

Knowledge, Attitude and Practice Regarding: “The Bacterial Connection between Oral Cavity and Gut Diseases”

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ABSTRACT

The human body hosts over 100 trillion microorganisms, including those in the oral cavity, skin, and gastrointestinal tract. Among these, the oral cavity contains one of the most diverse microbial communities, with over 770 bacterial species, second only to the gut. Advances in sequencing technologies have clarified the unique microbial ecosystems of these sites, shaped by environmental and functional differences. Emerging evidence suggests a microbial link between the mouth and gut in disease contexts, as oral bacteria can translocate to the gastrointestinal tract via hematogenous or enteral routes. This translocation may contribute to gastrointestinal diseases such as irritable bowel syndrome, inflammatory bowel disease, and colorectal cancer. While the mechanisms underlying the colonization of the gut by oral microbes remain unclear, recent research explores their role in disease pathogenesis and factors enabling ectopic colonization.

Aim: To Assess Knowledge, Attitude, and Practice of Students regarding "The Bacterial Connection between Oral Cavity and Gut Diseases.

Objectives

- 1) To determine the Knowledge, Attitude, and Practice regarding "The Bacterial Connection between Oral Cavity and Gut Diseases among Undergraduate Dental Students based on Gender.
- 2) To determine the Knowledge, Attitude, and Practice regarding "The Bacterial Connection between Oral Cavity and Gut Diseases among Undergraduate Dental Students based on Year of Study.

Keywords: Gut Diseases, Gastrointestinal (GI) Tract, Human Microbiota, Mouth to Gut, Oral Health, Dysbiosis.

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Introduction

The human body hosts over 100 trillion microorganisms, collectively known as the microbiota, which vary across different body sites. The gut and oral cavity are two of the most diverse microbial ecosystems, with the gut microbiota playing a key role in immunity, nutrient digestion, and pathogen defense. Disruptions in gut microbiota (gut dysbiosis) are linked to diseases such as IBS, IBD, and colorectal cancer. Interestingly, studies reveal an abnormal presence of oral bacteria in the gut of patients with intestinal diseases, suggesting the oral cavity

as a reservoir for pathobionts contributing to gut pathologies.

The oral microbiome, with over 770 bacterial species, is the second largest after the gut. Its complex ecosystem includes bacteria from diverse phyla like Firmicutes and Actinobacteria. While normally beneficial, oral bacteria can spread to other body sites and contribute to systemic diseases, including cardiovascular issues and rheumatoid arthritis. These bacteria can also translocate to the digestive tract, where they may

disrupt indigenous microbial communities and promote disease. Emerging evidence highlights the role of oral bacteria in the pathogenesis of gastrointestinal diseases, warranting further investigation.

Method

A cross-sectional survey was conducted among 203 dental students, comprising 41 males (20.2%) and 162 females (79.8%), including 88 final year BDS Students, 83 second year BDS students, 3 third year BDS students, and 29 interns. The survey included 10 questions exploring Knowledge, Attitude, and Practice on the Topic "The Bacterial Connection between Oral Cavity and Gut Diseases. Responses were analyzed based on gender and year of study using chi-square tests to identify statistically significant differences.

Methodology

A) Study Design and Area: A cross-sectional study was carried out at the tertiary care teaching hospital Khammam.

B) Study Population: The health care students, including those of Second, Third, Final year, and Interns who responded to the Online questionnaire survey.

C) Study Instrument: A self-administered questionnaire was designed based on knowledge, Attitude, and Practice on the Topic "The Bacterial Connection between Oral Cavity and Gut Diseases and had a total of 10 questions. Each participant has to fill in their demographic data, like Name, age, and year of study. Participant has to select

one option from the answers provided against the questions that were based on Knowledge, Attitude, and Practice among dental students.

D) Pilot Study: A pilot study was conducted on a group of students to assess the validity and reliability of the study.

E) Sampling Method: The sampling method used is the convenience method.

F) Inclusion Criteria: The students who were interested in studying and who were willing to participate.

G) Exclusion Criteria: students who are not willing to participate are excluded.

H) Organizing the study: The study was designed in an online-based version of the self-administered questionnaire of 10 questions focusing on knowledge, Attitude, and Practice. Includes the sections of demographic data: Name, Age, Sex, and Year of study demographic information, and asked to answer all questions by selecting one option from the provided answers.

