

ORIGINAL PAPER

A Study on Length of Human Appendix in Different Ages

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ABSTRACT

The vermiform appendix is a narrow, vermiform (worm like) tube which arises from the posterior medial caecal wall, approximately 2 cm below the end of the ileum. Appendicitis is the most common cause of acute abdomen in young people. Obstruction of the lumen is the dominating factor in acute appendicitis. In appendix lymphoid follicles are absent at birth but accumulate over the first 10 years of life to become a prominent feature of it. But in elderly people, the lymphoid follicles atrophy and are replaced by collagenous tissue, and the appendix may be filled with fibrous scar. The appendix is longest in childhood and gradually shrinks throughout adult life. The present study was undertaken at Gauhati Medical College & Hospital involving the departments of Anatomy and Forensic Medicine. Specimens of appendix were taken from the department of Forensic Medicine before putrefaction of the body. Specimens were collected after due permission / consent from the concerned authority and also from the nearest relatives of the deceased. Appendix of 63 males and 63 females were studied in four age groups as '0 to 20 years', '21 to 35 years', '36 to 50 years' & '51 to 70 years'. The data recorded was analysed statistically using Student's T-test. P value 0.05 is considered as statistically significant. Such a study may be useful in establishing a database which may be useful in medical science.

Keywords: *Appendicitis, lymphoid follicles, inflammation*

INTRODUCTION

The vermiform appendix is located in the right lower quadrant of the abdomen.^{1,2} The small entrance of the dead-end pocket of appendix makes it difficult to clean out and prone to physical blockage, which ultimately is the cause of appendicitis.³ The incidence as per position of appendix has been reported as 65.28% for retrocaecal, 31.01% pelvic, 2.26% subcaecal, 1% preileal and 0.4% for right paracolic / postileal.⁴ The most characteristic feature of the appendix, particularly in young, is the presence of masses of lymphoid tissue in mucosa and submucosa.⁵ Similar to the tonsils, the lymphatic tissue in the appendix is typically in a constant state of chronic inflammation, and it is generally difficult to tell the difference between pathological disease and the "normal" condition.⁶ The commonest positions seen in clinical practice are retrocaecal or retrocolic, pelvic or descending. Other positions are sub caecal, pre ilial and post ilial.⁷ Histologically appendix presents four coats from outside inwards: serous, muscular, submucous and mucous.⁸ The reduction in appendicular lymphoid tissue that occurs in later life may be another reason why the disease is infrequent in elderly.⁹ The appendix is commonly 8 to 10 cm in length (about 3½ inches), though cases upto 20 cm long or more have been reported. It was found that the average length of the appendix in 220 consecutive postmortem examinations to be 9.9 cm. It has been described as tending to be about a centimeter longer in the male than in the female, though some investigators have found no particular difference with sex; its average diameter is about 6 mm at its base.¹⁰ The appendix is the commencement of the large gut. At an early embryonic stage it has the same caliber as the caecum and is in line with it. It is formed by the excessive growth of the right wall of the caecum, which pushes the appendix to the inner side. It varies in length from 2.5 cm to 3 cm. The

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average length is 9 cm.¹¹ According to some author the length of the appendix varies from 2 to 20 cm & the average length is 9 cm in adults.¹²

OBJECTIVES

(i) To find out the length of appendix in male and female in different ages. (ii) To see whether there is any difference of the length of appendix between male and female.

MATERIALS AND METHODS

Materials: Scalpel and forceps (pointed & toothed)

Method: The present study was undertaken at Gauhati Medical College & Hospital involving the departments of Anatomy and Forensic Medicine. Appendix of 63 males and 63 females were studied in four age groups as '0 to 20 years', '21 to 35 years', '36 to 50 years' & '51 to 70 years'.

Collection of specimens: Specimens were collected before putrefaction of the body. Specimens were collected after due permission / consent from the concerned authority and also from the nearest relatives of the deceased.

Measurement of lengths: The lengths of each specimen were measured using same standard for all the specimens. Before measuring the length of the appendix these were cleaned thoroughly by removing the extra tissues with the help of scalpel and forceps. Length was measured between the two ends of the appendix.

