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Review Article

Anatomy of the Intestines: A Comparative Study of Greco-Arabic and Modern Perspectives

Aeliya Rukhsar[1*], Jamal Akhtar[1], Saiyad Shah Alam[2]

[1]Research Associate* (U) Central Council for Research in Unani Medicine, D-Block Janakpuri, New Delhi, India
[1]Research Officer (U), Central Council for Research in Unani Medicine, D-Block Janakpuri, New Delhi, India
[2]Director National Institute of Unani Medicine, Kottigepalya, Magadi Main Road, Bengaluru, Karnataka

***Corresponding Author:** Aeliya Rukhsar
Research Associate* (U) Central Council for Research in Unani Medicine, D-Block Janakpuri, New Delhi, India

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Abstract: The evolution of knowledge regarding the anatomy of the intestine throughout Greece-Arabic period and the Modern period is described. The common opinions of this organ at various points throughout this timeline are shown. The original words of great physicians from the period of time stretching from Ancient Egypt to the Avicenna era and hakim Kābbiruddin are quoted and discussed to demonstrate how knowledge of the intestine has evolved. Unani Medicine is a medical system that treats with the management of health and disease. *Jalinus* (Galen, 200 AD) observed that Small intestine heal more quickly and with lesser complications than wounds of the large intestine because of good blood supply. *Avicenna* stated that duodenal mucosa lacked the circular folds of mucosa (plicae circulares) found in the jejunum and ileum. According to *Avicenna*, the jejunum has a abundant blood vessels. It consisting of large, tall and closely packed circular folds of mucosa than the ileum.

Keywords: Anatomy, Antiquity, Duodenum, Avicenna, Intestine.

INTRODUCTION

Unani Medicine is a medical system that deals with the management of health and disease. It Provides promotive, preventive, curative and rehabilitative healthcare with holistic approach. Unani Medicine offers treatment for diseases related to all the system and organs of the body. The history of Unani Medicine is traced back to ancient Egypt and Babylon [1].

According to Unani Medicine human body made up of seven factors such as Elements (Arkān), Temperament (Mizāj), Humours (Akhlāṭ), Organ (A'd'ā), Pneuma (Arwāḥ), Faculties (Quwā) & Function (Af'āl). The Physical body is made up of organs/Tissue. According to Qarshi there are of two types of organ simple (Basīṭ, mufrad, Mushatabehatul ajza) and compound (murakkāb). The simple organs are tendon, membrane, nerves, ligament, bone, muscle, fat, cartilage, vein & artery are while the compound organs are also called A'd'ā Aaliya like heart brain & liver etc [2].

Anatomy is considered one of the oldest sciences as it was first recorded to be taught in ancient Egypt and Greece (300 BCE to 2nd century CE) namely through the mummification process and cadaver dissections. Egyptians became familiar with the human body. Specifically, the abdominal organs were removed, placed in their respective canopic jar, and entombed alongside the sarcophagus. Hippocrates, the father of medicine writing several books on anatomy back in 460-377 BCE [3].

Jalinus (Galen, 200 AD) observed that Small intestine heal more quickly and with lesser complications than wounds of the large intestine because of good blood supply, a better muscular layer, the liquid state of its contents, and a fewer content than other areas of the gastrointestinal tract [4].

Tashrīḥ-al-badan (Anatomy) was founded by *Herophilus* and *Aristotle*, who were the first to emphasize the importance of understanding human anatomy. A Famous anatomical teachers Herophilus and Erasistratus dissected the human body and described many of its structures in Egypt (from about 300 to 2nd century AD). Duodenum is a Latin misconduct of the Greek dodekadaktulus meaning 12 finger breadths, and was first originated by Herophilus in 300 BC to describe the length of the duodenum of animals then being dissected, presumably large domestic animals. *Aristotle* (384-322 BCE) was the first person to use the term *"anatome"* a Greek word meaning "cutting up or taking apart". The most influential anatomist in ancient world [5].