I) Statistical Analysis: Data from the filled questionnaire were conducted in a tabular form in an Excel worksheet and evaluated for analysis. The analysis was performed by SPSS version 29.

Result

A total of 203 students took part in this with female (79.8%) and male of (20.2%). The age of the participants ranged from 19-24 years. In this study, females have more knowledge than males, and Second-year students have more knowledge, followed by final-year students, Interns, and Third-year Students.

	N	Minimum	Maximum	Mean	Std. Deviation
Age	203	19	24	21.77	1.067
Valid N (listwise)	203				

Year of Study		Gender		Total
		Female	Male	
Final year	Count	74	14	88
	% of Total	36.5%	6.9%	43.3%
Intern	Count	21	8	29
	% of Total	10.3%	3.9%	14.3%
Second year	Count	66	17	83
	% of Total	32.5%	8.4%	40.9%

Third year	Count	1	2	3
	% of Total	0.5%	1.0%	1.5%
Total	Count	162	41	203
	% of Total	79.8%	20.2%	100.0%

Table 1

Gender								Total
				1	2	3	4	
Female	Year of Study	Final year	Count	24	12	26	12	74
			% of Total	14.8%	7.4%	16.0%	7.4%	45.7%
		Intern	Count	0	1	2	18	21
			% of Total	0.0%	0.6%	1.2%	11.1%	13.0%
		Second year	Count	3	9	4	50	66
			% of Total	1.9%	5.6%	2.5%	30.9%	40.7%
		Third year	Count	1	0	0	0	1
			% of Total	0.6%	0.0%	0.0%	0.0%	0.6%
		Total	Count	28	22	32	80	162
			% of Total	17.3%	13.6%	19.8%	49.4%	100.0%
Male	Year of Study	Final year	Count	5	3	3	3	14
			% of Total	12.2%	7.3%	7.3%	7.3%	34.1%
		Intern	Count	0	0	1	7	8
			% of Total	0.0%	0.0%	2.4%	17.1%	19.5%
		Second year	Count	0	0	2	15	17
			% of Total	0.0%	0.0%	4.9%	36.6%	41.5%
		Third year	Count	1	0	0	1	2
			% of Total	2.4%	0.0%	0.0%	2.4%	4.9%
		Total	Count	6	3	6	26	41
			% of Total	14.6%	7.3%	14.6%	63.4%	100.0%
Total	Year of Study	Final year	Count	29	15	29	15	88
			% of Total	14.3%	7.4%	14.3%	7.4%	43.3%
		Intern	Count	0	1	3	25	29
			% of Total	0.0%	0.5%	1.5%	12.3%	14.3%
		Second	Count	3	9	6	65	83

		year	% of Total	1.5%	4.4%	3.0%	32.0%	40.9%
		Third year	Count	2	0	0	1	3
			% of Total	1.0%	0.0%	0.0%	0.5%	1.5%
	Total		Count	34	25	38	106	203
			% of Total	16.7%	12.3%	18.7%	52.2%	100.0%

P-value = 0.000

Table 2

Gender								Total
				1	2	3	4	
Female	Year of Study	Final year	Count	23	19	25	7	74
			% of Total	14.2%	11.7%	15.4%	4.3%	45.7%
		Intern	Count	1	7	13	0	21
			% of Total	0.6%	4.3%	8.0%	0.0%	13.0%
		Second year	Count	4	7	52	3	66
			% of Total	2.5%	4.3%	32.1%	1.9%	40.7%
		Third year	Count	1	0	0	0	1
			% of Total	0.6%	0.0%	0.0%	0.0%	0.6%
	Total		Count	29	33	90	10	162
			% of Total	17.9%	20.4%	55.6%	6.2%	100.0%
Male	Year of Study	Final year	Count	4	2	7	1	14
			% of Total	9.8%	4.9%	17.1%	2.4%	34.1%
		Intern	Count	0	0	8	0	8
			% of Total	0.0%	0.0%	19.5%	0.0%	19.5%
		Second year	Count	2	1	14	0	17
			% of Total	4.9%	2.4%	34.1%	0.0%	41.5%
		Third year	Count	1	1	0	0	2
			% of Total	2.4%	2.4%	0.0%	0.0%	4.9%
	Total		Count	7	4	29	1	41
			% of Total	17.1%	9.8%	70.7%	2.4%	100.0%
Total	Year of Study	Final year	Count	27	21	32	8	88
			% of Total	13.3%	10.3%	15.8%	3.9%	43.3%
		Intern	Count	1	7	21	0	29
			% of Total	0.5%	3.4%	10.3%	0.0%	14.3%
		Second year	Count	6	8	66	3	83
			% of Total	3.0%	3.9%	32.5%	1.5%	40.9%
		Third year	Count	2	1	0	0	3
			% of Total	1.0%	0.5%	0.0%	0.0%	1.5%
	Total		Count	36	37	119	11	203
			% of Total	17.7%	18.2%	58.6%	5.4%	100.0%

