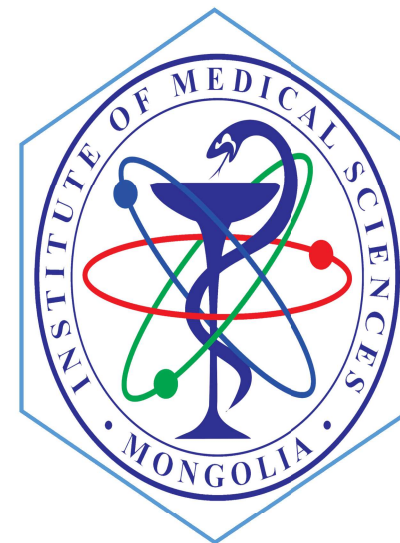


Factors affecting colorectal cancer and changes in microbiota



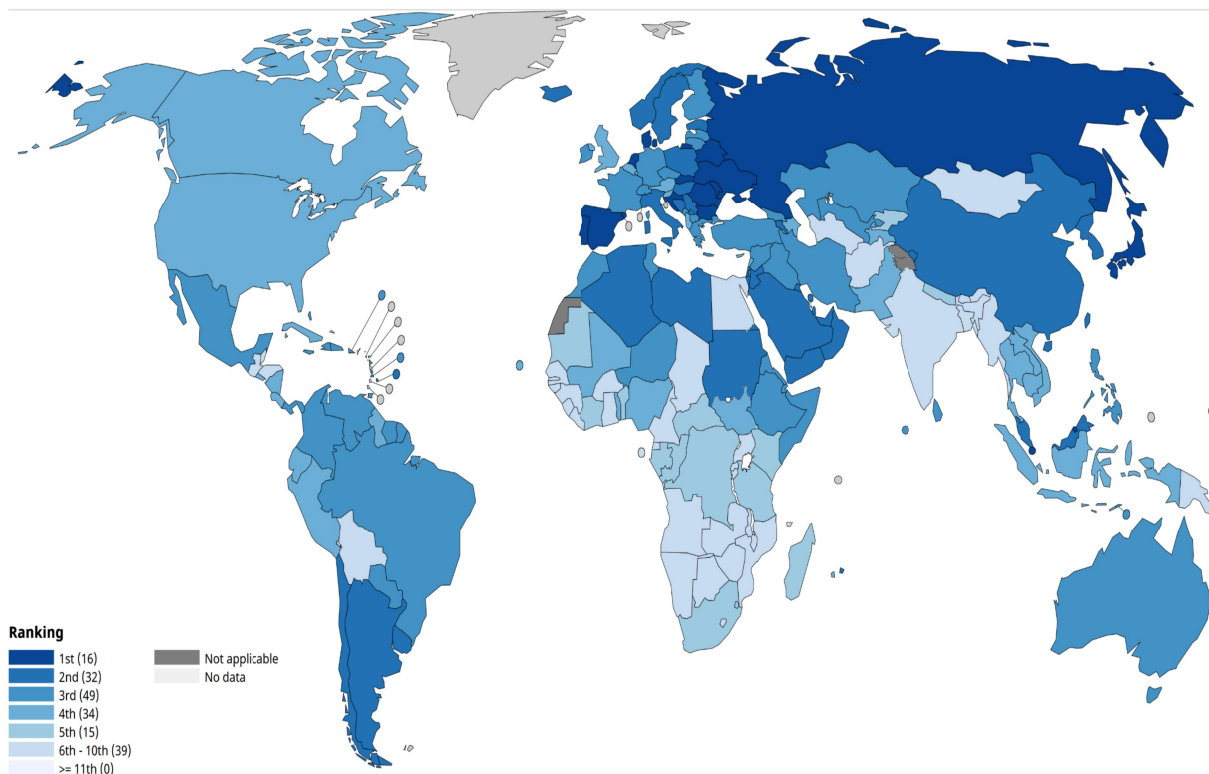
Batbold Batsaikhan MD., MMSc., PhD
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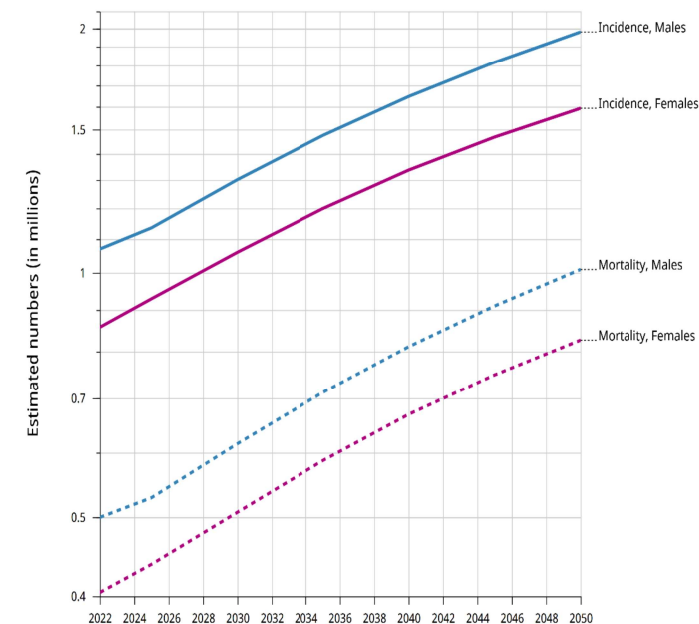
Introduction

3rd Mortality Over 903'000 Incidence Over 1'920'000

Ranking, Absolute numbers, Incidence, Both sexes, in 2022
Colorectum



Estimated numbers from 2022 to 2050, Males and Females, age [0-85+]
World



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Cancer TODAY | IARC
<https://gco.iarc.who.int/today>
Data version: Globocan 2022 (version 1.1) - 08.02.2024
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International Agency
for Research on Cancer
World Health
Organization

Introduction

Risk factors for colorectal cancer

In developing countries, lifestyle factors that increase the risk of colorectal cancer include:

- Physical inactivity,
- Smoking
- Alcohol consumption etc.

