

## REVIEW ON PLANTS THERAPEUTIC EFFECTS AGAINST GASTROINTESTINAL MICROBES

### Abstract

Plants play vital roles in many health care systems, be it rural or an urban community. Plants became familiar as medicine due to the primordial ideologies and believes. Several plants parts served as medicines to so many ailments including gastrointestinal ailments, due to the fact that their active ingredients are powerful against the microbes as well as healing so many physiological abnormalities. Most of the microbes identified were enteric bacterial isolates. The principal antimicrobial components were used to inhibit the growth of microbes, as well as most of the recognized compounds were aromatic or saturated organic compounds which enable the plants to be active against the gastrointestinal microbes. The commonly used diluents were; water, methanol and Di methyl sulphate oxides to ascertain the level of activity of the plants. As such, plants materials in one way or the other are very active when dealing with microbes due to their active ingredients or the phytoconstituents.

**Key words:** Ailments, compounds, Gastrointestinal, microbes and plants

### Introduction

Plants served as good sources of medicines especially in developing as well as some of the developed countries, due to the facts that the orthodox are not assessable to the larger communities for immediate consumption to cure their ailments. Nowadays, some of the traditional beliefs are also being abandoned, which made some of the practices were

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abandoned (1,2). Medicinal plant familiarity is like all local awareness, a community invention that is part of the specific traditional system. Local awareness is not always evenly distributed, and it is not every member of the group that is inescapably with the same facts (3). Researches had shown that, there are a lot of local plants in Nigeria for the handling of numerous diseases. However, scientific facts have been known only on to a limited scope with few medicinal plants. Owing to the adverse effect of many orthodox drugs and the cost of obtaining these drugs. It is needful as a matter of fact to use plants which are natural reservoir of many antimicrobial agents as well as various healing activities (4,5).

Moreover, African traditional curative system and ethno medication have established appreciable consideration. The widespread literature on the issue which indicates clearly that traditional medication practice occupies a very protruding place in the treatment of diseases in the African culture. Traditional medicine is the sum total of consociate, facilities, and put on the reproductions, views, and practices home-based to different beliefs that are used to maintain health, as well as to avoid, identify, recover, or treat physical and psychological disorders. The management been employed by other populaces often termed harmonising or auxiliary medicine (6).

About 80% of the developing nations relied in traditional medicines in treating many ailments and disorders as being reported by the World Health Organization (WHO) (6,7). Herbalists prepared many parts of the plants such as stem, leaves and roots as orthodox due to their abundant constituents. Almost 90% of the population in some parts of Africa used herbal preparations for their primary healthcare as well as being propounded in developed countries like Germany and Canada tend to show that at least 70% of their population have tried at least once (8).

Nevertheless, it is likely that the philosophical knowledge of herbal remedies in traditional cultures, developed through trial and error over many centuries, along with the most important cures was sensibly passed on orally from one generation to another. Indeed, modern allopathic medicine has its origins in this early medicine, and it is likely that many important new remedies will be developed and commercialized in the forthcoming from the African biodiversity, as it has been till now, by following the leads provided by traditional familiarity and experiences (6). The main aim of this review is to ascertain the curative activities of different plants extracts on the gastrointestinal microbes.

## **The consumption of plants as medicines**

The medicinal plants observed a myriad number of published works geared towards estimating the effectiveness from methodical proved in Africa which are whispered to have an important support in the maintenance of well-being and in the introduction of new treatments. However, there is still a scarcity of updated wide-ranging compilation of good medicinal plants from the African continent (6). Incorporation of traditional treatment in health systems since 1978, the WHO at its 31st Assembly has suggested nations around the globe to make a complete record of medicinal plants, evaluation of their effectiveness, care and a standardization of the active products (8). WHO has also reported some critical problems that hamper the incorporation of traditional medicine in the majority of countries; Public demands on common medicine exceeds the know-how and resources of health authorities; Inadequate guideline and registration for herbal products and other traditional treatments (8).

