

# Number of Brunner's Glands in Different Parts of the Duodenum in Bengalis of Bangladeshi Population

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## Abstract

**Context:** The existence of Brunner's glands in the duodenal submucosa is uncontested, but their exact numerical distribution along the full extent of the duodenal wall has not been reported in Bangladeshi Bengalis. To determine the numerical distribution of the Brunner's glands along different parts of the duodenum in Bangladeshi Bengalis, a cross-sectional analytical type of study was carried out in the department of Anatomy, Dhaka Medical College, from July 2010 to June 2011.

**Materials & Methods:** The study material consist of histological slides of 17 post mortem cadaveric duodenum of 20 to 59 years of age.

The study samples were divided into four age groups: Group A (20-29 years), Group B (30-39 years), Group C (40-49 years) and Group D (50-59 years). Histological study was carried out on 5 study samples from each of Group A, B and C and 2 study samples from group D. One slide was prepared from each part of the duodenum: first, second, third and fourth. These were stained with hematoxylin-eosin stain. Three microscopic fields, each representative of one-third of a slide were examined from each slide. The number of Brunner's Glands per field was counted; the mean number for each age group in each duodenal part was calculated.

**Result:** The mean ( $\pm$  SD) number of the Brunner's glands in first part of the duodenum per square millimeter was 61.10 ( $\pm$  12.68), 53.00 ( $\pm$  6.04), 58.13 ( $\pm$  8.90) and 40.25 ( $\pm$  7.42) for Groups A, B, C and D respectively. In the second part, it was 37.70 ( $\pm$  9.22), 33.30 ( $\pm$  6.06), 35.13 ( $\pm$  2.10), 27.50 ( $\pm$  4.24) respectively. In the third part, the number of the Brunner's gland per square millimeter was 14.10 ( $\pm$  14.54), 9.70 ( $\pm$  9.14), 6.38 ( $\pm$  5.12) and 5.25 ( $\pm$  7.42) respectively and in the fourth part, it was 0.50 ( $\pm$  1.12), for Group A. In the other age groups, there were no Brunner's gland in this part of the duodenum.

**Conclusion:** The number of Brunner's gland was found maximum in the first part of the duodenum for all age groups and decreased in the second and third part of the duodenum and was absent in the fourth part of the duodenum. However, further studies to standardise this finding are recommended.

**Key words:** Duodenum, Brunner's gland, number.

## Introduction

The duodenal glands or the glands of Brunner are present in all mammals and are believed to secrete an alkaline fluid containing mucin.<sup>1</sup> The first mention of the glands now known as the glands of Brunner was made by John Jacob Wepfer in 1679 in the course of his description of the autopsy findings on a beheaded woman. Wepfer made the significant observation that, when these glands gave forth copious mucus even 8 days after death.<sup>2</sup> Nine years

later John Conard Brunner, who had by then become his son-in-law, made them the subject of a dissertation in 1688.<sup>3</sup> Brunner called the 'glandulae duodeni' or 'pancreas secundarium,' as he took them to be accessory pancreas. Middeldori, in his dissertation published in 1846, was the first to record the fact that these glands are found only in mammals and the secretion of these glands differs from pancreatic juice and therefore suggested that they be designated as the glands of Brunner instead of pancreas secundarium.<sup>2</sup>

Brunner's glands are mucus secreting acinar glands located in the deep mucosa & submucosa of proximal duodenum.<sup>4</sup> They begin at the

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gastroduodenal junction and extend for variable distances distally in the wall of proximal small intestine.<sup>5</sup> However, there remain doubts as to their exact location along the full extent of the duodenal wall.<sup>6</sup> Most histological studies on digestive system (and more specially, on the duodenum) regard Brunner's glands the largest and most numerous near the pylorus and form an almost complete layer in the superior part & proximal half of the second part of the duodenum, there after they gradually diminish in number and disappear at the duodenojejunal junction.<sup>7</sup> From the histophysiological point of view, Brunner's glands produce an alkaline secretion (pH = 8.0-9.5) that is capable of, on one hand, neutraliz chyme acid that originates from the stomach, and on the other hand, support favorable pH conditions for adequate action by pancreatic juice enzymes.<sup>6</sup> Therefore, the study of the location and number of Brunner's glands has a great importance.