Approximately 500 types of microflora are found in the colon.



The human body is an ecosystem. It is home to trillions of microbes.

Photo Credit: Gaby D'Alessandro/AMNH

Introduction

MICROBIOTA - community of microorganisms (including bacteria, viruses, fungi, and archaea) that live in a specific environment in or on the human body

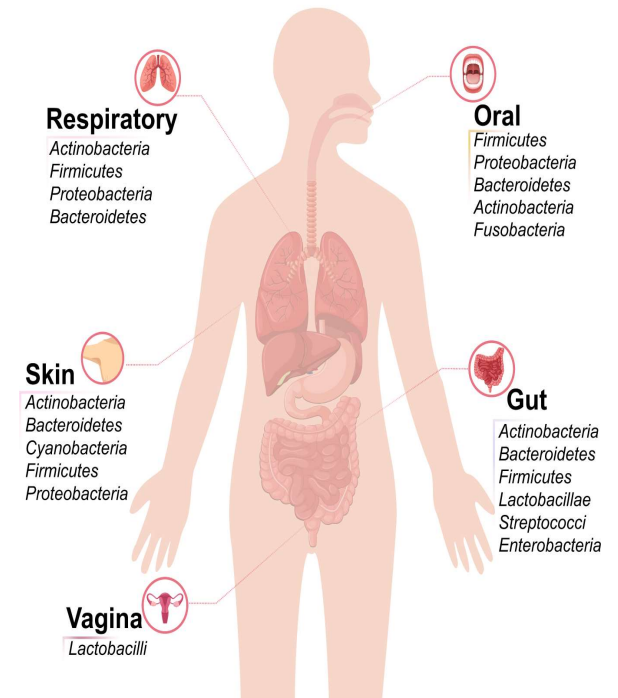
NORMAL MICROBIOTA: Microorganisms that naturally reside in or on the body without causing harm under normal conditions.

These microorganisms play a crucial role in gastrointestinal physiology, as they produce energy, support the immune system, and synthesize essential vitamins.

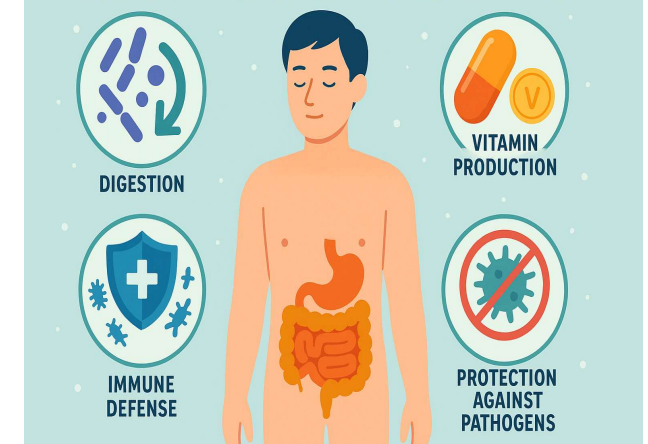
PATHOGENIC MICROBIOTA: Microbial species that, through virulence mechanisms such as toxin production, adhesion, and immune evasion, disrupt normal host function and lead to infectious disease.

The gut microbiota can influence **inflammation and DNA damage** mechanisms, producing metabolites that contribute to either tumor progression or suppression, thereby affecting the progression of colorectal cancer. For example, bacterial genera such as *Clostridium*, *Bacteroides*, *Enterococcus*, and *Escherichia* can secrete oncogenic virulence factors.

Microbiota composition in different regions



ROLES OF MICROBIOTA IN HOST HEALTH



Objective

We aimed to investigate the association between gut microbiota (normal and pathogenic) and colon cancer.