OBSERVATION

The results and observations of the present study is tabulated and graphed as follows:

Table 1 Length of male appendix in 0 to 20 years

Serial no.	Age in years	Length in cm
1	1	6.0
2	2	6.5
3	2	7.0
4	4	5.9
5	5	6.7
6	5	9.0
7	7	8.1
8	7	6.5
9	10	7.2
10	10	7.4
11	11	8.0
12	11	8.3

Serial no.	Age in years	Length in cm
13	13	6.0
14	13	7.9
15	15	11.52
16	16	10.2
17	18	11.0
18	19	7.7
19	20	9.0
Sum		149.92
Mean		7.891
S.D.		±1.647
S.E.M.		±0.377

Table 2 Length of male appendix in 21 to 35 years

Serial no.	Age in years	Length in cm
1	21	11
2	22	4.5
3	22	3.11
4	23	12.5
5	24	8.5
6	24	3.9
7	25	9.2
8	26	10.3
9	27	11.4
10	27	9.5
11	27	8.8
12	28	13.2
13	29	10.9
14	29	7.0
15	31	9.0
16	32	13.9
17	33	11.0
18	33	7.9
19	33	8.6
20	34	12.1
21	34	10.0
22	35	9.3
23	35	8.9
Sum		214.51
Mean		9.327
S.D.		±2.764
S.E.M.		±0.576

Table 3 Length of male appendix in 36 to 50 years

Serial no.	Age in years	Length in cm
1	36	10.0
2	37	6.5
3	37	11.0
4	40	5.6
5	40	12.1
6	42	9.4
7	43	8.6
8	44	9.9
9	45	12.20
10	49	3.30
11	50	7.91
Sum		96.51
Mean		8.774
S.D.		±2.773
S.E.M.		±0.836

Table 4 Length of male appendix in 51 to 70 years

Serial no.	Age in years	Length in cm
1	52	7.0
2	54	5.10
3	57	6.1
4	59	9.3
5	60	8.9
6	62	9.2
7	65	8.8
8	66	5.5
9	70	9.90
10	70	6.0
Sum		75.8
Mean		7.580
S.D.		±1.816
S.E.M.		±0.574

Table 5 Length of female appendix in 0 to 20 years

Serial no.	Age in years	Length in cm
1	1	5
2	2	5.4
3	3	5.2
4	3	6
5	4	6.2
6	4	7.1
7	5	7.4
8	6	9.1
9	8	10
10	9	11.6
11	10	8.7
12	12	12
13	14	9.8
14	15	10.2
15	18	13
16	20	9.6
Sum		136.3
Mean		8.519
S.D.		±2.556
S.E.M.		±0.639

Table 6 Length of female appendix in 21 to 35 years

Serial no.	Age in years	Length in cm
1	21	10
2	23	6
3	23	9.2
4	24	10.6
5	25	11.2
6	27	6.5
7	28	12.5
8	28	9.4
9	29	10
10	30	13.1
11	31	9.8
12	31	8.8
13	32	10.1
14	32	11.6
15	33	12.1
16	33	9.9
17	33	12.2
18	34	13.2
19	35	10
20	35	11
Sum		207.2
Mean		10.360
S.D.		±1.904
S.E.M.		±0.425

Mean Length of human appendix

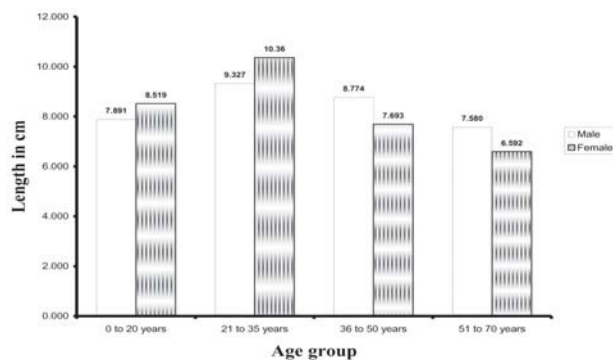


Figure 1 Mean length of appendix for male and female in different age groups

Table 7 Length of female appendix in 36 to 50 years

Serial no.	Age in years	Length in cm
1	36	9.3
2	37	8.5
3	37	9.3
4	38	8.2
5	39	7.5
6	40	8.1
7	41	9.1
8	41	6.4
9	42	7.7
10	43	5.1
11	45	8
12	46	6.1
13	47	5.2
14	48	9.0
15	50	7.9
Sum		115.4
Mean		7.693
S.D.		±1.395
S.E.M.		±0.360

