Screening of some commonly used plant extracts for their effects on some gut pathogens and probiotics

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Overview

Human gut is colonized by large number of bacteria which is mainly influenced by the plant extracts in the diet. Material and Methods: In this study, 4 different plant materials, the leaves of *Camellia sinensis*, *Mentha piperita, Petroselinum crispum, and Pimpinella anisum* seeds were collected and extracted with either hot water or methanol. The antimicrobial activity were determined using agar well diffusion method. Results: All the extracts showed antibacterial activity against some common pathogens which were used as a control. The water and methanol extract of *Camellia sinensis* and the water extract of *Pimpinella anisum* and *Petroselinum crispum* showed significant lower antibacterial activity against all the tested probiotic bacteria *Lactobacillus* and *Bifidobacteria*. MICs values of the water extracts of the 4 tested plants were recorded for the test bacterial pathogens in addition to the tested probiotic bacteria. Concerning pathogenic bacteria, MIC was ranged from 50-250 µg/ml, 100-150 µg/ml, 150 µg/ml and 75-125 µg/ml for *Camellia sinensis, Pimpinella anisum, Petroselinum crispum,* respectively. Concerning the probiotics, the MIC of the 4 tested plants was greater than 250 µg/ml except for *L. plantarum,* where the MIC of *Camellia sinensis* was 250µg/ml. The presence of plant extracts slightly decrease the rate of growth *L.* acidophilus and the decrease was clear in case of *Camellia sinensis> Mentha piperita > Pimpinella anisum > Petroselinum crispum.*

Introduction

More than 1000 different bacterial species and 10^{14} bacterial cells colonised the adult human gastrointestinal (GI) tract and among individuals, the count vary greatly according to dietary components and host age and health (Hooper *et al.* 2002, Eckburg *et al.* 2005). There is interactive associations and symbiotic relationship between these bacteria and the host cells. Within the tract, they have critical roles in motility, nutrient absorption, protection from invading GI pathogens, fermentation the unused substrates, production vitamins and conservation of mucosal immune function *(Flint et al. 2007,* Ley *et al.* 2008, Zoetendal *et al.* 2008*)*. The bacteria break down the ingested polysaccharides to monosaccharides, which are then fermented to form short-chain fatty acids. Unbalanced bacterial community in the gut plays a role in some diseases and gut disorders. There is an interest to remove gut disorders by influencing the composition and activities of resident microflora. Certain carbohydrates such as arabinoxylan or other plant materials or extracts, which are prebiotics, are selectively metabolised by gut bacteria, thereby changing the gut ecosystem towards a more beneficial structure (Swennen *et al.* 2006). Some plant extracts and antibiotic may affect the intestinal physiology and inhibit or enhance microbiota in human and animals (Manzanilla *et al*., 2004). The aim of the present study was to evaluate the inhibitory effect of some used tradition plants on microbiota and some bacterial pathogens.

Material and Methods

Four medicinal plants including the leaves of *Camellia sinensis*, *Mentha piperita* and *Petroselinum crispum* in addition to the *Pimpinella anisum* seeds were collected and identified at Biology Department, Faculty of Science, KAU, Saudi Arabia. The collected samples were washed, dried, grinded and extracted with either hot water or methanol (Aly and Bafeel, 2010). About 50 g of each sample were extracted with 200 ml hot water or 200 ml methanol Clinical isolates of the Gram negative *Escherichia coli, Salmonella typhimurium* and *Pseudomonas earuginosa,* and the Gram positive *Enterococcus faecalis, Enterococcus faecium, Staphylococcus aureus* and *Streptococcus agalactiae* were obtained from the culture collection from King Fahd General Hospital, Jeddah, Saudi Arabia. Gut normal flora strains *Lactobacillus acidophilus, L. bulgaricus, L. plantarum, Bifidobacterium* and *Streptococcus thermophilus* were obtained from Culture collection Unit, Faculty of Agriculture, Ain Shams, Egypt. All extracts were dissolved in DMSO and bacterial growth inhibition was tested by using agar well diffusion method while the MIC was determined by the micro dilution method.