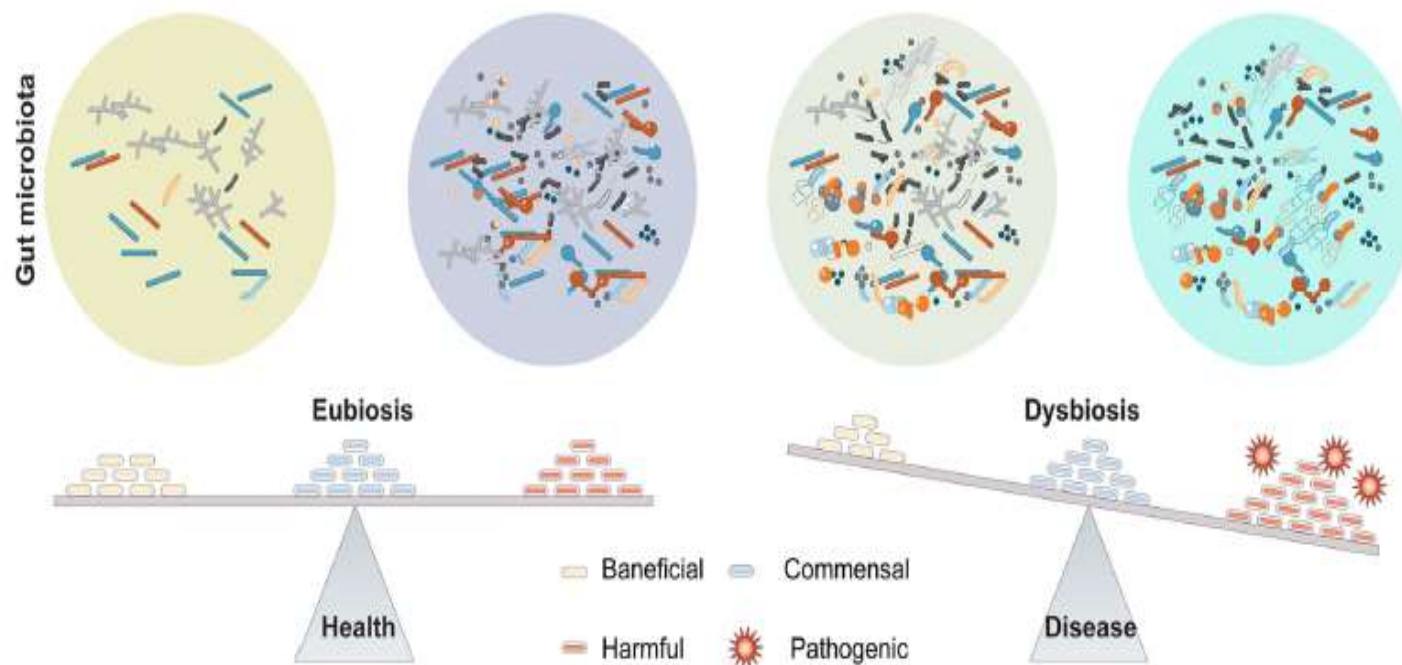


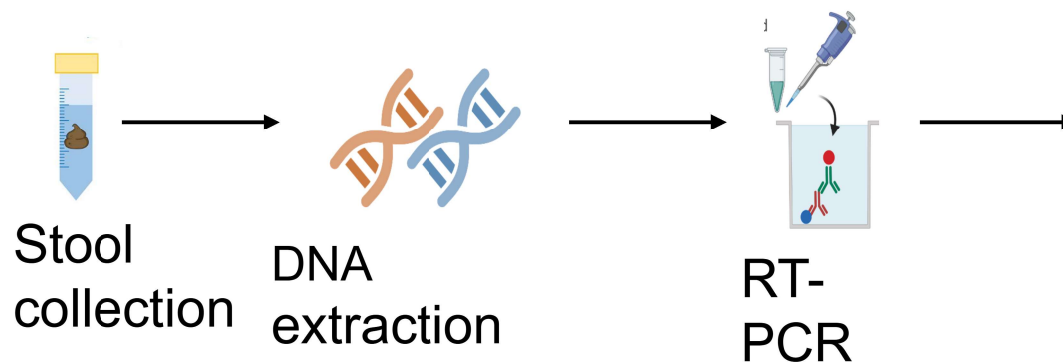
Figure 1. The physiologic succession of gut microbiota across the life cycle.

Material and methods

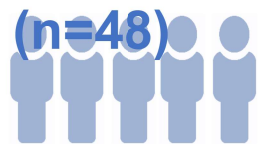
Colon cancer patients



- Newly diagnosed with colon cancer by biopsy
- 20 years or older



Healthy subjects



- Matching with the case group in terms of age, sex
- No gastrointestinal symptoms
- No colorectal disorders by colonoscopy

FULL NAME:		CONTAINER ID:		DATE OF SAMPLING:	
		29 Buyandelger 83		11/20/2023	
NAME OF RESEARCH	ABSOLUTE, Lg (GE/g feces)*		RELATIVE, %		
	Value*	Reference interval	Value	Reference interval	
Total bacterial mass	10.4				
NORMAL MICROBIOTA	9.7		63.7		
Actinobacteria					
Bifidobacterium spp	6.7		0.1		
Metabolically active bifidobacteria species, proportion			> 10		
Metabolically active "infant" bifidobacteria **	5.4		29.6		
Bifidobacterium longum subsp. infantis	-		-		
Bifidobacterium longum subsp. longum	5.4		29.6		
Bifidobacterium bifidum	-		-		
Bifidobacterium breve	-		-		
Metabolically active "adult" bifidobacteria **	5.8		70.4		
Bifidobacterium adolescentis	-		-		
Bifidobacterium catenulatum spp	5.3		23.5		
Bifidobacterium animalis subsp. lactis			-		
Bifidobacterium dentium	5.6		46.9		
Coriobacteria	8.2		1.8		
Firmicutes					
Clostridium leptum gr	9.5		36.1		
Dialister+Allisonella+Megasphaera+Veillonella	7.1		0.1		
Faecalibacterium prausnitzii	6.4		< 0.1		
Lachnospiraceae	9.1		14.4		
Lactobacillaceae	5.5		< 0.1		
Streptococcus spp	5.6		< 0.1		
Lactococcus lactis	5.5		< 0.1		
Bacteroidetes					
Alisipes spp	7.9		0.9		
Bacteroides spp	8.1		1.4		
Butyrivibrio spp	7.3		0.2		
Parabacteroides spp	7.9		0.9		
Prevotella spp	6.7		0.1		
Other bacteria					
Akkermansia muciniphila	8.4		2.9		
Desulfovibrio spp	7.2		0.2		
Methanobrevibacter spp	8.6		4.5		
Diversity, number of taxa:	17				
Firmicutes/Bacteroidetes ratio:	-				
OPPORTUNISTIC PATHOGENS	9.5		36.3		
Clostridium difficile gr	6.8		0.1		
Clostridium perfringens gr	5.9		< 0.1		
Enterobacteriales	9.5		36.1		
E.coli	9.6		45.5		
Enterococcus spp	4.8		< 0.1		
Erysipelotrichaceae	6.8		0.1		