Nevertheless, the consumption of plants and their resources for treating different ailments have been proven by the olden day's literatures (Sumerian clay slab from Nagpur ~ 5000 years old) where by their usage are maintained up to today. While the isolation of some important compounds like morphine from opium started in the early 19th century, which were mainly at isolating active compounds from medicinal plants and as such, many compounds were also been discovered again. These product are later be used by many pharmaceutical companies and other developmental organizations (1).

More so, maximum number of medicinal plants are traditionally obtained from the wild, where they grow naturally. But as a result of many human activities, the floral communities become somehow disturbed. However, (~15,000 medicinal plants) are at risk of becoming extinct due to over unnecessarily destruction. This activity is mostly found in the developing countries for the sake of their well-being which are also compounded to so many impacts which has been reported by (1).

Consequently, detailed deliberations with the informants and a cross-section of key informers among the traditional healers further exposed that even when the healers prescribe treatment to their patients, only the traditional doctor can prepare it; the patients are not well informed about the plant species from which the treatment is derived nor the method of preparation of the treatment. Even so, this system is slowly changing and in recent years, some flexibility

seemed to be emerging, with the traditional healers and quite willing to provide information about the traditional treatments in exchange of financial benefits or compensation (9). Lastly, today plants are considered in different uses varying from region to region and individuals to individuals. That is to say the use to which the same plant species can be put by the people in the riverine area may likely be different from those in the savannah and in certain restricted areas. Furthermore, man uses plant resources in many forms, the most basic are the following: food, medicine, cosmetics, architecture and for domestic facilities (10).

However, almost 30% scientific botanical data were mentioned to be the collated data showing the overall activities of medicinal plants in drugs production. Traditional medicine is somehow limited to local communities due to the lack of profound or broader knowledge on it. Phytochemical screenings of medicinal plants are very important in recognising new sources of medicinally and industrially vital compounds. It is also used to provide some of the products made by these natural products. (11). Some of the plants products are often used in producing many antibiotics to treat bacterial and parasitic infections. (11). Today artemisinin based combination treatment is documented as drug of choice for handling malarial case, there are numerous advantages of herbal medicine which include; low-cost, affordability, prepared availability, convenience, adequacy and low harmfulness and are ready sources of medical power. However, many various disadvantages of the practices need to be resolved. Medicinal plants play spirited roles in disease prevention and their promotion and their usage in prevention strategies. Conscious efforts need to be made to properly recognise, distinguish and position medicinal plants in the design and implementation of these strategies (12).

Nevertheless, preparations were made by many diluents to extract the present plants need to be extracted, the natural products are screened based on the diluents used in the extraction procedures. In the crude extraction could be either in hot or cold water which worked differently. In most instances contents were not accurately measured (13). Occasionally the patient used the aqueous extract for bathing the affected area. Where by some of the mixtures were used to support the extracts in treating the ailments in a good way, without ascertaining the right quantity of the mixtures administered (13). Some years back, many researches have been carried out and documented in the late 19th century on medicinal plants by drawing a lot of attentions in myriad ways of applications. Therefore, many scientific findings have proved,

many microbes are well treated based on the bioactive ingredients present in the plants extract (14).

### **Plants therapeutic effects on organisms**

Traditional medicine based on plants curative activity may increase and offer alternatives for animal disease control, particularly for resource-poor breeders. In respect of this, many researches have been recommended to be carried out so as to know how to preserve the plants materials that will suit cultural heritage mankind utilization in many aspects in an entire African regions (15).

Consequently, the bacteria that colonize the gastrointestinal tract (GIT) achieved a number of functions which normalize and control the body of the host against the replication of microbes specifically the gastrointestinal ones (15). Many factors triggered in the reduction of GIT bacteria and their beneficial functions due to their genetic composition to establish prime factors in the causation of diseases. (15).