P-value = 0.000

Table 3

Gender						Total
				1	2	
Female	Year of Study	Final year	Count	24	50	74
			% of Total	14.8%	30.9%	45.7%
		Intern	Count	0	21	21
			% of Total	0.0%	13.0%	13.0%
		Second year	Count	7	59	66
			% of Total	4.3%	36.4%	40.7%
		Third year	Count	0	1	1
			% of Total	0.0%	0.6%	0.6%
		Total		Count	31	162
				% of Total	19.1%	100.0%
Male	Year of Study	Final year	Count	1	13	14
			% of Total	2.4%	31.7%	34.1%
		Intern	Count	0	8	8
			% of Total	0.0%	19.5%	19.5%
		Second year	Count	2	15	17
			% of Total	4.9%	36.6%	41.5%
		Third year	Count	0	2	2
			% of Total	0.0%	4.9%	4.9%
		Total		Count	3	41
				% of Total	7.3%	100.0%
Total	Year of Study	Final year	Count	25	63	88
			% of Total	12.3%	31.0%	43.3%
		Intern	Count	0	29	29
			% of Total	0.0%	14.3%	14.3%
		Second year	Count	9	74	83
			% of Total	4.4%	36.5%	40.9%
		Third year	Count	0	3	3
			% of Total	0.0%	1.5%	1.5%
		Total		Count	34	203
				% of Total	16.7%	100.0%

P-value = 0.001**Table 4**

Gender							Total
				1	2	3	
Female	Year of Study	Final year	Count	26	18	30	74
			% of Total	16.0%	11.1%	18.5%	45.7%
		Intern	Count	15	1	5	21
			% of Total	9.3%	0.6%	3.1%	13.0%
		Second year	Count	9	11	46	66
			% of Total	5.6%	6.8%	28.4%	40.7%
		Third year	Count	0	0	1	1
			% of Total	0.0%	0.0%	0.6%	0.6%

	Total		Count	50	30	82	162
			% of Total	30.9%	18.5%	50.6%	100.0%
Male	Year of Study	Final year	Count	4	3	7	14
			% of Total	9.8%	7.3%	17.1%	34.1%
		Intern	Count	4	1	3	8
			% of Total	9.8%	2.4%	7.3%	19.5%
		Second year	Count	2	2	13	17
			% of Total	4.9%	4.9%	31.7%	41.5%
		Third year	Count	1	0	1	2
			% of Total	2.4%	0.0%	2.4%	4.9%
	Total		Count	11	6	24	41
			% of Total	26.8%	14.6%	58.5%	100.0%
Total	Year of Study	Final year	Count	30	21	37	88
			% of Total	14.8%	10.3%	18.2%	43.3%
		Intern	Count	19	2	8	29
			% of Total	9.4%	1.0%	3.9%	14.3%
		Second year	Count	11	13	59	83
			% of Total	5.4%	6.4%	29.1%	40.9%
		Third year	Count	1	0	2	3
			% of Total	0.5%	0.0%	1.0%	1.5%
	Total		Count	61	36	106	203
			% of Total	30.0%	17.7%	52.2%	100.0%

P-value = 0.000

Table 5

Gender								Total
				1	2	3	4	
Female	Year of Study	Final year	Count	7	15	20	32	74
			% of Total	4.3%	9.3%	12.3%	19.8%	45.7%
		Intern	Count	2	4	12	3	21
			% of Total	1.2%	2.5%	7.4%	1.9%	13.0%
		Second year	Count	1	5	58	2	66
			% of Total	0.6%	3.1%	35.8%	1.2%	40.7%
		Third year	Count	0	0	0	1	1
			% of Total	0.0%	0.0%	0.0%	0.6%	0.6%
	Total		Count	10	24	90	38	162
			% of Total	6.2%	14.8%	55.6%	23.5%	100.0%
Male	Year of Study	Final year	Count		2	6	6	14
			% of Total		4.9%	14.6%	14.6%	34.1%
		Intern	Count		0	7	1	8
			% of Total		0.0%	17.1%	2.4%	19.5%
		Second year	Count		2	14	1	17
			% of Total		4.9%	34.1%	2.4%	41.5%
		Third year	Count		0	1	1	2
			% of Total		0.0%	2.4%	2.4%	4.9%
	Total		Count		4	28	9	41