17 normal microbes:

- Actinobacteria - 2,
- Firmicutes - 7,
- Bacteroidetes - 5,
- Other - 3,

10 pathogenic microbes



The average
age **59.5 ±
11.4 years**



57.8% (n =
56)

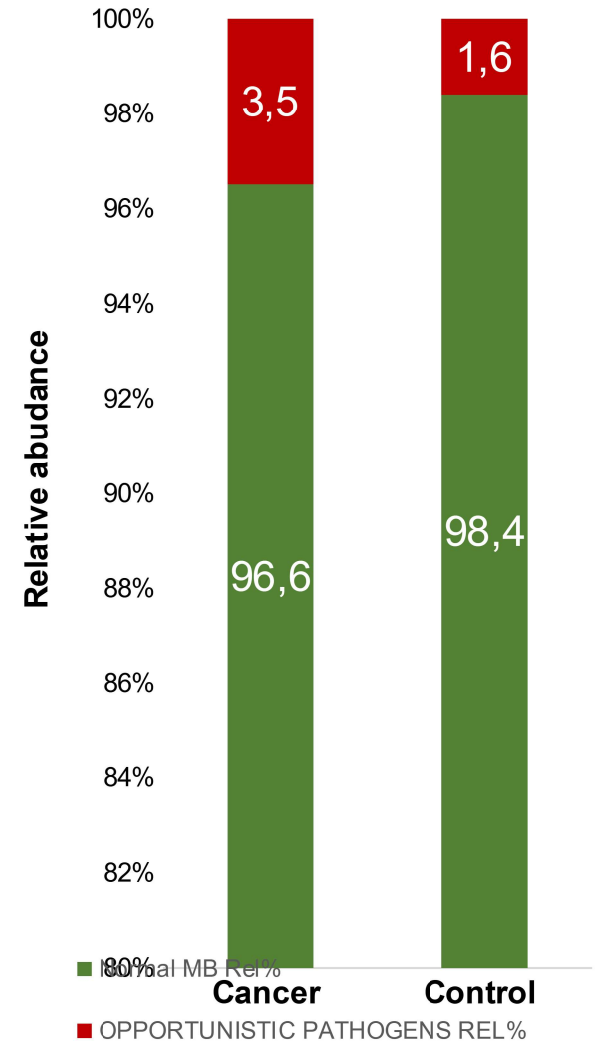


42.2% (n =
41)

In this study, we calculated the absolute counts of identified bacteria, as well as their relative proportions within the fecal samples.

- The **total microbial mass** among all participants was $10^{10.22}$, of which $10^{10.13}$ **represented normal microbiota**.
- The proportions of normal bacteria were $96.6\% \pm 6.8$ in the patients with colon cancer, and $98.4\% \pm 2.1$ in healthy subjects ($p = 0.12$).

Results



Results

IDENTIFY RISK FACTORS FOR COLORECTAL CANCER

Indicators	Cancer	Control	P value
Age, years (дундаж±SD)	59.4±12.3	54.5±13.7	0.04
Gender (male, %)	42 (42.9%)	38 (35.5%)	0.231
Education (bacholer, %)	40 (50%)	49 (49.5%)	0.144
Body mass index (mean, kg/m ² ±SD)	29.7±12.2	30.6±29.3	0,890
Working conditions (Hazardous, %)	11 (13.8%)	7 (7.3%)	0.159
Smoke (yes, %)	15 (18.8%)	17 (17.3%)	0.808
Daily smoking (yes, %)	15 (100%)	14 (82.4%)	0.087
Alcohol (yes, %)	38 (47.5%)	63 (64.3%)	0.025
Diabet, (yes, %)	12 (16.0%)	7 (7.1%)	0.065
Exercise (yes, %)	5 (19.2%)	37 (41.1%)	0.041 OR 0.341 (0.118-.0986)

