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## A Cadaveric Study Of Morphological Variations Of Vermiform Appendix: A Cross-Sectional Study.

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### ABSTRACT

The morphological study of the vermiform appendix in terms of its location in relation to abdominal regions, the clock position of the tip of the appendix, the length of the appendix, and the breadth of the appendix is very important. In the present study, an attempt is made to correlate the morphometry of the vermiform appendix with other studies in the adult human cadaveric vermiform appendix that have been carried out. The position and average dimension of different parameters of the vermiform appendix in both sexes will help surgeons who perform appendectomy. The aim to analyze anatomical parameters of the vermiform appendix in human cadavers. The study was conducted on 60 vermiform appendices (36 males and 24 females) in the Department of Anatomy at Krishna Mohan Medical College & Hospital, Mathura, and Dr. Vithalrao Vikhe Patil Foundation's Medical College & Hospital, Ahmednagar, Maharashtra, India, from May 2022 to July 2024. The position of the vermiform appendix in males was 15% subcaecal and paracolic, 15% retrocaecal and retrocolic, 15% midinguinal, 5% postileal, and 10% promonteric, whereas in females it was 10% subcaecal and paracolic, 15% retrocaecal and retrocolic, 5% midinguinal, 15% pelvic, and 5% preileal. The average length of the vermiform appendix in males and females was  $6.78 \pm 2.43$  cm and  $6.44 \pm 1.16$  cm, respectively. The average breadth of the vermiform appendix in males and females was  $0.89 \pm 0.25$  cm and  $0.75 \pm 0.37$  cm, respectively. The average distance from the iliocaecal junction to the base of the vermiform appendix in males and females was  $2.66 \pm 1.22$  cm and  $3.04 \pm 0.91$  cm, respectively. We concluded that the results of this study with respect to the morphometric variations of the vermiform appendix are in correlation with the results of various studies mentioned in the literature. **Keywords:** Appendectomy, Breadth, Clock position, Length, Morphological study, Vermiform appendix.

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## INTRODUCTION

The vermiform appendix is a narrow, worm-like diverticulum arising from the posteromedial wall of the caecum, about 2 cm below the ileocaecal junction. It usually lies in the right iliac fossa [1]. It is suspended by a peritoneal fold known as the meso-appendix to the lower part of the ileal mesentery. The presenting parts of the appendix include the base, body, and tip. The base is attached to the posteromedial wall of the caecum, about 2 cm below the ileocaecal junction, whereas the body is narrow and tubular and opens into the caecum through the canal. The tip, which is least vascular, has various positions and is classified under different types, like subcaecal, paracolic, retro-caecal, retro-colic, splenic, promonteric, pelvic, mid-inguinal, and ectopic [2]. The knowledge of anatomical variations of different positions, shapes, locations, parameters, and dimensions of the appendix is essential for surgeons during accurate appendectomy operations [3]. Hence, a thorough knowledge of various possible variations and morphometric parameters of the vermiform appendix is important for surgeons to encounter challenging, diagnostic, and therapeutic problems while performing abdominal surgeries like appendectomy [4].

## MATERIALS AND METHODS

This was a descriptive cross-sectional study which was carried out on 60 vermiform appendices (36 males and 24 females) in the Department of Anatomy at Krishna Mohan Medical College & Hospital, Mathura, and Dr. Vithalrao Vikhe Patil Foundation's Medical College & Hospital, Ahmednagar, Maharashtra, India, after obtaining ethical clearance from Institutional Ethics Committee. The study duration was from May 2022 to June 2024. The specimens for the study of the vermiform appendix were obtained from the 10% formaldehyde-preserved cadavers from the Department of Anatomy. The anterior abdominal wall was opened by using the incisions given in Cunningham's Manual of Practical Anatomy, 15<sup>th</sup> edition [5]. All the cadavers were dissected and abdominal cavity was exposed as per the guidelines given in the dissection manual by Cunningham. The position of the vermiform appendix was then noted in all parameters. All measurements were recorded by using a digital Vernier caliper, measuring scale, and thread [Table/Fig-1, 2 & 3] showing measurement of length and breadth & [Table/Fig-4-10] showing different positions of vermiform appendix].