Avicenna examined the similarities and differences between the duodenum, jejunum, and ileum's vascularity and structure. He came to the view that the duodenal mucosa lacked the circular folds of mucosa (plicae circulares) found in the jejunum and ileum. According to *Avicenna*, the jejunum has a abundant blood vessels. It consisting of large, tall and closely packed circular folds of mucosa than the ileum. He was observed that the caecum and colon were described as the most dilated parts of the intestines. He also mentioned that the caecum was a blind pouch lying on the right side of the body and has higher chances of herniation. According to *Avicenna*, the rectum is a dilated, straight tube that enters the anal canal. Furthermore, he emphasized that the rectum's topography is situated in front of the sacral bones and has a close connection to the pelvic floor's exterior muscles, which facilitate defecation [6].

Objectives

The primary objectives of this thorough research paper are as follows:

i. To acknowledge the significant role played by Unani physicians in providing a detailed understanding of the Tashrih of Ama (Anatomy of Intestine).
ii. The Tashrih of Ama (Anatomy of intestine) was thoroughly explored and documented by the Unani physicians and compared to Modern Eras.

MATERIAL AND METHOD

Classical Unani text was searched extensively to compile the literature related to Tashrih of Ama. In this paper, the literature was extracted from Unani Classical books Al-Qanun-fit-Tibb, Kamil-us-Sanaa, Ifada kabeer, Kitab Al-Umda Fil Jarahat and Tashreeh-ul-Asha, Tashrīḥ-al-badan and Makhzanul hikmat. For more information, journals were also explored. Online search was done through major scientific databases such as Scopus, PubMed, Google Scholar and Science Direct with key words: Ama, Tashreeh, Intestine, Anatomy.

Unani Aspect

Small Intestine

In Tâshrėh-ul-Sāghėer by hakim kābbiruddin defines Amaa is the plural of word maa means āânte (Intestine). There are two types of intestine a) Ămā sāgėer/ Choti āânt/ Ămā Dāqâq (Small intestine) & Ămā Kābeer / Bādhî āânt (Large intestine) [7-12].

Parts of Small Intestine

It is 20 Feet (6 meter) long. There are three parts of Small intestine i.e., Ãsna Ãshrî (Duodenum), Sāiyėm (Jejunum) & Dāqėeq / Lāfeefi (Ileum) [7].

Duodenum

Asna Ashri is derived from arabic word meaning twelve. Length of duodenum is twelve finger (9 qėerat & 25 cm). (1 Qirat = 2 Rattii, 8 chawal= 1 Ratti & 8 Ratti = 1 gm) [8]. Three Parts of duodenum are a) Chadhne wala (Ascending part), Utarne wala (Descending part) & Adha chalne wala. Length of first part is 2 Qirat, second part is 3 Qirat & third part length is 4 Qirat. It starts from bāb-ul-kābad (pylorous) end at Jejunum (Sāiyėm). Duodenum is most widest, smallest and immobile part of small intestine [11, 12].

Jejunum

Meaning of word Sāiyėm Khāli Aānt (Jejunum) is rozadar reason behind that when we did autopsy it was found empty. It is speculated that even in living condition, food would not have lasted for long in it. It is 7.5 feet long and 4 cm in diameter [11]. Jejunum is wider in caliber than the ileum [9-12]

Ileum

Dāqėeq / Lāfeefi / Pechida Aānt (Ileum) meaning is kinky. It is longest and thinnest among all the parts of intestine. It is also called zāâṭ-ul-talāfeef in Arabic.

Large Intestine

The length of Ămā Ghilāz is 5 feet long. It is divided into 1) Ăwār (Caecum) 2) Qolõn (Colon) & Mustāqėem (Rectum)

Caecum

Ăwār/ Kafi āânt Ăwār meaning is yāk chāshm and it resembles like a bag. Its have only one opening for transportation of food. It is widest among all other part of intestine. Its length and width are the same such 2.5 Qirat. It has an additional protrusion on the back side that resembles like a Doodiya (insect). Length of this protrusion is 8cm - 18cm. It is also known as Zaaiyad Doodiya (Appendix). Doodh means insect. In the cecum, it has a single aperture. When it is obstructed by the Guava, pomegranate and grapes seeds, produces appendicitis [9-12].

Colon

Qolõn is a Unani term means kushada (wide).