FRUIT AND VEGETABLE CONSUMPTION

Results

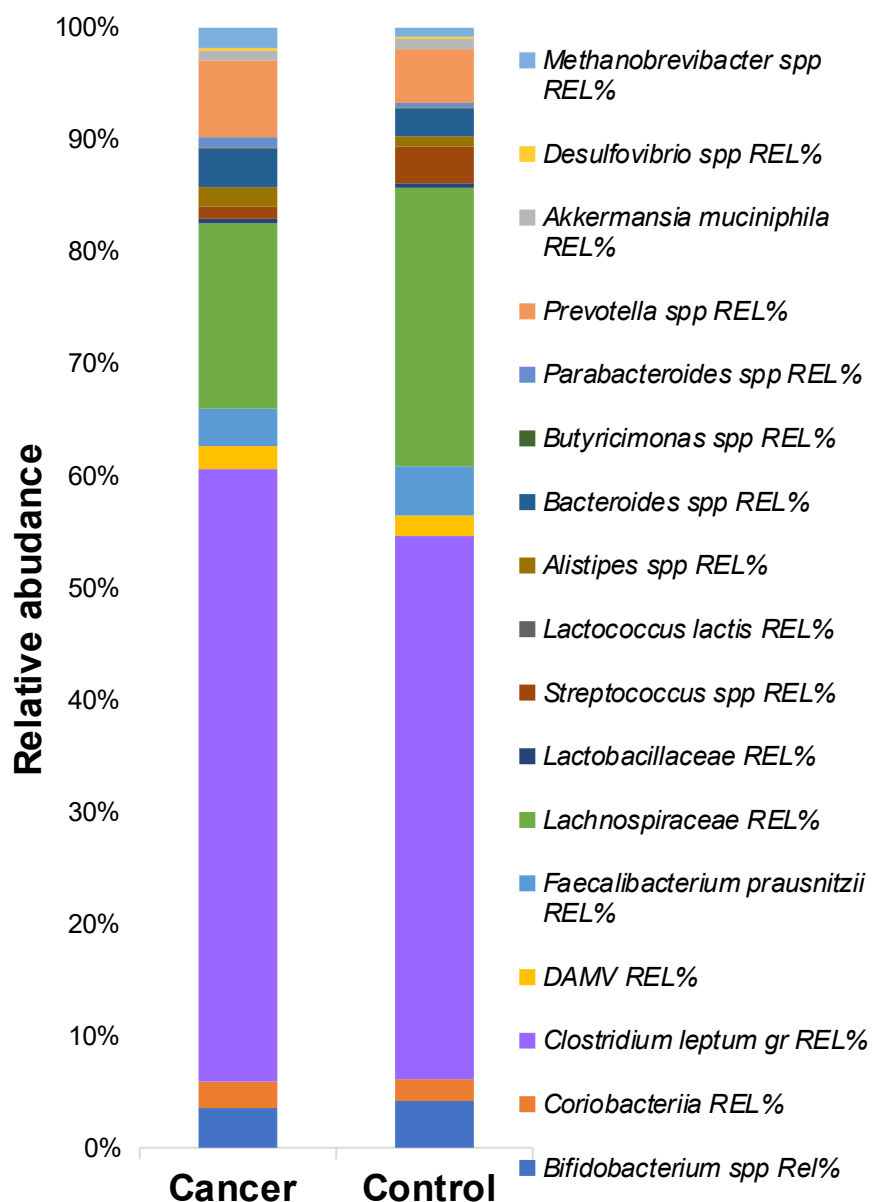
Indicators	Cancer	Control	<i>p value</i>
Fruit consumption			
Never	18(23.1%)	14(14.4%)	<i>p=0.010</i>
Once a week	28(35.9%)	31(32%)	<i>OR 0.9 (0.27-2.96)</i>
2-3 times a week	20(25.6%)	27(27.8%)	<i>OR 0.63 (0.21-1.89)</i>
4-6 times a week	2(2.6%)	18(18.6%)	<i>OR 0.52 (0.17-1.6)</i>
Daily	10(12.8%)	7(7.2%)	<i>OR 0.08 (0.01-0.45)</i>
			-
Vegetable consumption			
Never	2(2.6%)	1(1%)	<i>p<0.0001</i>
Once a week	3(3.8%)	6(6.3%)	<i>OR 1.05 (0.92-11.99)</i>
2-3 times a week	5(6.4%)	17(17.7%)	<i>OR 0.26 (0.62-1.12)</i>
4-6 times a week	5(6.4%)	39(40.6%)	<i>OR 0.15 (0.52-0.46)</i>
Daily	63(80.8%)	33(34.4%)	<i>OR 0.07 (0.02-0.19)</i>
			-

Results

BEEF AND MUTTON CONSUMPTION

Indicators	Cancer	Control	P value
Beef consumption			<i>p<0.0001</i>
Never	9(11.5%)	2(2.1%)	<i>OR 2.94 (0.57-15.3)</i>
Once a week	4(5.1%)	11(11.6%)	<i>OR 0.24 (0.06-0.87)</i>
2-3 times a week	23(29.5%)	21(22.1%)	<i>OR 0.72 (0.31-1.68)</i>
4-6 times a week	16(20.5%)	44(46.3%)	<i>OR 0.24 (0.10-0.55)</i>
Daily	26(33.3)	17(17.9%)	-
Mutton consumption			<i>p=0.08</i>
Never	6(7.7%)	9(9.5%)	
Once a week	8(10.3%)	22(23.2%)	
2-3 times a week	27(34.6%)	32(33.7%)	
4-6 times a week	18(23.1%)	21(22.1%)	
Daily	19(24.4%)	11(11.6%)	