			% of Total		9.8%	68.3%	22.0%	100.0%
Total	Year of Study	Final year	Count	7	17	26	38	88
			% of Total	3.4%	8.4%	12.8%	18.7%	43.3%
		Intern	Count	2	4	19	4	29
			% of Total	1.0%	2.0%	9.4%	2.0%	14.3%
		Second year	Count	1	7	72	3	83
			% of Total	0.5%	3.4%	35.5%	1.5%	40.9%
		Third year	Count	0	0	1	2	3
			% of Total	0.0%	0.0%	0.5%	1.0%	1.5%
	Total		Count	10	28	118	47	203
			% of Total	4.9%	13.8%	58.1%	23.2%	100.0%

P-value = 0.000

Table 6

Table 3

Gender							Total
				1	2	3	
Female	Year of Study	Final year	Count	37	13	24	74
			% of Total	22.8%	8.0%	14.8%	45.7%
		Intern	Count	19	0	2	21
			% of Total	11.7%	0.0%	1.2%	13.0%
		Second year	Count	49	9	8	66
			% of Total	30.2%	5.6%	4.9%	40.7%
		Third year	Count	1	0	0	1
			% of Total	0.6%	0.0%	0.0%	0.6%
	Total		Count	106	22	34	162
			% of Total	65.4%	13.6%	21.0%	100.0%
Male	Year of Study	Final year	Count	7	2	5	14
			% of Total	17.1%	4.9%	12.2%	34.1%
		Intern	Count	7	1	0	8
			% of Total	17.1%	2.4%	0.0%	19.5%
		Second year	Count	15	0	2	17
			% of Total	36.6%	0.0%	4.9%	41.5%

Total	Year of Study	Third year	Count	2	0	0	2
			% of Total	4.9%	0.0%	0.0%	4.9%
		Total	Count	31	3	7	41
			% of Total	75.6%	7.3%	17.1%	100.0%
		Final year	Count	44	15	29	88
			% of Total	21.7%	7.4%	14.3%	43.3%
		Intern	Count	26	1	2	29
			% of Total	12.8%	0.5%	1.0%	14.3%
Total	Year of Study	Second year	Count	64	9	10	83
			% of Total	31.5%	4.4%	4.9%	40.9%
		Third year	Count	3	0	0	3
			% of Total	1.5%	0.0%	0.0%	1.5%
		Total	Count	137	25	41	203
			% of Total	67.5%	12.3%	20.2%	100.0%

P-value = 0.000

Table 7

Gender						Total
				1	2	
Female	Year of Study	Final year	Count	42	32	74
			% of Total	25.9%	19.8%	45.7%
		Intern	Count	21	0	21
			% of Total	13.0%	0.0%	13.0%
		Second year	Count	57	9	66
			% of Total	35.2%	5.6%	40.7%
		Third year	Count	1	0	1
			% of Total	0.6%	0.0%	0.6%
		Total	Count	121	41	162
			% of Total	74.7%	25.3%	100.0%
Male	Year of Study	Final year	Count	9	5	14
			% of Total	22.0%	12.2%	34.1%
		Intern	Count	8	0	8
			% of Total	19.5%	0.0%	19.5%
		Second year	Count	15	2	17
			% of Total	36.6%	4.9%	41.5%
		Third year	Count	2	0	2
			% of Total	4.9%	0.0%	4.9%

			% of Total	4.9%	0.0%	4.9%	
	Total		Count	34	7	41	
			% of Total	82.9%	17.1%	100.0%	
Total	Year of Study	Final year	Count	51	37	88	
			% of Total	25.1%	18.2%	43.3%	
		Intern	Count	29	0	29	
			% of Total	14.3%	0.0%	14.3%	
		Second year	Count	72	11	83	
			% of Total	35.5%	5.4%	40.9%	
		Third year	Count	3	0	3	
			% of Total	1.5%	0.0%	1.5%	
		Total		Count	155	48	203
				% of Total	76.4%	23.6%	100.0%