Ascending Colon/Colon Sāîyad is start from caecum moves upward and curved at right inferior surface of liver and ends at the Ăâdhi Colon.The name of this right curved in Arabic is Tėrij Kābid (Hepatic Flexure)

Transverse Colon / Ăādhi Qolõn / Qolõn Mustārėz. It is long compared to other parts of colon and transversely placed. It is start from ascending colon and curved at left side of spleen. The name of this left curved in Arabic is Tėrij Tihāli (Splenic Flexure)

Nāzil Qolõn Utarne wala Qolõn (Descending Colon) is a last part of colon. It curved at Tėrij Seeni (sigmoid flexure). It is narrowest part of colon [9-12].

Rectum

Mustāqėem (Rectum) because it is more straight than other intestinal parts, however the rectum is also referred to as "straight." it is 6-8 inch long. It is end part is called Dubâr in perssian, Māqâd/ Mābâz in Urdu and Anus in Modern. Anus lasts part have two types of muscles. Outer is Irâdi Azlāât (Voluntary muscles) & inner is Ghāir irādi (involuntary muscles). Its responsible for stool continence [10-13].

Modern Aspect

Small Intestine

The small intestine is a longest part of gastrointestinal tract connecting the pyloric orifice of the stomach to the ileocecal fold [16]. It is about 6-7 meters in length and extends from the pyloric sphincter to the ileocecal junction. The small intestine is located in the central and lower parts of the abdominal cavity surrounded by the large intestine. Its have following three parts: (a) duodenum, (b) jejunum, and (c) ileum. The jejunum is the name given to the upper two-fifth ($2/5^{th}$) of the remainder of the small intestine and the lower three-fifth ($3/5^{th}$) is termed ileum [20].

Duodenum

Other name: C intestine.

The duodenum (Latin. duodeni=twelve; old Greek name of this viscus was Dodeka daktulon meaning 12 fingers, signifying its length of 12 fingers breadth) constitute the first 25 cm (10 inches) of the small intestine.[18] The duodenum is a C Shaped tube. It is the shortest, broadest, and most fixed segment of the small intestine. It is retroperitoneal except for the beginning of the first part, which is joined to the liver by the hepatoduodenal ligament of the lesser omentum. The junction usually takes the form of an acute angle, the duodenojejunal flexure. The duodenum is divisible into four parts [14].

Superior (First) Part

Duodenum first part is 2 inches / 5cm long [15]. Clinically, initial of this part of the duodenum is referred to as the ampulla or duodenal cap, and it's a most common site of duodenal ulcers [16].

Descending (Second) Part

It is about 7.5 cm long and descends along the right sides of the L1–L3 vertebrae [18]. It Contains the junction of the foregut and midgut, where the common bile and main pancreatic ducts open in posteromedial aspect [21]. It Contains the greater papilla (Major Papilla), on which terminal openings of the bile and main pancreatic duct (Wirsung) [21]. And the lesser papilla (Minor Papilla), which is situated 2 cm above to the major papilla and marks the site of entry of the accessory pancreatic duct [15].

Inferior/ Transverse/ Horizontal (Third) Part

This is the longest part. It is 10 cm long and crosses the L3 vertebra.[16]

Ascending (Fourth) Part

It is 2.5 cm long begins at the left of the L3 vertebra and rises superiorly as far as the superior border of the L2 vertebra [14].

Jejunum

Together, the jejunum and ileum are 6–7 meters in length; the ileum makes up around three-fifths of the small intestine and the jejunum about two-fifths [14]. The jejunum is primarily located in the upper left quadrant of the abdomen. Its wall is thicker and its diameter is greater than that of the ileum. In addition, several prominent folds that encircle the lumen (plicae circulares) are found in the inner mucosal lining of the jejunum. The less prominent arterial arcades and longer vasa recta (straight arteries) contrast to those of the ileum are a distinctive characteristic of the jejunum [16].

Ileum

The ileum is mostly located in the lower right quadrant and comprises the distal three-fifths of the small intestine. The ileum is thinner than the jejunum, and it has more mesenteric fat, more vascular arcades, a shorter vasa recta, and fewer and less prominent mucosal folds (plicae circulares) [16].

Large Intestine

In adults, the large intestine is about 1.5 meters long, extending from the distal end of the ileum to the anus. It involves the colon, rectum, anal canal, appendix, and cecum. It obtains fluids and salts from the gut contents and produces feces [16]. The large intestine consists of the cecum; appendix; ascending, transverse, descending, and sigmoid colon; rectum; and anal canal [16].

Cecum

The cecum is the first part of the large intestine. The cecum is a blind intestinal pouch, approximately 7.5 cm in both length and breadth [14].