Table 8 Length of female appendix in 51 to 70 years

Serial no.	Age in years	Length in cm
1	51	9.6
2	53	10.1
3	55	9.0
4	58	11.9
5	58	8.6
6	60	6.4
7	63	5.4
8	64	5.7
9	65	4.5
10	68	3.6
11	70	2.3
12	70	2.0
Sum		79.1
Mean		6.592
S.D.		±3.226
S.E.M.		±0.931

Table no 9 Frequency, relative frequency & percentage of length of appendix

Class interval	Length of Appendix					
	Male			Female		
	f (frequency)	fr (relative)	f% (percentage)	f (frequency)	fr (relative)	f% (percentage)
0 to 20 years	19	0.279	27.931	16	0.253	25.334
21 to 35 years	23	0.399	39.963	20	0.385	38.513
36 to 50 years	11	0.180	17.982	15	0.214	21.449
51 to 70 years	10	0.142	14.124	12	0.148	14.704
Sum	63	1.000	100.000	63	1.000	100.000

Table 9 shows that for male group highest number of subjects (maximum numbers of subject) are found in the class interval of 21 to 35 years with a relative frequency of 0.399, simple frequency of 23 and a percentage of 39.936. The lowest number of subjects (minimum numbers of subject) are found in the class interval of 51 to 70 years with a relative frequency of 0.142, simple frequency of 10 and a percentage of 14.124 as evident in **Figure 2** and **3**.

For female group highest number of subjects (maximum numbers of subject) are found in the class interval of 21 to 35 years with a relative frequency of 0.385, simple frequency of 20 and a percentage of 38.513. The lowest number of subjects (minimum numbers of subject) are found in the class interval of 51 to 70 years with a relative frequency of 0.148, simple frequency of 12 and a percentage of 14.704 as evident in **Figure 2** and **3**.

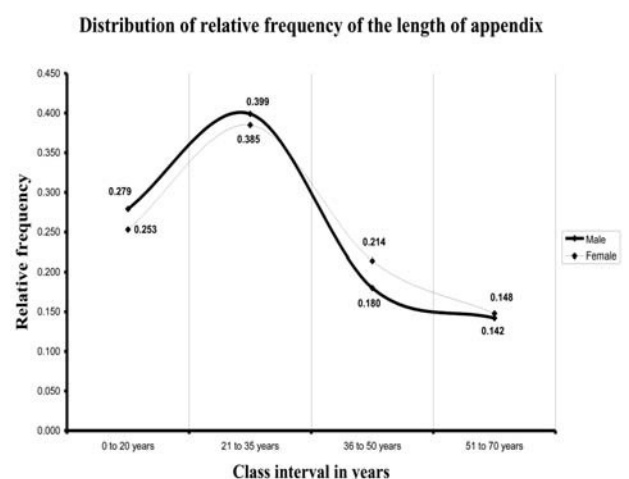


Figure 2 Distribution of relative frequency

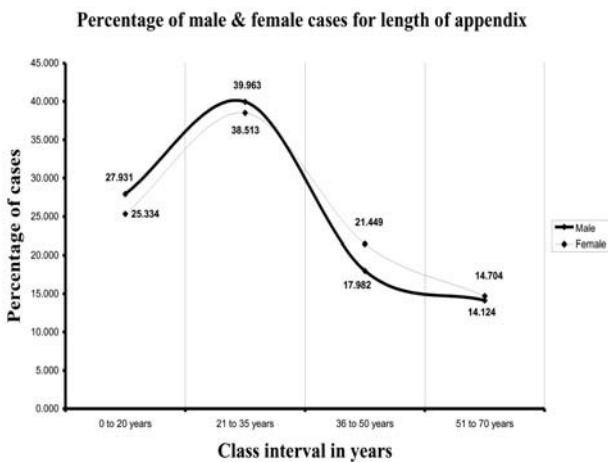


Figure 3 Distribution of percentage

Table 10 Level of significance of differences of length

Comparison of mean between	“t”	P
Length of male appendix of ‘0 to 20 years’ and ‘21 to 35 years’	2.09	<0.05
Length of male appendix of ‘21 to 35 years’ and ‘36 to 50 years’	0.553	>0.05
Length of male appendix of ‘36 to 50 years’ and ‘51 to 70 years’	1.153	>0.05
Length of male appendix of ‘21 to 35 years’ and ‘51 to 70 years’	2.151	<0.05
Length of female appendix of ‘0 to 20 years’ and ‘21 to 35 years’	2.403	<0.05
Length of female appendix of ‘21 to 35 years’ and ‘36 to 50 years’	4.805	<0.001
Length of female appendix of ‘36 to 50 years’ and ‘51 to 70 years’	1.104	>0.05
Length of female appendix of ‘21 to 35 years’ and ‘51 to 70 years’	3.687	<0.001