P-value = 0.000

Table 8

Gender				1	2	3	Total
Female	Year of Study	Final year	Count	33	16	25	74
			% of Total	20.4%	9.9%	15.4%	45.7%
		Intern	Count	17	0	4	21
			% of Total	10.5%	0.0%	2.5%	13.0%
		Second year	Count	47	9	10	66
			% of Total	29.0%	5.6%	6.2%	40.7%
		Third year	Count	1	0	0	1
			% of Total	0.6%	0.0%	0.0%	0.6%
		Total	Count	98	25	39	162
			% of Total	60.5%	15.4%	24.1%	100.0%
Male	Year of Study	Final year	Count	9	4	1	14
			% of Total	22.0%	9.8%	2.4%	34.1%
		Intern	Count	7	0	1	8
			% of Total	17.1%	0.0%	2.4%	19.5%
		Second year	Count	16	0	1	17
			% of Total	39.0%	0.0%	2.4%	41.5%
		Third year	Count	2	0	0	2
			% of Total	4.9%	0.0%	0.0%	4.9%
		Total	Count	34	4	3	41
			% of Total	82.9%	9.8%	7.3%	100.0%
Total	Year of Study	Final year	Count	42	20	26	88
			% of Total	20.7%	9.9%	12.8%	43.3%
		Intern	Count	24	0	5	29
			% of Total	11.8%	0.0%	2.5%	14.3%
		Second year	Count	63	9	11	83
			% of Total	31.0%	4.4%	5.4%	40.9%
		Third year	Count	3	0	0	3
			% of Total	1.5%	0.0%	0.0%	1.5%
		Total	Count	132	29	42	203
			% of Total	65.0%	14.3%	20.7%	100.0%

P-value = 0.001

Table 9

Gender									Total	
				1	2	3	4	5		
Female	Year of Study	Final year	Count	10	17	13	10	24	74	
			% of Total	6.2%	10.5%	8.0%	6.2%	14.8%	45.7%	
		Intern	Count	10	7	2	2	0	21	
			% of Total	6.2%	4.3%	1.2%	1.2%	0.0%	13.0%	
		Second year	Count	44	10	8	2	2	66	
			% of Total	27.2%	6.2%	4.9%	1.2%	1.2%	40.7%	
		Third year	Count	0	0	0	0	1	1	
			% of Total	0.0%	0.0%	0.0%	0.0%	0.6%	0.6%	
		Total		Count	64	34	23	14	27	162
				% of Total	39.5%	21.0%	14.2%	8.6%	16.7%	100.0%
Male	Year of Study	Final year	Count	3	5	3	1	2	14	
			% of Total	7.3%	12.2%	7.3%	2.4%	4.9%	34.1%	
		Intern	Count	6	2	0	0	0	8	
			% of Total	14.6%	4.9%	0.0%	0.0%	0.0%	19.5%	
		Second year	Count	14	3	0	0	0	17	
			% of Total	34.1%	7.3%	0.0%	0.0%	0.0%	41.5%	
		Third year	Count	0	0	1	0	1	2	
			% of Total	0.0%	0.0%	2.4%	0.0%	2.4%	4.9%	
		Total		Count	23	10	4	1	3	41
				% of Total	56.1%	24.4%	9.8%	2.4%	7.3%	100.0%
Total	Year of Study	Final year	Count	13	22	16	11	26	88	
			% of Total	6.4%	10.8%	7.9%	5.4%	12.8%	43.3%	
		Intern	Count	16	9	2	2	0	29	
			% of Total	7.9%	4.4%	1.0%	1.0%	0.0%	14.3%	
		Second year	Count	58	13	8	2	2	83	
			% of Total	28.6%	6.4%	3.9%	1.0%	1.0%	40.9%	
		Third year	Count	0	0	1	0	2	3	
			% of Total	0.0%	0.0%	0.5%	0.0%	1.0%	1.5%	
		Total		Count	87	44	27	15	30	203

		% of Total	42.9%	21.7%	13.3%	7.4%	14.8%	100.0%
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P-value = 0.000

