ABSTRACT

Mankind since ages has used herbal medicines to alleviate symptoms and get cured of the abnormal physiological problems. Those olden days may not have a strong evidence and full proof mechanism of actions by which the herbs relieved the ailments. However the strong faith in Ayurveda and traditional medicines available those days made wonders. As the modernization and literacy rate increased, people adopted the allopathic system of medicine. The science and discovery of modern medicines created a revolution in the healthcare. Hence use of synthetic molecules increased whereas herbal medicines were diminished. Continual use, irrational dose and contraindications of the synthetic molecules erupted undesirable reactions. Thus patients at large reverted to the age old herbal system.

Ultraviolet rays are harmful if exposed to uncontrolled extent and reaches the sufficient depth in human skin. Sunscreens are thus used to protect the skin. These sunscreens mainly constitute the synthetic ultraviolet radiation absorbing molecule; although effective have shown numerous undesirable reactions, sensitivities and chemical decomposition to free radicals. Prolong exposure of the human skin to ultraviolet radiations further led to formation of reactive oxygen species which could damage the skin structure and be cancerous. Thus use of antioxidants is must for effective skin protection. Attempts were made using synthetic antioxidant molecule however the associated side effects led to discontinuation of their use. Thus herbal antioxidants were thought as a suitable option. Another area of the skin care products includes the antiacne molecules. Antibiotics till today are the majorly prescribed antiacne drugs. And as with other infective ailments acne condition also faces the problem of bacterial resistance.

With an objective to overcome the unwanted reactions associated with the use of chemical components, plant extracts could be a natural, cheap, safe, and effective sunscreen agent if found to absorb the harmful ultraviolet radiations. Also the continual development of bacterial resistance towards the acne causing organisms led to initiate the present research work using herbal extracts. Reviewing the extensive literature and availability of the plant Manilkara zapota (L.) P. Royen, with prior reported free radical scavenging and antimicrobial activities, it was thought worthwhile to check whether the hydroalcoholic Manilkara zapota extracts could exhibit the sunscreen and antiacne
efficacy. To be an effective sunscreen and antiacne agent, addition of lemongrass oil which possesses good ultraviolet absorbance as well as very low minimum effective concentration against the acne causing bacteria was considered advantageous. As the research methodology and design progressed it was revealed that the nutritional value of the *Manilkara zapota* fruit was overlooked for so many years; hence the development of the nutraceutical product using the fruit pulp was also undertaken.

The procurement and authentication of the crude drug was carried out. Further maceration technique using hydroalcohol solvent was used to get the leaves and bark extracts. Qualitative and quantitative test helped to reveal the phytochemical compositions of the extracts. Methodology of the sunscreen activity included the measurement of the effective absorption spectra of the test extract and its comparison with the standard sunscreen agents. In order to be a safe sunscreen, the extract must be stable to ultraviolet irradiation hence the photostability test to predict the phototoxicity of the most promising extract were performed using various *in vitro* tests like candida yeast test, spectra measurement, linoleic acid peroxidation test. Further the hydroalcoholic leaves and bark extracts were screened for antiacne activity against *Staphylococcus epidermidis* and *Propionibacterium acnes* by cup plate method and agar dilution method in aerobic and anaerobic conditions respectively. Also the potentiation effect of lemongrass oil was evaluated. The most promising extract in combination with lemongrass oil was further developed into a topical O/W cream formulation, characterized and evaluated for Sun protection factor determination and dermal safety studies. The fruit pulp was spray dried as well as freeze dried to yield a stable powder product and characterized further for its nutritional value, stability and safety.

Results thus obtained revealed that the hydroalcoholic extract of *Manilkara zapota* leaves possess higher ultraviolet radiation absorptive property than the bark extract. Also the addition of lemongrass oil potentiated the sunscreen ability of the hydroalcoholic *Manilkara zapota* leaves extract. Further the extract also exhibited photostability when compared to the conventionally used sunscreen para amino benzoic acid. Comparison with the marketed product gave similar results. The leaves extract also possessed good antiacne activity than that of the bark extract and the effect was potentiated on addition of lemongrass oil. The combination of the leaves extract and
lemongrass oil produced antiacne activity better than standard Erythromycin at similar concentrations. Thus the leaf extract was used for topical product development. The o/w cream thus obtained; comprising the leaves extract possessed acceptable skin feel properties and retention of maximum content in the skin layers. The SPF value of the cream was estimated to be 2.70 thus revealing a potential sunscreen activity. The final product showed no skin irritation potential and was found to be safe for use as per Acute Dermal Toxicity studies. The results thus revealed that chemical constituents like flavonoids, phenolics, coumarins, terpenoids etc. which were shown to be positive as present in the preliminary tests could be responsible for the observed effects, also they worked synergistically with lemongrass oil to produce the desired effects. Further the nutraceutical product as spray dried as well as freeze dried powders of the fruit pulp were prepared and characterized. However since the flow characteristics of the spray dried powder was poor than the freeze dried, hence freeze dried powder was used further in the evaluations. Also the freeze dried further showed marked nutritional value as antioxidant potential, elemental composition etc. along with improvement in stability, retention of the nutritional potential on freeze drying and exhibiting safe oral consumption even upto 5000 mg/Kg.

The present research work thus concludes to provide effective solution combating the undesirable skin reactions and other disadvantages associated with synthetic sunscreens and antiacne molecules and also alleviate the deficiencies of simple nutrients through use of products like topical skin cream and freeze dried fruit powder respectively.

**KEYWORD**

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*Manilkara zapota*, hydroalcoholic extract, *M. zapota* leaves, *M. zapota* bark, sunscreen, photostable, antiacne, SPF, sapota fruit, chicku fruit.