Appendix

A thin, hollow tube with a blind end that is attached to the cecum is called the appendix. It has large aggregations of lymphoid tissue in its walls and is suspended from the terminal ileum by the mesoappendix, which contains the appendicular vessels [21].

Colon

Ascending and descending colons that are retroperitoneal and transverse and sigmoid colons that are surrounded by peritoneum (they have their own mesenteries, the transverse mesocolon and the sigmoid mesocolon, respectively). The superior mesenteric artery and the vagus nerve supply blood to the ascending and transverse colons, the pelvic splanchnic nerves and the inferior mesenteric artery supply the descending and sigmoid colons [15]. The colon (but not the appendix, caecum or rectum), contains characteristic fat-filled peritoneal tags called appendices epiploicae. These are especially more in the sigmoid colon. The taeniae coli mark the colon and caecum, but not the appendix or rectum. These are three flattened bands extending at the base of the appendix and end at the rectosigmoid junction [21]. The transverse colon is the third, longest, and most mobile part of the large intestine [14]. The sigmoid colon, characterized by its S-shaped loop [15].

The large intestine presents 3 cardinal features:

- Presence of appendices epiploicae: These are peritoneal sacs filled with fat.
- Presence of the taeniae coli: These are three longitudinal muscular bands.
- Presence of sacculations: These are sacculated dilatations in the wall. They are formed taeniae coli are shorter in length than the intestine itself [20].

Table 1: Length of different parts of Intestine [21]

S.No.	Parts of Intestine	Length
1.	Duodenum	25cm
2.	First part of Duodenum	5 cm long
3.	Second part of Duodenum	7.5 cm long
4.	Third part of Duodenum	10 cm long
5.	Fourth part of Duodenum	2.5 cm long
6.	Jejunum	2.5 m
7.	Ileum	3 m
8.	Cecum	7.5 cm
9.	Ascending colon	5–8 inches (12–20 cm)
10.	Transverse colon	18 inches (45 cm)

S.No.	Parts of Intestine	Length
11.	Descending Colon	9–12 in (22–30 cm)
12.	sigmoid colon	15 inches (37 cm)
13.	Rectum	5 inches (12 cm)
14.	Anal Canal	1.5 inches (4 cm)

CONCLUSION

The duodenum (Latin.duodeni=twelve; old Greek name for this viscus was Dodeka daktulon meaning 12 fingers, denoting its length of 12 fingers breadth) was first coined by Herophilus in 300BC to describe the length of the duodenum of animals then being dissected. Avicenna examined the similarities and differences between the duodenum, jejunum, and ileum's vascularity and structure. He came to the view that the duodenal mucosa lacked the circular folds of mucosa (plicae circulares) found in the jejunum and ileum. According to Avicenna, the jejunum has a abundant blood vessels. It consisting of large, tall and closely packed circular folds of mucosa than the ileum. He was observed that the caecum and colon were described as the most dilated parts of the intestines. He also mentioned that the caecum was a blind pouch lying on the right side of the body and has higher chances of herniation. Much of the research into this viscus that took place over many centuries from Antiquity to the Early Middle Ages was characterized by the doctrine of the humors and strongly influenced by the works of Avicenna Herophilus and Hakeem Kābbiruddin. Asna Ashri is derived from arabic word meaning twelve. Length of duodenum is twelve finger (9 qėerat & 25 cm). Meaning of word Sāiyėm Khāli Aānt (Jejunum) is rozadar reason behind that when we did autopsy it was found empty. Dāqėeq / Lāfeefi / Pechida Aānt (Ileum) meaning is kinky. It is longest and thinnest among all the parts of intestine. Ăwār/ Kafi āânt Ăwār meaning is yāk chāshm and it resembles like a bag. Its have only one opening for transportation of food. It is widest among all other part of intestine. Qolõn is a Unani term means kushada (wide). Mustāqėem (Rectum) because it is more straight than other intestinal parts, however the rectum is also referred to as "straight." it is 6-8 inch long. Generally speaking, those works reported macroscopic observations of the ancient Intestine (usually based on studies of animals) as well as arbitrary hypotheses concerning the modern Intestinal Anatomy. Therefore, descriptions of the intestine's gross anatomy were usually relatively accurate.

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