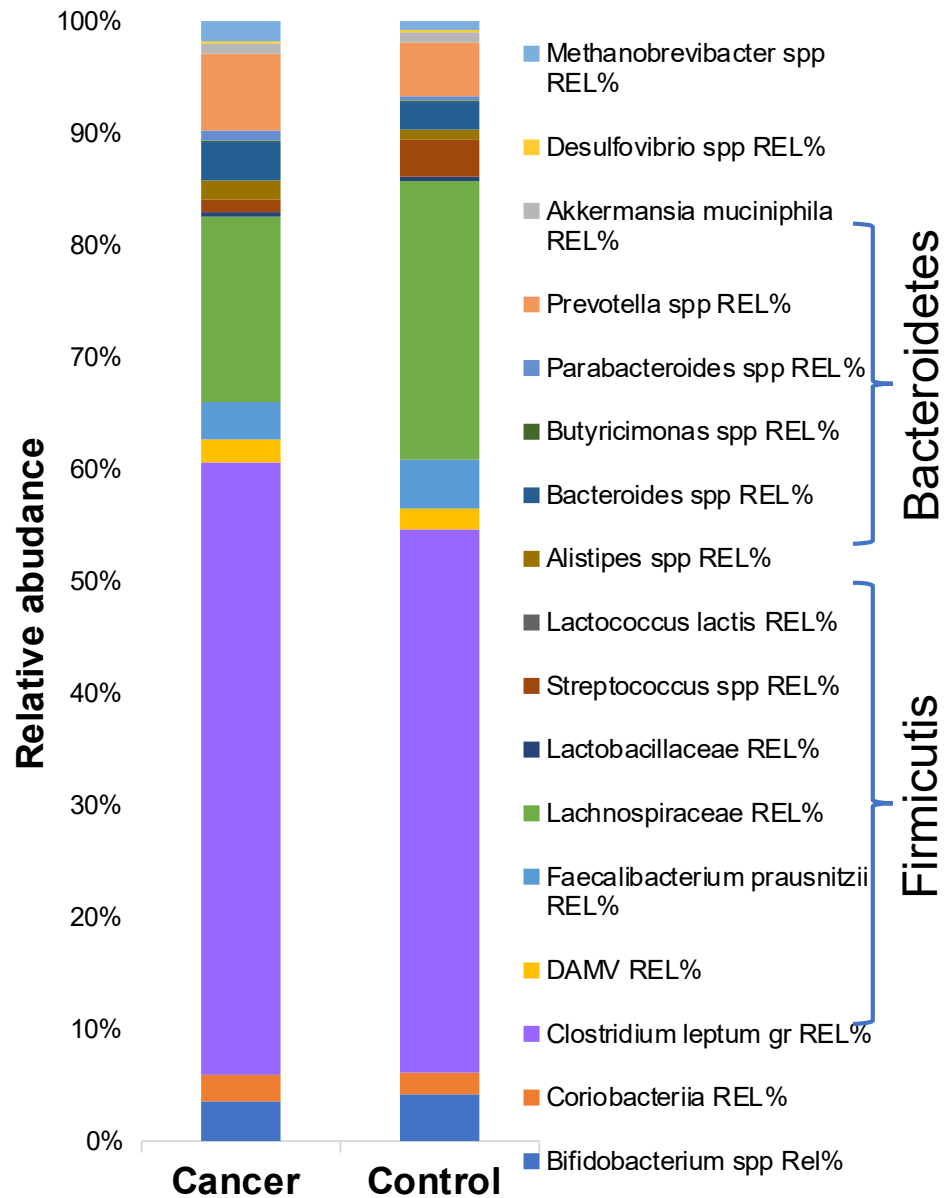
Results



Gut microbiota analysis revealed between **11 and 17 normal bacterial species** in each participant, with a median of 16 species identified.

Microbes	Healthy subjects	Colorectal cancer	p value
<i>Parabacteroides spp</i> , REL% (median, min-max)	0.25 (0-3)	0.5 (0-4)	0.001
<i>Butyricimonas spp</i> , REL% (mean±SD)	0.14±0.08	0.26±0.15	0.009
<i>Alistipes spp</i> , REL% (median, min-max)	0.8 (0-3)	0.85 (0-8)	0.022
<i>Lachnospiraceae spp</i> , REL% (mean±SD)	24.89±12.08	16.18±9.54	<0.0001
<i>Faecalibacterium prausnitzii spp</i> , REL% (mean±SD)	4.39±1.94	3.35±2.30	0.022