More so, Saponins are among the secondary metabolites mainly possessed by plants and in some lower animals and bacteria. (16). Saponins compounds are mostly, found in some parts of the plants; stems, leaves, tuber, seeds and in fruits which make them to be active in curing parasitic, fungal, bacterial infections and as well as insecticidal predator. In plants, saponins do also have a subclass of the large and chemically assorted group of phytoanticipin and phytoprotectant metabolites produced by plants (16). Subsequently, most of the gastrointestinal microbes specifically bacteria served as gut micro flora which are linked with human diseases in such a way that caused infections. They partially depends upon the production of bioactive compounds such as short-chain fatty acids (SCFAs) and polyunsaturated fatty acids (PUFAs). These compounds served as by products which are vital to the maintenance of a healthy gut microbial community. Moreover, SCFAs and PUFAs play multiple dangerous roles in host defence and immunity, including anti-cancer, anti-inflammation, and anti-oxidant activities, as well as out-competition of enteric bacterial pathogens. Finally, advanced to the potential uses of these fatty acids with regards to food safety and human gut heal (17).

The ethno botanicals surveys of medicinal plants species, were important for consequent chemical and pharmacological bio prospections (18). Moreover, the presence of several flavones and phenolic acids, which have radical scavenging properties, some of the compounds served which are both found in the plants extract and the microbes; *Populus nigra* potential protective role of pinocembrin and pinostrobin and extracts from buds

*Populus nigra* and ~~*Populus*~~ *P. berolinensis* against AgNPs induced inflammation and cytotoxicity in HGF-1 cells (19).

In addition, the antioxidant properties of poplar bud extracts have been demonstrated. *P. berolinensis* buds showed the highest activity in both the in vitro model and in the bio autographic tests (19).

#### **Diversity of gastrointestinal species and their activities on different plants materials**

*Escherichia coli* represents a spectrum of host relationships that can range from mutualism to opportunistic serving as micro flora and specialized pathogenesis explicit examples by which strains of commensal *E. coli* are known to modulate host immunity. Studies in germfree guinea pigs, chickens, and piglets were the first to describe that replicating *E. coli* could stimulate both mucosal and systemic immune responses. Since then, most studies looking for ways to define specific interactions between the host immune system and *E. coli* have focused on isolates such as the probiotic strain *E. coli*, which provides protection against Salmonella and pathogenic *E. coli* O157:H7 infections in mice via competition over nutritional resources and may further help immune regulation by encouraging the expansion of plasmacytoid DC, small intestine as compared to germfree mice (8). In contrast to the immunoregulatory and protective effects of *E. coli*, other human commensal *E. coli* are hypothesized to contribute to the development of intestinal inflammation in a subset of Crohn's disease (CD) patients. These opportunists are known collectively as Adherent and Invasive *E. coli* (AIEC). AIEC strains are generally defined by their ability to stick to and conquer epithelial cells, replicate inside macrophages and induce tumour necrosis factor (TNF) production from macrophages in vitro. Although detailed in vivo studies defining the immunological response induced by these strains are still needed, one recent study sophisticatedly demonstrated that the IgA-coated AIEC strain A2 isolated from CD patients with peripheral spondyloarthritis (SpA), an extra intestinal display often found in patients with active IBD, induced both mucosal and systemic Th17 responses in germfree mice as compared to non-AIEC *E. coli*. Induction of such Th17 immunity required the *E. coli* to harbour the virulence associated metabolic t seems that in this occurrence the pathobiont alters host responses such that the host- micro biota balance tips from tolerance to inflammatory (20).