DISCUSSION

Many biological structures can be considered vestiges given our current evolutionary knowledge of comparative anatomy and phylogenetics. In evolutionary discussions the human vermiform appendix is one of the most commonly cited vestigial structures, and one of the most disputed.¹³ The appendix is an evagination of the caecum characterized by a relatively small, narrow and irregular lumen due to presence of abundant lymphoid follicles. It contains fewer and shorter intestinal glands and has no teniae coli.¹⁴ The appendix is commonly 8 to 10 cm in length (about 3½ inches), though cases upto 20 cm long or more have been reported. It was found that the average

length of the appendix in 220 consecutive postmortem examinations to be 9.9 cm. It has been described as tending to be about a centimeter longer in the male than in the female, though some investigators have found no particular difference with sex; its average diameter is about 6 mm at its base. A lot of research has been conducted till date on the size of appendix. Size of the appendix has been described by many authors in different times like Decker, Fisher, Russel *et al*, Brunicardi, Paterson-Brown and Snell.^{15,16,17,18,19,20} Our study is consistent with this universal observation. Length of appendix have been measured in matched sets of observation using the null hypothesis: Reject H_0 if $P \leq t_a$ when $t_a = t_{0.05}$ setting the level of confidence at 95% probability signifying that if the differences in observation between the matched groups is significant at the level of $P < 0.05$, the hypothesis will be rejected establishing differences in length between the tested groups.

CONCLUSION

The average length of appendix in the age group of ‘0 to 20 years’ is 7.891 ± 0.377 cm for males and 8.519 ± 0.639 cm for females; in the age group of ‘21 to 35 years’ 9.327 ± 0.576 cm for males and 10.360 ± 0.425 cm for females, in the age group of ‘36 to 50 years’ 8.774 ± 0.836 cm for males and 7.693 ± 0.360 cm for females, in the age group of ‘51 to 70 years’ 7.580 ± 0.574 cm for males and 6.592 ± 0.931 cm for females.

The length of the male appendix in the age group of ‘21 to 35’ years is more than the age group of ‘0 to 20 years’, which is significant ($P < 0.05$). Whereas the length of the male appendix in the age group of ‘36 to 50 years’ is less than the age group of ‘21 to 35 years’, but without any significance ($P > 0.05$) and length of the appendix in the age group of ‘51 to 70 years’ is less than the age group of ‘36 to 50 years’, but again without any significance ($P > 0.05$). But the length of the male appendix in the age group of ‘51 to 70 years’ is less than the age group of ‘0 to 20 years’, which is again significant ($P < 0.05$). On the other hand length of the female appendix in the age group of ‘21 to 35 years’ is more than the age group of ‘0 to 20 years’, which is significant ($P < 0.05$). Whereas the length of the female appendix in the age group of ‘36 to 50 years’ is less than the age group of ‘21 to 35 years’, which is highly significant ($P < 0.001$) and length of the appendix in the age group of ‘51 to 70 years’ is less than the age group of ‘36 to 50 years’, but without any significance ($P > 0.05$). But the length of the female appendix in the age group of ‘51 to 70 years’ is less than the age

group of '0 to 20 years', but without any significance ($P>0.05$).

Hence, from the above study, we can conclude that the length of both male & female appendix increases up to the age of 35 years. After the age of 35 years the length of the appendix shrinks or reduces up to old age. In male the reduction of size is more significant after the age of 50.

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Conflicts of interest: No conflict of interest is associated with this work.

Contribution of Authors: We declare that the authors named in this article did this work and all liabilities pertaining to claims relating to the content of this article will be borne by the authors.

Ethical clearance: Taken from Institutional Ethical Committee.

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