Results



Parabacteroides spp, REL%

Butyricimonas spp, REL%

Alistipes spp, REL%

Lachnospiraceae spp, REL%

Faecalibacterium prausnitzii spp, REL%

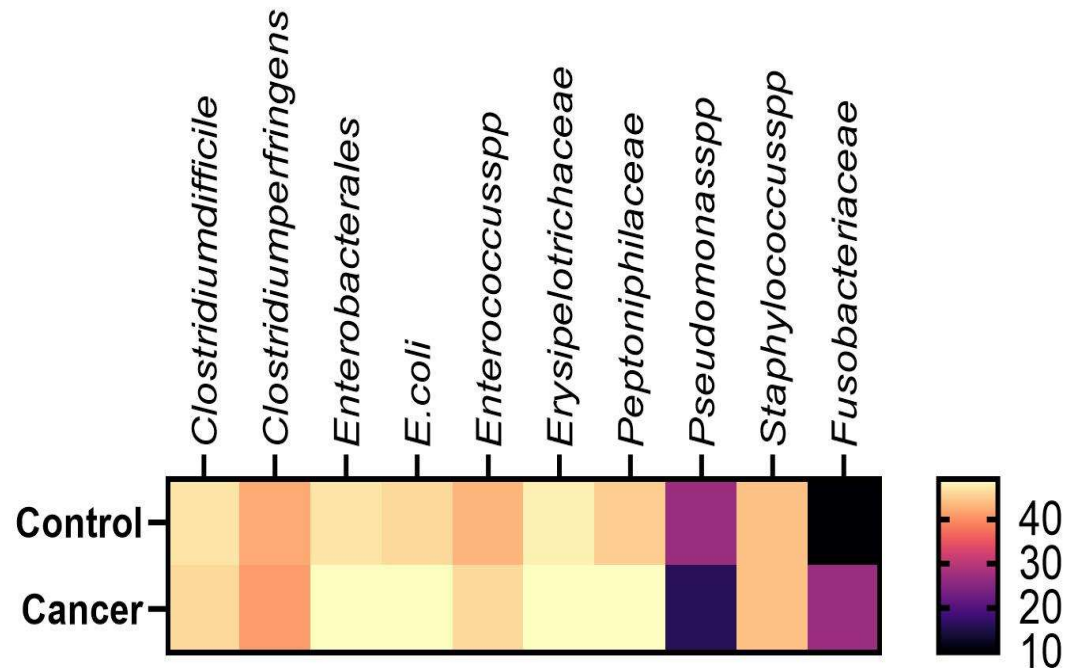
Firmicutes/Bacteroidetes ratio, p value = 0.002

median (min-max):

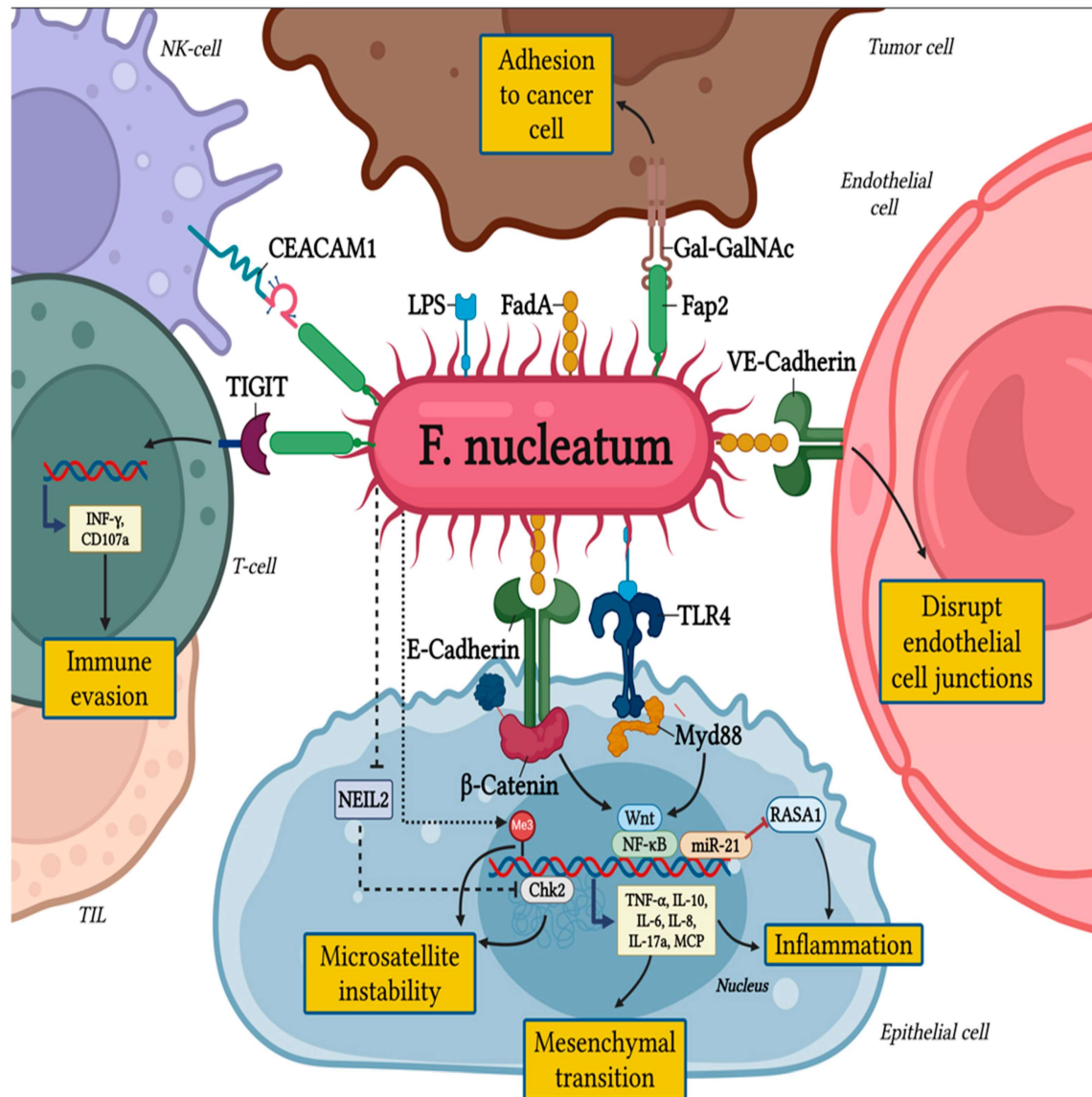
- Healthy subjects – 17.8 (0.3–195)
- Colon cancer - 7.5 (0.8–35.8)