More so, no effects recorded as inquired from the respondents of the listed plants, which were stated to be used in the grounding of 55 medical remedies for treating diseased animals. Virtually half of the plants were reported for use in all common ruminants, i.e. cattle, sheep

and goats, and the vast majority of the remaining arrangements were aimed at cattle only. Only 2 plant species were for exclusively for sheep and goats, and one plant species, *Passiflora foetida* L., was used specifically for preventing diseases in poultry, while *Olex subscorpioidea* Oliv. Was also indicated for deworming dogs. The most common plants used by breeders were *Cassiasieberiana* DC., *Khaya senegalensis* (Ders) A. Juss, *Diospyros mespiliformis* Hochst. ex A. DC., *Sterculia setigera* Del, *Bridelia ferruginea* Benth, *Guiera senegalensis* J F Gmel., *Opilia amantalea* Roxb., *Saba senegalensis* (A. DC.) Pichon and *Vitellaria paradoxa* CF Gaertn. These plant species are more often used to delight gastroenteritis and skin diseases. This may be explained by the prevalence of parasitic gastroenteritis and ticks (21).

Moreover, the routes of administration of these herbal therapies were essentially oral, followed by topical applications and drops to treat ears or eyes. For most of the remedies, the dose depended on age or breed of the sick animal. For applications in liquid form, the recommended quantities seemed to be a function of body size, and were generally 0.25 l for sheep and goats, 0.5 l for calf and 1 l for cattle. The 25 plants species were used as ethno veterinary medicinal plants out of 44 were testified for the first time in Côte d'Ivoire. The knowledge revealed that, only the remaining 19 species had been recorded in previous ethno veterinary surveys for veterinary care in West Africa, including Northern Côte d'Ivoire or in Africa as a whole (21). However, these plants had been described for the treatment of other diseases. Only 5 species, namely *Maytenus senegalensis*, *Mitragyna inermis*, ~~*Khaya-K. senegalensis*~~, ~~*Vitellaria-V. paradoxa*~~ and *Anogeissus leiocarpus*, had been reported for the same therapeutic indication in the previous ones, namely against diarrhoea and infection with intestinal worms. The later, traditional property has been linked to the auspicious anthelmintic activity of ~~*Khaya-K. senegalensis*~~ ~~*Vitellaria-V. paradoxa*~~ and ~~*Anogeissus-A. leiocarpus*~~. The survey revealed that the stem bark of *K. senegalensis* was used to treat a host of diseases. That observation is in full agreement with the statement of who recognized the great importance of *K. senegalensis* in traditional veterinary medicine in Africa. In Nigeria, this plant species one of the most common plants used for treatment of trypanosomiasis in domestic animals (21). The three strains of the test organism (~~*StaphylococcusS. aureus*~~) were more liable towards *Penicillin g* than the tea extract. Also, the restraint of the microorganisms by *Pen. g.* increased with increasing concentration of *Pen g* (22).

On the other hand, increasing concentration of the tea extracts bring about in decreasing activity (22). The active components in the crude extract may be acting synergistically to

produce antimicrobial effects, the disparity between the activities of the extracts and the normal antimicrobial drug, may be due to the combinations of bioactive compounds present in the extract compared to the pure compound contained in the standard antibiotic. Thus a standard drug had the highest zone of inhibition of 29mm. Methanol and ethyl acetate are polar solvents, since they showed the highest antibacterial activities. Some of the principal antibacterial components of plants were suggested being polar compounds. While most of the identified components with antimicrobial activity extracted from plants were aromatic or saturated organic compounds which are more soluble in polar solvents such as water and methanol. However water extracts were less potent (23).