**Materials & Methods**

**Materials of the study**

A cross-sectional type of study was carried out in the Department of Anatomy, Dhaka Medical College, from July 2010 to June 2011. The study materials consisted of histological slides of 17 postmortem human cadaveric duodenums of 20 to 59 years of age.

**Grouping of the samples**

The collected samples were divided into four age groups according to Simadibrata et al (1999).<sup>8</sup>

**Table - I**

*Grouping of the samples of the present study (n =17)*

Group	Age in years	Number of samples
A	20-29	5
B	30 -39	5
C	40- 49	5
D	50-59	2

**Procedure of histological study**

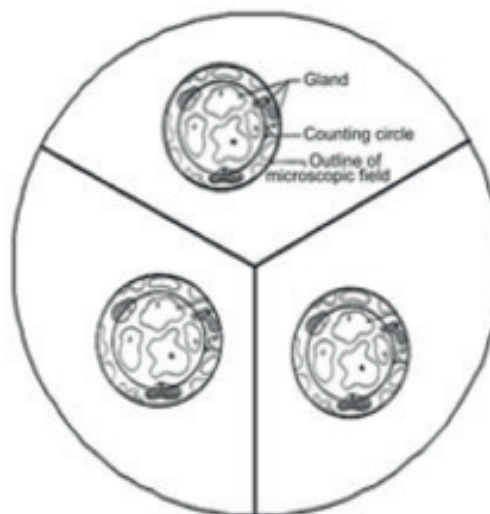
**Preparation of slide**

The duodenums were fixed in 10% formol saline in a plastic container. Wedge- shaped pieces of duodenal tissues from each parts of duodenum

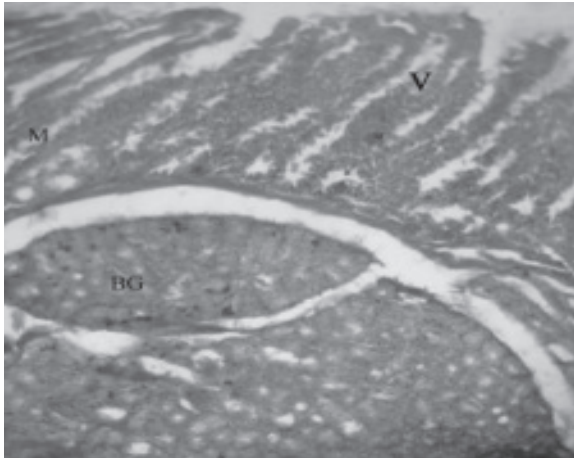
were sectioned. Then the tissues were prepared in standard method and stained with routine Harris' Haematoxylin and Eosin (H & E) stain.

**Microscopic measurement**

For the purpose of counting of Brunner's gland, a counting circle was graphically designed by a computer, printed over a transparent plastic sheet where the circle was divided into three equal lines by drawing three lines (Y shaped) which was radiated from the center towards the periphery at 10 o'clock, 2 o'clock & 6 o'clock position. A counting circle with a diameter of 5 mm was printed on a plastic sheet, which was fit into the eyepiece of the light microscope. The circle encircled some full Brunner's gland, while some other Brunner's gland was partly included inside the circle. The portions of the Brunner's gland seen in the field were taken in consideration by an eye estimation e.g. 1 (means full Brunner's gland within the circle), 0.75 (means ¾<sup>th</sup> Brunner's gland within the circle), 0.5 (means ½ Brunner's gland within the circle), 0.25 (means ¼<sup>th</sup> Brunner's gland within the circle). From three counts of three different circles of each slide, an average number of glands were calculated for each slide. Then this number was converted into the number of Brunner's gland per square millimeter (sq mm) of duodenum by using the ocular micrometer and stage micrometer (Fig. 1 photograph 1\_.



**Figure 1:** Diagrammatic representation of counting the number of Brunner's gland



**Photomicrograph 1:** Sectional view of second part of duodenum from Group A (20-29 years) under light microscope (x 10 objective x eyepiece) [H & E](V-villi, M-mucosa, BG- Brunner's glands)

**Ethical Clearance**

This research work was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka.

**Statistical processing of data**

The data collected from the histological studies were processed and statistical analyses were done by one – way ANOVA test. All the statistical analyses were done by using the SPSS version 16.0.