Table 10

Gender				1	2	3	4	Total
Female	Year of Study	Final year	Count	28	15	10	21	74
			% of Total	17.3%	9.3%	6.2%	13.0%	45.7%
		Intern	Count	2	1	0	18	21
			% of Total	1.2%	0.6%	0.0%	11.1%	13.0%
		Second year	Count	4	10	6	46	66
			% of Total	2.5%	6.2%	3.7%	28.4%	40.7%
		Third year	Count	1	0	0	0	1
			% of Total	0.6%	0.0%	0.0%	0.0%	0.6%
		Total	Count	35	26	16	85	162
			% of Total	21.6%	16.0%	9.9%	52.5%	100.0%
Male	Year of Study	Final year	Count	5	1	3	5	14
			% of Total	12.2%	2.4%	7.3%	12.2%	34.1%
		Intern	Count	0	0	0	8	8
			% of Total	0.0%	0.0%	0.0%	19.5%	19.5%
		Second year	Count	3	0	1	13	17
			% of Total	7.3%	0.0%	2.4%	31.7%	41.5%
		Third year	Count	1	1	0	0	2
			% of Total	2.4%	2.4%	0.0%	0.0%	4.9%
		Total	Count	9	2	4	26	41
			% of Total	22.0%	4.9%	9.8%	63.4%	100.0%
Total	Year of Study	Final year	Count	33	16	13	26	88
			% of Total	16.3%	7.9%	6.4%	12.8%	43.3%
		Intern	Count	2	1	0	26	29
			% of Total	1.0%	0.5%	0.0%	12.8%	14.3%
		Second year	Count	7	10	7	59	83
			% of Total	3.4%	4.9%	3.4%	29.1%	40.9%
		Third year	Count	2	1	0	0	3
			% of Total	1.0%	0.5%	0.0%	0.0%	1.5%
		Total	Count	44	28	20	111	203
			% of Total	21.7%	13.8%	9.9%	54.7%	100.0%

Table 11

Gender				1	2	3	Total
Female	Year of Study	Final year	Count	49	14	11	74
			% of Total	30.2%	8.6%	6.8%	45.7%
		Intern	Count	11	5	5	21
			% of Total	6.8%	3.1%	3.1%	13.0%
		Second year	Count	35	15	16	66
			% of Total	21.7%	9.3%	9.9%	40.9%

			% of Total	21.6%	9.3%	9.9%	40.7%
			Count	1	0	0	1
		Third year	% of Total	0.6%	0.0%	0.0%	0.6%
		Total	Count	96	34	32	162
Male	Year of Study	Final year	% of Total	59.3%	21.0%	19.8%	100.0%
			Count	9	1	4	14
		Intern	% of Total	22.0%	2.4%	9.8%	34.1%
			Count	4	1	3	8
		Second year	% of Total	9.8%	2.4%	7.3%	19.5%
			Count	10	3	4	17
		Third year	% of Total	24.4%	7.3%	9.8%	41.5%
			Count	1	0	1	2
		Total	% of Total	2.4%	0.0%	2.4%	4.9%
			Count	24	5	12	41
Total	Year of Study	Final year	% of Total	58.5%	12.2%	29.3%	100.0%
			Count	58	15	15	88
		Intern	% of Total	28.6%	7.4%	7.4%	43.3%
			Count	15	6	8	29
		Second year	% of Total	7.4%	3.0%	3.9%	14.3%
			Count	45	18	20	83
		Third year	% of Total	22.2%	8.9%	9.9%	40.9%
			Count	2	0	1	3
		Total	% of Total	1.0%	0.0%	0.5%	1.5%
			Count	120	39	44	203
		Total	% of Total	59.1%	19.2%	21.7%	100.0%
			Count	120	39	44	203

P-value = 0.655

Table 12

Gender							Total
				1	2	3	
Female	Year of Study	Final year	Count	26	21	27	74
			% of Total	16.0%	13.0%	16.7%	45.7%
		Intern	Count	8	4	9	21
			% of Total	4.9%	2.5%	5.6%	13.0%
		Second year	Count	19	12	35	66
			% of Total	11.7%	7.4%	21.6%	40.7%
		Third year	Count	0	0	1	1
			% of Total	0.0%	0.0%	0.6%	0.6%
		Total	Count	53	37	72	162
			% of Total	32.7%	22.8%	44.4%	100.0%
Male	Year of Study	Final year	Count	5	2	7	14
			% of Total	12.2%	4.9%	17.1%	34.1%
		Intern	Count	3	2	3	8
			% of Total	7.3%	4.9%	7.3%	19.5%
		Second year	Count	4	7	6	17
			% of Total	9.8%	17.1%	14.6%	41.5%