[Table/Fig-1&2]: Measurement of the length of the appendix with thread and scale.



[Table/Fig-3]: Measurement of the breadth of the appendix with a vernier caliper.



[Table/Fig-4]: Subcaecal



[Table/Fig-5]:  
Retrocaecal



[Table/Fig-6]: Midinguinal



[Table/Fig-7]: Promonteric



[Table/Fig-8]: Pelvic



[Table/Fig-9]: Preileal



[Table/Fig-10]: Postileal

**OBSERVATION AND RESULTS**

Parameters (in cm)	Male		Female		In Both Sexes		t-value	p-value
	Mean	S.D.	Mean	S.D.	Mean	S.D.		
Length of vermiform appendix	6.78	2.43	6.44	1.16	6.645	1.98401	0.3731	0.7134
Breadth of vermiform appendix	0.89	0.25	0.75	0.37	0.835	0.30136	1.0317	0.3195
Distance from iliocaecal junction to base of vermiform appendix	2.66	1.22	3.04	0.91	2.81	1.09684	-0.749	0.4638

**[Table/Fig-11]: Comparison of male and females with mean parameters of the appendix (cms) by independent 't' test.**

Variables	r-value	t-value	p-value
Length of appendix vs breadth of appendix	0.1205	0.5148	0.6129
Length of appendix vs distance from ilium to appendix opening	0.3084	1.3754	0.1859
Breadth of appendix vs distance from ilium to appendix opening	-0.0011	-0.0047	0.9963

**[Table/Fig-12]: Correlations among length of appendix (cms), breadth of appendix (cms), and distance from ilium to appendix opening (cms) by Karl Pearson's correlation coefficient method.**

In the present study, we observed that the position of the vermiform appendix was 25% subcaecal, 15% retrocaecal, 20% midinguinal, 15% pelvic, 5% preileal, 5% postileal, and 10% promonteric. The position of the vermiform appendix in males was 15% subcaecal, 15% retrocaecal, 15% midinguinal, 5% postileal, and 10% promonteric. The position of the vermiform appendix in females was 10% subcaecal, 15% retrocaecal, 5% midinguinal, 15% pelvic, and 5% preileal. The average length of the vermiform appendix in males and females was  $6.78 \pm 2.43$  cm and  $6.44 \pm 1.16$  cm, respectively. The average breadth of the vermiform appendix in males and females was  $0.89 \pm 0.25$  cm and  $0.75 \pm 0.37$  cm, respectively. The average distance from the iliocaecal junction to the base of the vermiform appendix in males and females was  $2.66 \pm 1.22$  cm and  $3.04 \pm 0.91$  cm, respectively.

**DISCUSSION**

Nilesh A. S. observed that the position of the vermiform appendix was retrocaecal (56.67%), then pelvic (25%), preileal (15%), and postileal (3.33%). In males, it was retrocaecal 23.33%, then pelvic 15%, preileal 8.33%, and postileal 3.33%, and in females, it was retrocaecal 33.33%, then pelvic 10%, and preileal 6.67%. The position of the vermiform appendix between males and females was statistically not significant (P value = 0.28). [6] The study done by Philip Mwachaka (2014) observed that the position of the vermiform appendix was 27% retrocaecal, 25% pelvic, 18% postileal, 18.8% subileal, 4.2% subhepatic, 4.2% subcaecal, and 2% paracaecal [8] Sudagar M studied the position of the vermiform appendix and found the following positions: retrocaecal 38%, pelvic 28%, postileal 20%, pre-ileal was not found, midinguinal 4%, and subcaecal 10% [10]. Another study was done by Golalipour, who observed that the position of the vermiform appendix was 33.3% pelvic, 32.4% retrocaecal, 18.8% preileal, and 12.8% subcaecal. In males, it was 20% retrocaecal, 5% subcaecal, 20% pelvic, 12% preileal, and 2% postileal, and in females, it was 18% retrocaecal, 10% subcaecal, 19% pelvic, 10% preileal, and 1% postileal [11]. In the present study, we found that the most common position of the vermiform appendix was subcaecal 25%, retrocaecal 20%, midinguinal 20%, pelvic 15%, preileal 5%, postileal 5%, and promonteric 10%. In the present study, we also observed that the retrocaecal and pelvic positions were less than the other subcaecal and midinguinal positions of the vermiform appendix, whereas the preileal, postileal, and promonteric positions of the vermiform appendix were quite similar to the other studies. The present study was not correlated with another study.