Results

The number of detected pathogenic bacteria was compared between the control and cancer groups. *Fusobacteriaceae* was found in 10 individuals in the control group and 27 individuals in the cancer group, showing a sta

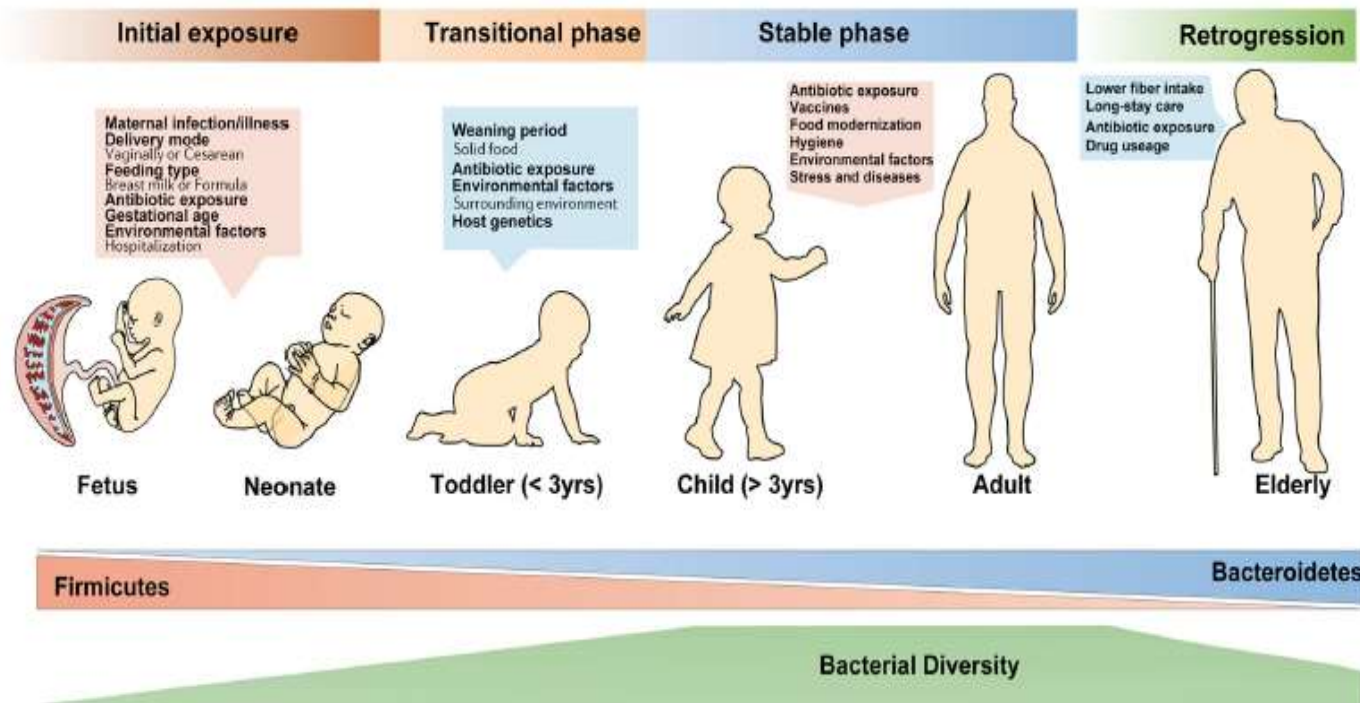


Results



The pro-tumorigenic role of *Fusobacterium nucleatum* in colorectal cancer

Discussion



In our study, we examined the composition of the gut microbiota by comparing individuals diagnosed with colorectal cancer and those with normal mucosa, as assessed through colonoscopy. The results showed that the distribution of bacterial species in the microbiota varied depending on disease status. PCR analysis revealed a significant decrease in microbial diversity, number of species, and the Firmicutes/Bacteroidetes ratio in patients with cancer. This indicates that the normal microbiota on the mucosa of cancer patients is reduced, leading to dysbiosis and impaired functionality due to the deficiency of beneficial microbes.

The result closely aligns with the findings of an international study conducted. This study examined the differential abundance of various gut microbial taxa between individuals with cancer and healthy controls, providing insights into potential microbial biomarkers or contributors to disease pathology. Several taxa demonstrated statistically significant differences between the two groups, suggesting that microbial composition may be altered in the context of cancer.

Conclusion

- In colorectal cancer, the balance of the gut microbiota is disrupted, Firmicutes/Bacteroidetes ratio is decreased in colon cancer patients.
- Among the identified pathogenic bacteria, Fusobacteriaceae was more prevalent in the cancer group

*Thank you
for your
attention*