Moreover, approximately five species of South African orchids are used to treat inflammatory conditions. *Polystachya ottoniana* is also used to soothe pain experienced in teething babies and to treat diarrhoea. *Ansellia Africana* is also administered as an antimicrobial while *Eulophia* species such as *Eulophia E. cucullata* and *Eulophia E. ovalis*, are used primarily to relieve pain. Investigation has shown that *Cyrtorchis arcuata* treat diabetes and skin infections as well as *Tridactyle tridentata* treat psychological disorders such as madness. Two orchid species; *B. scaberulum* and *E. hereroensis*, used in South African traditional medicine were also included as they were being traded around the world. Orchid extracts that displayed significant effects in an anti-inflammatory, antioxidant and AChE inhibitory assays may have potential natural plant product targets in the treatment of inflammatory and neurodegenerative -tive disorders. Extracts include: *A. africana*, Et OH root, *B. scaberulum* DCM root, *Cyrtorchis. arcuata* methanolic root, *E. hereroensis* DCM tuber, *E. petersii* DCM stem and *T. tridentata* DCM root extracts. The Et OH root extract of *B. scaberulum* exhibited the most potent selective inhibitory effect on COX-2, while the DCM tuber extract of *E. hereroensis*, was the only extract to significantly inhibit both COX enzymes (24).

Preliminary tests suggest significantly higher levels of Gallo tannin content in *A. africana*, and *E. hereroensis* methanol root extracts. This may account for the significant anti-inflammatory activity. Similarly, the presence of condensed tannins in *E. hereroensis* root and *B. scaberulum* stem/root extracts may explain the observed anti-inflammatory effects. The potent anti-inflammatory and antioxidant effect of *E. hereroensis* and *E. petersii* supports the use of species from this genus for inflammatory-related symptoms in South African traditional medicine. The overall % ant of *Prosopis pubescens pseudo bulb* and root extracts was greater than 90%, which might validate the use of species from this genus as

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substitutes to *P. ottoniana*, to treat certain inflammatory disorders. Flavonoids in the pseudo bulbs and roots of *P. pubescens* may have contributed to the antioxidant effects. During the survey of leaf flavonoid content in Orchidaceae, (24)., as well as isolated xanthonenes, mangiferin and isomangiferin from five species of Polystachya and Maxillaria. The author also detected that there was no pattern of flavonoid distribution within the family Orchidaceae, and geographical location played a noteworthy role in the presence of flavonoid compounds. All four species record some flavonoid content in primary studies, shared similar sharing ranges; and are all epiphytic species. Plant compounds such as flavonoids, naphthoquinones, alkyl amides and phenolic phenyl-propane derivatives represent the usual compounds found in certain natural products that are responsible for COX inhibition (24). The presence of flavonoids in *B. scaberulum* and *T. tridentata* may clarify the potent activity observed in the anti-inflammatory and AChE inhibitory assays. The medicinal value of flavonoids includes; anti-inflammatory, antifungal, antioxidant activities and wound healing. The wound healing efficacy of *Oncidium flexuosum*, an epiphytic orchid used in Brazilian traditional medicine for inflammation and wounds, was attributed to the presence of flavonoids and tannins (24). Antibacterial pharmaceuticals are not accessible to the majority of the people who need them. The use of botanical medicines is generally on the rise in many parts of the world (25).

The antibacterial activity could be due to different classes of compounds. Some of the classes of compounds acknowledged in the crude extract, include; alkaloids and triterpenoids, have been reported to possess antibacterial activity (25). The increased occurrence of resistance to commonly used antibiotics has led to the search for newer, cheap, and easily cheap drugs in the management of infectious diseases. Although conventional drugs are popular, however, herbal medicine continued to be practiced due to richness of certain plants in varieties of secondary metabolites such as alkaloids, flavonoids, tannins, and terpenoids which have been stated to have antibacterial activities. Different studies showed different concentrations of the methanolic extracts of the leaves and barks of *Psidium guajava*, leaves of *Mangifera indica* and fruits and seeds of *Carica papaya* showed antimicrobial activities against all the isolates of bacteria (*Bacillus cereus*, *Bacillus-B. subtilis*, *Escherichia-E. coli* and *Salmonella typhi*) (14).