Nilesh AS observed that the average length of the appendix was 5.93 cm, with a range from 2.8 cm to 12 cm. The average length of the appendix in males was 6.30 cm with a range from 2.8 cm to 12 cm, and in females it was 5.5 cm with a range from 3 cm to 10.3 cm [6]. S. Umamaheshwar R observed that the average length of the vermiform appendix in males was 7.72 cm with a range from 3.0 cm to 12.0 cm, and the average length of the vermiform appendix in females was 6.993 cm with a range from 3.0 cm to 10.0 cm [9]. Geethanjali HT reported that the average length of the vermiform appendix was 5.9 cm, ranging from 4.2 cm to 10.3 cm. The average length in males was 6.47 cm, ranging from 4.8 cm to 10.3 cm, and in females it was 5.34 cm, ranging from 4.2 cm to 6.3 cm [7]. Kasukurthy A concluded that the average length of the vermiform appendix in males was 6.56 cm and varied from 2.2 cm to 11.5 cm. The average length of the appendix in females was 4.58 cm, varying from 3.3 cm to 6.2 cm. The average length of the appendix in adults was 6.03 cm, which varied from 2.2 cm to 11.5 cm [12]. When comparing the measurement of the length of the vermiform appendix with other studies, it was observed that the values obtained in the above study were similar to the previous studies. In the present study, the mean values of the length of the vermiform appendix in males were higher than those of females, as seen in other studies, which may be due to the short stature of females. The average value of our study was quite similar to that of Ranga Reddy.

Nilesh AS performed a study on 60 embalmed, donated cadavers. They reported that the average breadth of the vermiform appendix was 2.8 cm, with a range from 1.4 cm to 5.3 cm. The average breadth of the appendix in males was 2.83 cm with a range from 1.4 cm to 4 cm, and in females it was 2.76 cm with a range from 1.6 cm to 5.3 cm [6]. S Umamaheswara R observed that the average breadth of the vermiform appendix was 1.24 cm, ranging from 0.7 cm to 2.2 cm. The average breadth of the vermiform appendix in males was 1.24 cm, ranging from 0.7 cm to 2.2 cm, and in females, it was 1.08 cm, ranging from 0.5 cm to 2 cm. [9] In the study done by Kasukurthy A it was reported that the average breadth of the vermiform appendix at the base was 0.5 cm, which varied from 0.3 cm to 0.8 cm [12]. When comparing the measurement of the breadth of the vermiform appendix with other studies, it was observed that the values obtained in the above study were similar to the previous studies. In the present study, the mean values of the breadth of the vermiform appendix in males were higher than those of females, as seen in other studies, which may be due to the short stature of females.

Nilesh AS reported that the average distance between the iliocaecal junction and the base of the vermiform appendix was 2.5 cm, with a range of 2 cm to 3 cm [6]. Kasukurthy A observed that the average distance between the iliocaecal junction and the base of the vermiform appendix was 1.65 cm, ranging from 0.42 cm to 3 cm [12]. Another study was done by Sheikh M. It was reported that the average distance between the iliocaecal junction and the base of the vermiform appendix was 3 cm, which varied from 1.9 cm to 3.8 cm [14].

### CONCLUSION

We concluded that the results of this study with respect to the morphometric variations of the vermiform appendix are in correlation with the results of various studies mentioned in the literature. The position and average dimension of different parameters of the vermiform appendix in both sexes will help surgeons who perform appendectomy. Hence, the result of the present study could be valuable information to surgeons as it gives comprehensive knowledge about the varied patterns of calico-appendicular positions, which may be helpful to avoid misdiagnosis and surgical errors.

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