Conclusion

The most common aqueous extracts of Camellia *sinensis*, *Mentha piperita, Petroselinum crispum* and *Pimpinella anisum* can be used to inhibit gut pathogens without any bad effects on gut benefit bacteria, *Lactobacillus* and *Bifidobacterium.*

Tested extract / pathogen	Diameter of the inhibition zone (mm)			
	Camellia	*Pimpinella*	*Petroselinum*	*Mentha*
E coli	17.6±0.0	16.0±0.0*	19.6±0.5*	17.0±1.0*
Salmonella	17.6±0.5	13.3±1.5	14.6±1.5	23.3±1.5*
P aeruginosa	14.6±1.5	13.6±1.5	23.0±1.0*	19.3±2.0*
E faecalis	13.0±1.0*	13.6±0.5	14.3±1.5	14.6±1.1
E faecium	12.3±1.1*	15.3±2.0	14.3±1.5	17.0±1.0*
Staphaureus	14.3±0.5	18.3±1.1*	18.0±1.7*	18.0±1.0*
S agalactiae	17.0±0.5	15.6±0.5	13.3±1.5	12.3±0.5
Bacterial index	15.2	14.5	16.6	17.3

The Antibacterial Activity of The Methanolic Extracts of The 4 Tested Plant Extracts Against Some Tested Bacterial Pathogens

Gut bacteria	Diameter of the inhibition zone (mm)							
	Camellia		*Pimpinella*		*Petroselinum*		*Mentha*	
	Aqueous	methanol	Aqueous	methano	Aqueous	methanol	Aqueous	methanol
L acidophilus	5.3±0.1*	7.1±0.1*	7.0±1.5*	7.3±1.0*	7.3±0.5*	7.6±0.5*	7.3±0.1*	10.0±1.0*
L bulgaricus	7.3±1.5*	11.1±1.0*	7.0±1.5*	12.3±1.0	7.3±1.5*	11.6±1.5	10.±1.0*	14.0±1.5
L plantarum	7.3±2.3*	11.0±0.5*	7.0±0.1*	12.4±1.3	7.3±2.3*	10.±0.5*	11.0±1.0	13.3±1.3
Bifidobacterium	9.9±1.1*	11.6±1.5*	7.0±1.5*	12.6±1.0	9.9±1.1*	11.0±1.0	10±0.3*	13.9±1.5
S thermophilus	9.0±0.5*	10.6±1.0*	9.0±1.2*	10.6±0.9	7.0±0.5*	11.3±1.5	11.0±0.3	14.0±0.2
S agalactiae	11.6±0.5	17.0±0.5	11.6±0.7	15.6±0.5	14.3±1.0	13.3±1.5	13.3±1.5	12.3±0.5
Bact index	8.6	11.0	9.0	11.8	7.8	11.2	10.6	13.5

The Antibacterial Activity of The Aqueous Extracts of The 4 Tested Plant Extracts Against Some Gut Bacteria

The water extract of *Camellia sinensis* showed significant antibacterial activity against both *Enterococcus faecalis* and *E. faecium,* while *Pimpinella anisum* extract showed significant antibacterial activity against *Salmonella typhimurium* and *Pseudomonas earuginosa.* The water extract of *Petroselinum crispum* has antibacterial activity against *Escherichia coli, S. typhimurium, P. earuginosa* and *E. faecalis.* Moreover, *Mentha piperita* recorded significant antibacterial activity against *E. coli, S. typhimurium, P.earuginosa.* The bacterial index showed that the maximum activity was recorded for water extract of *Petroselinum crispum,* followed by *Pimpinella anisum* and finally *Camellia sinensis* and *Mentha piperita.* Similarly, the methanolic extract of *Camellia sinensis* showed significant antibacterial activity against both *E. faecalis* and *E. faecium,* while the methanol extract of *Pimpinella anisum* showed significant abtibacterial activity against *E. coli* and *Staphylococcus aureus* (Table 3). Furthermore, *Petroselinum crispum* extract showed antibacterial activity against *E. coli, P. earuginosa* and *Staphylococcus aureus,* while *Mentha piperita* recorded significant antibacterial activity against *E. coli, S. typhimurium, P. earuginosa, E. faecium* and *S. aureus.* Bacterial index showed that the maximum activity was recorded for the methanol extract of *Mentha piperita* and *Petroselinum crispum,* followed by *Camellia sinensis* and finally *Pimpinella anisum.*

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