



A NEW INSIGHT ON MICROBIAL ENDOPHYTES

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ABSTRACT

Plants existed on earth, ages before man. Obviously ailing humans restored plants' cure since very very ancient times. Plants produce phytochemicals which are used for the treatment of various diseases including Urolithiasis. But in recent years a new trend in treatment is introduced, as it is discovered that many vital activities of the host plant are known to be influenced by the presence of microorganisms. These micro-organisms are referred as Endophytes. Some of these Endophytes produce Oxalate oxidase, a necessary enzyme for degradation of Calcium Oxalate. Several researches also concluded the presence of oxalate degrading bacteria in human intestine and humans lack the ability to produce oxalate degrading enzymes. Based on this concept, it can be considered that intestinal micro flora may have potential to degrade urine stone, i.e. calcium oxalate crystals by influencing absorption of dietary oxalate. Hence, retention of this microbiota using probiotics may be useful in prevention and treatment of urolithiasis.

KEYWORDS : Endophytes, Medicinal Plants, Calcium Oxalate crystals, Urolithiasis

A variety of lifestyle or health related habits can have a major impact on a person's mental and physical health. A modern lifestyle may increase the risk of some psychological and physiological health problems. Urolithiasis is one of the major and common health problems affecting a large population all over the world. Urolithiasis or renal lithiasis is characterized by complex pathophysiology, high recurrence rate as well as multifactorial etiology.

The kidney stones are differentiated into five categories viz. calcium oxalate, calcium phosphate, uric acid, struvite and cysteine stones depending upon their composition. Among the different types, calcium oxalate (CaOx) based kidney stones are predominant and near about 85% of the kidney stones are formed due to deposition of Calcium oxalate compounds.

Oxalates in human body increases due to non - enzymatic breakdown of ascorbic acid or over consumption of oxalate rich foods like spinach, almonds, cashews etc. The increased oxalate intake and intestinal absorption may lead to Hyperoxaluria which is characterized by excessive urinary excretion of oxalates. This condition can be prevented by dietary restrictions. However, it may lead to nutritional deficiencies (Lieske, *et al* 2010; Gomathi *et al*, 2014). Currently, the treatment of kidney stones is highly expensive and may pose many side effects.

Nature has been a source of medicinal agents for thousands of years. Plants produce phytochemicals which can be used for therapeutic purposes. This method of treatment is much more popular for treatment of urolithiasis as they are safe, efficient, and cost effective and prevent recurrence of stone formation.

Akram and Idrees in 2019 reported that certain medicinal plant species like *Hibiscus sabdariffa* Linn., *Asparagus racemosus*, *Acalypha indica*, *Bergenia lingulata* etc. are used for the treatment of Urolithiasis.

Yadav *et al*, 2019 demonstrated that *Bryophyllum pinnatum* leaf extracts prevent formation of Renal calculi in Lithiatic Rats and also the dissolution of preformed stones. Same type of new strategy is put forward by Afkari *et al* in 2019 stating that simultaneous use of oxalate-degrading bacteria and herbal extract can reduce the urinary oxalate in a rat model.

The efficacy of phytomolecules mainly hyperoside, catechin,

curcumin, epicatechin, rutin, quercetin, diosmin etc; obtained from Grapefruit juice, Lemonade juice, Cranberry juice etc. and other medicinal plants like *Tribulus terrestris*, *Pyracantha crenulata* etc. are demonstrated and found to be useful against kidney stone treatment as well as management by Gupta and Kanwar in 2018.

The informatory review on Kidney stones and their treatment using plants as antiurolithiatic agents has reviewed in article by Arya *et al* in 2017. The same concept of use of herbal plants in the treatment of Urolithiasis is mentioned in Review article by Yadav *et al* in 2011.

In recent years a new trend in treatment is introduced, as it is discovered that many vital activities of the host plant are known to be influenced by the presence of microorganisms. Compounds isolated from plants are largely the products of plant metabolism. However, microorganisms living in symbiosis with plants also produce bioactive compound. These are referred as Endophytes.

The presence of Bacterial endophytes is confirmed in various researches including –

Burkholderia picketii in Maize by McInroy and Kloepper in 1995, *Azorhizium caulnodans* in Rice by Engelhard *et al* in 2000, *Bacillus spp.* In Citrus plants by Araujo *et al* in 2001 & 2002. *Pseudomonas fluorescence* and *Pseudomonas putida* by Surette *et al* in 2003. *Streptomyces* in Wheat by Coombs and Franco in 2003. *Enterobacter sakazakii* in Soyabean by Kuklinsky-Sobral *et al* in 2004.