		Third year	Count	1	1	0	2
			% of Total	2.4%	2.4%	0.0%	4.9%
	Total		Count	13	12	16	41
			% of Total	31.7%	29.3%	39.0%	100.0%
Total	Year of Study	Final year	Count	31	23	34	88
			% of Total	15.3%	11.3%	16.7%	43.3%
		Intern	Count	11	6	12	29
			% of Total	5.4%	3.0%	5.9%	14.3%
		Second year	Count	23	19	41	83
			% of Total	11.3%	9.4%	20.2%	40.9%
		Third year	Count	1	1	1	3
			% of Total	0.5%	0.5%	0.5%	1.5%
	Total		Count	66	49	88	203
			% of Total	32.5%	24.1%	43.3%	100.0%

P-value = 0.840

Discussion

The human body is host to more than 100 trillion microorganisms, collectively referred to as the human microbiota. These microorganisms populate different areas of the body, such as the oral cavity and gastrointestinal (GI) tract, forming distinct microbial ecosystems based on their specific environments. Among these, the oral cavity houses an exceptionally diverse microbiota, second only to the gut, with over 770 bacterial species identified. Advances in sequencing technologies have shed light on these microbial communities, revealing that while the oral and gut microbiota are predominantly distinct, there is a microbial connection between the two, particularly in relation to disease development.

Research shows that oral bacteria can travel to the GI tract via hematogenous and enteral routes, potentially exacerbating gut disorders like irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), and colorectal cancer (CRC). This process of ectopic colonization can disrupt the native gut microbiota, leading to dysbiosis, a state associated with various intestinal diseases. Bacteria such as *Streptococcus* and *Veillonella* are commonly found in both the oral cavity and the gut. While these bacteria may play beneficial roles in gut maintenance and immune modulation under normal conditions, they can contribute to disease progression under certain circumstances.

In IBS, the gut microbiota of affected individuals often exhibits an increase in oral bacteria, including *Streptococcus* and *Veillonella*. These bacteria may contribute to the condition through mechanisms like increased hydrogen production, which can cause gastrointestinal discomfort. Similarly, in IBD, an altered gut microbiota is characterized by reduced diversity and a higher prevalence of oral bacteria, such as *Veillonellaceae* and *Fusobacteriaceae*. Oral bacteria like *Klebsiella* have been implicated in triggering inflammatory responses that aggravate gut inflammation, particularly in individuals with a genetic predisposition.

In CRC, oral bacteria such as *Fusobacterium*, *Porphyromonas*, and *Peptostreptococcus* are frequently detected in the gut microbiota of patients. These bacteria may promote tumor development by driving inflammation, disrupting epithelial barriers, and influencing the tumor microenvironment. For example, *Fusobacterium nucleatum* has been shown to bind to tumor cells, enhance their invasiveness, and facilitate tumor progression.

The mechanisms by which oral bacteria impact gut diseases remain an area of ongoing research. Current studies suggest that interactions between bacterial effector proteins and host receptors play

a critical role in disease progression. For instance, *Fusobacterium nucleatum* employs its adhesin proteins to invade epithelial cells, fostering colorectal tumor growth.

In summary, the oral cavity acts as a reservoir for bacteria that can migrate to the gut and contribute to the development of gastrointestinal diseases under certain conditions. This highlights the importance of oral health and understanding the oral-gut microbial connection to inform potential therapeutic approaches. Further research is necessary to fully uncover the mechanisms by which oral bacteria influence gut health and disease outcomes.

Conclusion

The transmission of bacteria from the mouth to the gut appears to play a significant role in bacteria-driven gastrointestinal pathologies, as suggested by numerous studies. However, most of the existing research linking oral bacteria to extraoral diseases remains observational, focusing primarily on associations rather than definitive mechanisms. Further investigations are needed to clarify how oral bacteria migrate to extraoral sites and to determine their specific role in the development of diseases in these regions, including the gastrointestinal tract. Additionally, extensive epidemiological cohort studies are essential to establish the clinical significance of oral pathology and the proliferation of oral pathobionts in the onset of gut diseases. These research efforts will be instrumental in developing

innovative diagnostic and therapeutic strategies aimed at targeting oral bacteria.

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