The antibacterial activity of organic extracts and essential oils of *P. guajava* leaves was also examined, and the methanolic extract showed the highest inhibition against shrimp isolates and type strains of *S. aureus*, *E. coli* and *Salmonella spp* (26). *Salmonella-S. paratyphi* is

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Gram-negative, rod shaped, facultative anaerobe, non-encapsulated, non-spore forming, flagellated and motile bacteria. Three serotypes of *Salmonella-S. paratyphi* were described; *S. salmonella paratyphi* A, B and C worldwide. *Salmonella-S. paratyphi* transmission is through faecal oral route or via eating of unclean food/water as well as coming in contact with chronic asymptomatic carriers. The *S. paratyphi* caused enteric fever which is an important health issue in many developing countries. The incidence is increasing globally particularly in endemic regions such as certain provinces in China and Pakistan. The disease mortality rate is up to 30 and 90% of deaths is due to enteric fever occur in Asia. Humans are the only reservoir and natural host for *S. paratyphi*. The *S. paratyphi* can be isolated from paratyphoid fever patients' blood for diagnosis. Paratyphoid fever is highest in teenagers and young adults as compared to typhoid fever that is common in children as being highlighted by (27).

Nevertheless, the DNA was extracted from culture through DNA purification kit (Hiper Bacterial Genomic DNA Extraction Teaching Kit). The final PCR product was run on 1.5% agarose gel and observed under UV light (27). Consequently, Out of reasonable number of the samples collected about 55% were positive and 45% negative for *S. paratyphi*. Gender wise distribution result showed that the male (34%) were more affected with paratyphoid fever as compared to age wise distribution which concurrently revealed that *Salmonella paratyphi* was high in 20-30 years (38%) followed by 10-20 years (9.16%) and 1-10 years (7.5%) age group patients Race wise distribution results of paratyphoid fever cases were significantly high (25.41%) in Pashtoon followed by 15.83% in Baloch, 8.33% in Punjabi and 5.41% in Hazara. The 40% paratyphoid fever were observed in patients with a very low income status, 9.16% (14). PCR based identification of specific gene used to sense *Salmonella-S. Paratyphi*. All isolates of *Salmonella-S. paratyphi* used to produce the specific size of 329 base pair fragment of flic-a gene as carried out by (27).

### **Genomes and ETEC strains profile**

The ST ETEC strains were collected over a period of 31 years (1980–2011), worldwide; Argentina, Bangladesh, Bolivia, China, Egypt, Guatemala, Indonesia, Japan, Mexico, Morocco and Thailand (28). The preliminary phytochemical components of methanolic and water extracts of *P. guajava* stem bark contained carbohydrates, cardiac glycosides, tannins and proteins at high concentration while reducing sugar, alkaloids, Saponins and oil were present in moderate concentration, steroids and terpenoids were present at low

concentrations. This study indicated that *P. guajava* is an important source of tannin, cardiac glycosides and Saponins (26). The MIC and MBC were determined on earlier tested MRSA isolates. The MIC results reported that five of the isolates were inhibited by the methanol extracts with activities ranging from 62.5 to 125 µg/~~ml~~mL while seven were inhibited by the water extracts between 125 and 500 µg/~~ml~~mL. The MBC results showed that five of the isolates were susceptible to the methanol extracts within the range 62.5 to 125 µg/~~ml~~mL and five of the isolates were susceptible to the water extracts within the range 125 to 250 µg/~~ml~~L. The results of the MIC and MBC on the MRSA isolates long-established the antimicrobial potency of the plant extracts as previously observed by the disc diffusion assay. This gave credence to the findings of other workers on antimicrobial studies of *P. guajava* (26).

### Conclusion

The use of medicinal plants in the treatment of diseases has generated renewed interest in recent times, as herbal preparations are increasingly being used in both human and animal healthcare systems. Diarrhoea is one of the common clinical signs of gastrointestinal disorders caused by both infectious and non-infectious agents and an important human and livestock debilitating condition, therefore, collection of plants supported in folklore as having beneficial medicinal applications (29).

### Conflict of interest

Authors declared no conflict of interest as far as this review article is concerned.<sup>s</sup>

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