

## ***ABSTRACT***

Since the dawn of human civilization, plants and plant-derived natural remedies have been a vital part of traditional healing. With advances in development of synthetic drug, their usage has dominated over natural products. However, with several examples of synthetic drug side effects in recent decades, there has been a huge increase in the hunt for natural and safer pharmaceuticals. Plants derived phytochemicals or bioactive substances are safer and more cost-effective resource for drug development.

The rate of development of numerous devastating oxidative stress-related disorders such as cancer, diabetes, atherosclerosis, arthritis, Alzheimer's disease, and other neurological disorders has grown as people's lifestyles have changed. Plant phytochemicals have been described as effective free radical scavengers or quenchers, making them a rich source of natural antioxidants. Herbal medications have been utilized for antibacterial, antiviral, anti-inflammatory, anti-rheumatid, antiallergic and other purposes.

The use of ethnomedicinal herbs in traditional medicine dates back over 2000 years; and many more beneficial therapeutic metabolites are expected to be discovered during later years. Despite being abundantly available and offering economic, ecological and therapeutic values, ethnic plants have received very little attention. The aim of this study was to screen and quantify different phytochemicals present in specific ethnomedicinal plants of Darjeeling district, West Bengal, Pin 734101, in light of the importance of natural products and their application as pharmaceuticals. The plant extracts were investigated for antioxidant, antimicrobial, and antidiabetic activities. Further, the cone extract of *Thuja orientalis* was fractionated by column chromatography for the isolation of active compound followed by characterization of the compound as Octacosanol. The antidiabetic potential of the compound was evaluated in streptozotocin (STZ) induced rat model.

A systematic review of the literature has been assembled to provide the details of previous studies on the several bioactive substances found in plants and their antioxidant, antimicrobial and antidiabetic potential. For present investigation *Thuja orientalis* (THU), *Tupistra nutans* (TUP), *Astilbe rivularis* (AST), *Calamus erectus* (CAL), *Zanthoxylum oxyphyllum* (ZAN) and *Artemisia vulgaris* (ART) were collected from various locations of Darjeeling district. The plant materials were shed dried, powdered and extracted with various solvents. With the different solvents utilized, a difference in extraction yield was noticed. The yield percent was least with hot water and ethanol, while methanolic extracts produced the highest percentage of yield and therefore used for further studies. The plant methanolic extracts were examined qualitatively and quantitatively for the presence of phytochemicals. Among various secondary metabolites phenol, flavonoid, tannin, carbohydrate and reducing sugar were found to be present in all the extracts. The quantitative analysis showed THU cones having the highest quantity of phenol, flavonoid, tannin and total carbohydrate whereas ART leaf exhibited all these phytochemicals in least quantity. The plant extracts showed different degrees of antioxidant activities as measured by DPPH radical, H<sub>2</sub>O<sub>2</sub>, NO and ABTS scavenging assays. AST rhizome exhibited maximum antioxidant activity in assay

based on DPPH, NO and ABTS assay, whereas THU cone showed highest activity with H<sub>2</sub>O<sub>2</sub>.

The antibacterial potential of the plant extracts was tested against two gram positive (*Bacillus amyloliquefaciens* and *Bacillus subtilis*) and two gram negative (*Flexibacter sp.* and *Aeromonas liquefaciens*) bacteria. While comparing antibacterial effect of various plant extracts, the THU cone exhibited highest antibacterial activity against *Bacillus amyloliquefaciens*, *Bacillus subtilis* and *Aeromonas liquefaciens* whereas AST rhizome showed highest activity against *Flexibacter sp.* The plant extracts were effective in limiting the growth of tested fungi, namely, *Aspergillus niger*, *Rhizopus stolonifer*, and *Fusarium oxysporum*, as measured by radial growth bioassay. The extracts of THU cone and THU leaf effectively suppressed radial growth of all of the fungi examined, but TUP flower and CAL fruit extracts only partially inhibited the radial growth.

Depending upon phytochemical constituents, antioxidant and antimicrobial activity, THU cone was found to exhibit the highest possible avenue for profiting from their use in pharmaceuticals. Hence THU cone was used for isolation and purification of bioactive molecule followed by its characterization by UV, IR and NMR spectroscopy and LC-ESI-MS analysis. The active compound in THU cone was characterized as Octacosanol with molecular formula C<sub>28</sub>H<sub>56</sub>O and molecular weight of 408.

Octacosanol was found to inhibit the in vitro  $\alpha$ -amylase activity, and its inhibitory effect was about two fold lesser than that of the positive control acarbose. In an in vivo antidiabetic assay on streptozotocin-induced diabetic rats, Octacosanol was found to be effective in restoring various blood parameters that had been altered by the induction of diabetes. Variable parameters evaluated was change in body weights, fasting blood sugar level, cholesterol, triglycerides and HDL cholesterol content, SGPT and SGOT activities and serum urea and creatinine level. Higher concentration of compound revealed higher reduction in the tested blood parameters than the lower concentration used in the study. Treatment with Octacosanol significantly improved and restored the histological structure of both liver and pancreas in STZ-induced diabetes rat. The molecule Octacosanol has potential application in pharmaceuticals due to its hypoglycemic, antimicrobial and antioxidant effects.