**Results**

The mean (± SD) number of the Brunner's gland in the first part of the duodenum per sq mm was 61.10 (± 12.68), 53.00 (± 6.04), 58.13 (± 8.90), and 40.25 (± 7.42) for Group A, B, C and D respectively. In the second part, it was 37.70 (± 9.22), 33.30 (± 6.06), 35.13 (± 2.10) and 27.50 (± 4.24) respectively. In the third part, the number of the Brunner's gland per sq mm was 14.10 (± 14.54), 9.70 (± 9.14), 6.38 (± 5.12) and 5.25 (± 7.42) respectively and in the fourth part, it was 0.50 (± 1.12) for Group A. In the other age groups, there was no Brunner's gland at all in this part of the duodenum. The mean difference of the number of the Brunner's gland in the first part of the duodenum between Group A and D, Group C and D found statistically significant (p value <0.05). But in different parts of the duodenum between Group A and B, Group A and C, Group B and C, Group B and D were statistically not significant.

**Table –II**  
*Number of the Brunner's gland in the different parts of the duodenum in different age groups*

Age Groups	Number			
	1st part Mean (±SD)	2nd part Mean (±SD)	3rd part Mean (±SD)	4th part Mean (±SD)
A (n=5)	61.10±12.68 (44.50 78.50)	37.70±9.22 (30.00 52.50)	14.10±14.54 (0.00 30.00)	0.50±1.12 (0.00 2.50)
B (n=5)	53.00±6.04 (45.50 62.00)	33.30±6.06 (25.00 41.50)	9.70±9.14 (0.00 18.50)	0.00±0.00 (0.00 0.00)
C (n=5)	58.13±8.90 (45.50 65.50)	35.13±2.10 (32.00 36.50)	6.38±5.12 (0.00 12.00)	0.00±0.00 (0.00 0.00)
D (n=2)	40.25±7.42 (35.00 45.50)	27.50±4.24 (24.50 30.50)	5.25±7.42 (0.00 10.50)	0.00±0.00 (0.00 0.00)
	<i>P value</i>	<i>P value</i>	<i>P value</i>	<i>P value</i>
A vs B	>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>	>0.50 <sup>ns</sup>	>0.10 <sup>ns</sup>
A vs C	>0.50 <sup>ns</sup>	>0.50 <sup>ns</sup>	>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>
A vs D	<0.05*	>0.05 <sup>ns</sup>	>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>
B vs C	>0.10 <sup>ns</sup>	>0.50 <sup>ns</sup>	>0.50 <sup>ns</sup>	>0.50 <sup>ns</sup>
B vs D	>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>	>0.50 <sup>ns</sup>	>0.50 <sup>ns</sup>
C vs D	<0.05*	>0.10 <sup>ns</sup>	>0.50 <sup>ns</sup>	>0.50 <sup>ns</sup>

Figures in parentheses indicate range. Comparison between different age group by One way ANOVA (PostHoc), ns = not significant, \* = significant

Group A : Age 20 29 years  
Group B : Age 30 39 years

Group C : Age 40 49 years  
Group D : Age 50 59 years

### Discussion

Macea (2006)<sup>6</sup> studied microscopic field of 20 duodenums and found presence of Brunner's glands in 100% slides in first part, 89% in the second part, 27% in the third part and 12% only in the fourth part. Ham and Cormack (1979)<sup>9</sup> stated that generally they were most numerous in the proximal part of the duodenum and less numerous (finally) disappear in its more distal parts. Einhorn (2009)<sup>10</sup> observed that the Brunner's glands were most abundant at the commencement of this portion of the intestine, diminishing gradually as the duodenum advances. Segal (1997)<sup>11</sup> conducted a study on duodenum and found that Brunner's glands were abundant in the first part of the duodenum, less prominent in the second part and was absent in the third & fourth parts. Yamada et al (1999)<sup>12</sup> and Feldman (2006)<sup>13</sup> stated that Brunner's glands were most numerous in the proximal duodenum & progressively diminish in number distally. Keele (2008)<sup>14</sup> observed that Brunner's glands were numerous in the first part of the duodenum, there were few below the common opening of bile ducts. The results of the present study were similar with the previous studies. There were no previous studies on number of the Brunner's gland of the duodenum in our country. The present study was a modest effort to collect data on number of Brunner's glands and to set a standard for Bengalis of Bangladeshi population.

### Conclusion

The number of Brunner's gland was found maximum in the first part of the duodenum of all age groups and decreased in the second and in the third part of the duodenum and was absent in the fourth part of the duodenum with increasing age. Further studies with larger samples with advanced histological techniques are recommended.

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