Isolation and Characterization of Endophytic Bacteria from the leaves of the Common Bean by de Oliveira Costa *et al*; 2012,; Koly *et al* 2018. All this research also confirms the presence of endophytic bacteria and influence of their communities in plant growth as well as an important source of probiotics.

Kumar and Belur 2018 isolated Endophytic bacteria *Ochrobactrum intermedium CL6* from *Colocasia esculenta* tubers and confirmed the production of Oxalate Oxidase (Enzyme having the ability to digest Kidney stone).

Several studies indicated that some vital activities of the host plant are known to be influenced by the presence of microorganisms. Compounds isolated from plants are largely the products of plant metabolism. However, microorganisms

living in symbiosis with plants also produce bioactive compound (Palanichamy *et al.*, 2018; Strobel *et al.*, 2003). These microorganisms are called as Endophytes. Endophytes colonise the host tissue internally without damaging the host or producing plant disease.

According to recent studies the bioactive compounds produced by endophytes includes oxalate oxidase, one of the enzyme needed for the degradation of urine stone (Kumar *et al.* 2016; Herve *et al.*, 2016).

Various treatments are available for Urolithiasis, including use of ancient methods like use of medicinal plants and a modern method like use of probiotics. Recent methodology sometimes use the combination of both.

Several researches concluded the presence of oxalate degrading bacteria in human intestine and humans lack the ability to produce oxalate degrading enzymes (Ellis *et al.*, 2017; Herve *et al.*, 2016; VR Abratt *et al.* 2010; Campieri *et al.*, 2001). Based on this concept, it can be considered that intestinal micro flora may have potential to degrade urine stone, i.e. calcium oxalate crystals by influencing absorption of dietary oxalate. It is also mentioned that as urinary oxalate level increases there is decreasing gut microflora. Hence, retention of this microbiota using probiotics maybe useful in prevention of urolithiasis. Probiotic supplements have emerged as an adjuvant therapy for treatment of various diseases including CKD due to their low cost and more acceptability by patients (Jia *et al.* 2018).

Use of probiotics cannot be considered as the most modern method for the treatment of kidney stone but it is found that in ancient days also the source of probiotic viz the curd was used for treatment of digestive tract disorder. Modern methods utilizes combination of newly found microorganisms and formulating them to produce a new type of probiotic which can be beneficial for treatment of diseases and also act as food supplement.

Sadaf *et al.* 2019 carried out investigatory study on effect of locally isolated *Lactobacillus* strains on degradation of Calcium Oxalate and Calcium Phosphate.

Chamberlain *et al.* 2019 characterized, compared and validated the oxalate degrading ability of *Lactobacillus acidophilus* and *Lactobacillus gasseri*. Di Cerbo *et al.*, 2015, experimentally concluded that various species of *Lactobacillus* can be used as therapeutic agent and can be used to induce qualitative and quantitative modification in GIT.

In-vitro examination on efficacy of *Oxalobacter formigenes* as probiotic for the treatment of recurrent Calcium Oxalate stones was performed by Ellis *et al.* In 2016.

Lieske in 2016 concluded that intestinal microbiome plays an important role in modification of gastrointestinal absorption of lithogenic substances, hence their manipulation may decrease the risk of kidney stone formation.

Kullin *et al.*, in 2016 studied and concluded that certain species of *Lactobacillus* and *Bifidobacterium* may have great potential to survive in GIT as well as to degrade Calcium Oxalate and can be used as probiotic bacteria for treatment of recurrent Calcium Oxalate kidney stone disease.

Three strains of LAB, viz., *L. fermentum* AB1, *L. fermentum* TY5, *L. salivarius* AB11, isolated from Human Faeces and South Indian Fermented Foods have ability to degrade Calcium Oxalate and possesses good probiotic activity. This study is put forwarded by Gomathi *et al.*; in 2014. Rokade *et al.* 2015

reported Oxalate degrading new Bacterial isolate N₁ which can facultatively convert Calcium Oxalate to Formic acid and can be used as probiotic tool for the treatment of Urolithiasis.

Giardina *et al.* 2014, mentioned that oxalate degrading activity of some probiotics and their capability to modulate the release of inflammation mediators could be exploited as a new nutraceutical and therapeutic approach for the treatment of oxalate accumulation and the related inflammatory state.

Hatch *et al.* (2011) and Sidhu *et al.*, (2001) have administered rats with *O. formigenes* daily for two weeks and exhibited a 39%-80% reduction in excretory urinary oxalates. Likewise, Hoppe B. (2006) mentioned that, when humans are administered with *O. formigenes* for 4 weeks exhibited 22%-92% reduction in urinary oxalates.

CONCLUSION

Considering all these reviews and studies it could be stated that the endophytes may have the ability to produce secondary metabolites which can be used as Probiotic for the treatment of various diseases including Urolithiasis.

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