SUMMARY AND CONCLUSION

Thyroid disorder is an increasing disorder amongst endocrine diseases in India. The seriousness of thyroid disorders should not be underestimated as thyroid storm and myxedema coma can lead to death in a significant number of cases. Allopathic medicines available for the treatment of thyroid disorder are quite effective in long term but leads to adverse effects. Nature has been a source of medicine for thousands of years and plant-based systems continue to play an essential role in the primary health care of 80% of the world’s developing countries. Therefore, in the present study an alternative way to treat thyroid disorder using brown algae and *Zea mays* hair were followed and tested on experimental animals.

The study was organized in three phases. Phase I involved the survey and the study of the prevalence of hypo and hyperthyroidism in selected hospitals of Coimbatore city. Biochemical and clinical changes were studied in selected hypo and hyperthyroid patients who were undergoing treatment. Phase II comprised of the selection of *Sargassum wightii* Greville (brown algae) and *Maydis stigma* (*Zea mays* hair) for the study and its phytochemical analysis and phase III included the assessment of the effect of methanolic extract of *Sargassum wightii* Greville and *Maydis stigma* on experimental animals.

Screening for thyroid disorder was done by analyzing the serum thyroid hormone and TSH levels for those who have symptoms of thyroid disorder. Cases of hypothyroidism were found to be more than that of hyperthyroidism and women were mostly affected than men. The prevalence of thyroid disorder increased with increase in age. Sixty per cent of the affected subjects were above 40 years of age. During the survey medical history and clinical symptoms were noted for the patients. Medical history of patients indicated the presence of hypertension, joint pain, obesity, dyslipidemia and low back pain.
Female subjects have the history of infertility, irregular menstruation, white discharge, bilateral anxiety, coughing and body ache. Symptoms commonly observed in hypothyroid patients includes tiredness, weakness, fatigue, sleepiness, cold intolerance, dry skin, hoarseness, constipation, joint pains, muscle cramps, mental impairment, depression, low heart rate, menstrual disturbances in women and especially menorrhagia, infertility and weight gain. Symptoms observed in hyperthyroidism are nervousness, fatigue, palpitations, exertional dyspnea, weight loss, heat intolerance, irritability, tremor, muscle weakness, breathlessness, fast heart rate, decreased menstrual flow in women, sleep disturbance, hair loss, increased perspiration, and increased frequency of bowel movements, change in appetite and thyroid enlargement.

In order to observe the changes in hypo and hyperthyroid patients during the treatment, 50 each of hypo and hyperthyroid patients were selected of which 25 were women and 25 were men and follow up was noted for one year. Patients diagnosed with thyroid disorder for the first time and who had not undergone treatment before were selected. The study group was above 40 years of age. The selected hypo and hyperthyroid patients were compared with age and sex matched control (n=10) who were not having thyroid problem. Serum thyroid hormones (T₃ and T₄), TSH, thyroid antibodies (TPO Ab and Tg Ab) and lipid profile (total cholesterol, triglycerides, HDL-C, LDL-C and VLDL-C) of the selected thyroid patients and control were analyzed. Hypothyroid patients recorded a significant decrease in T₃ and T₄ values than the control whereas they recorded a significant increase in the TSH level, their lipid profiles were also found to be at higher level. Hyperthyroid patients recorded a significant increase in the value of T₃ and T₄ whereas their TSH value was found to be significantly lower than the control. Hyperthyroid patients showed a significant decrease in total cholesterol and LDL-C, their triglycerides, HDL-C and VLDL-C were within the normal limit. Thyroid antibodies were found to be at a higher level both in hypo and hyperthyroid patients but were within the normal range.
Thyroid hormone, TSH and lipid profile showed a significant improvement after 3 months of treatment in hypothyroid patients. Levels of thyroid hormone were increased whereas TSH and lipid profile decreased and reached normal level within 3 months of treatment in hypothyroid patients. Hyperthyroid patients also showed a profound improvement during the treatment period. Significant change was observed in thyroid antibodies level in hypo and hyperthyroid patients after 12 months of treatment. The thyroid status of hypo and hyperthyroid patients undergoing treatment became stable after 12 months of treatment. The symptoms observed in thyroid patients were controlled after taking thyroid medication. During the medication period some of the patients faced complications such as hair loss, diarrhoea, increased appetite, pulse rate, fever, rashes, itching, nausea, headache, joint aches, pruritis, skin pigmentation, paraesthesias, urticaria, arthralgia and gastrointestinal disturbances.

Hence, the study of phase I indicated that hypo and hyperthyroid patients showed a significant improvement during the treatment. Adverse reactions to thyroid medications were observed in some of the patients who were undergoing treatment.

The use of traditional medicine holds a great promise as an easily available source and serves as effective medicinal agent to cure a wide range of ailments. Various herbs have been used in the treatment of hypothyroidism. In phase II *Sargassum wightii* Greville and *Maydis stigma* were selected for the treatment of experimentally induced hypo and hyperthyroidism in Swiss albino rats. Iodine content was estimated in both the samples. In order to understand the active components present in the study samples, phytochemical screening was carried out using various extracts such as aqueous, benzene, chloroform, ethanol, ethyl acetate, methanol and petroleum ether.

Preliminary phytochemical screening of *Sargassum wightii* Greville showed the presence of phytoconstituents such as alkaloids, anthraquinones,
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amino acids, carbohydrates, phenols, flavonoids, terpenoids, steroids, proteins and tannins whereas *Maydis stigma* showed the presence of alkaloids, amino acids, carbohydrates, phenols, glycosides, sterols, steroids, saponins, flavonoids, tannins and terpenoids. Methanolic extract gave maximum extraction of phytochemicals for both the samples. The antioxidant status of the various extracts were analyzed using the estimation of free radical scavenging activity (DPPH radical scavenging activity) and total antioxidant activity. The methanolic extract exhibited highest DPPH scavenging activity and total antioxidant activity for both the samples.

For the characterization of bioactive components in *Sargassum wightii* Greville and *Maydis stigma* methanolic extract of the samples were subjected to chromatographic (HPLC, HPTLC and GC-MS) and spectral (UV-visible and FT-IR) analysis.

HPLC analysis of the methanolic extract of *Sargassum wightii* Greville showed the presence of five major bioactive components and the methanolic extract of *Maydis stigma* showed two major bioactive components. HPTLC studies confirmed the presence of alkaloids, flavonoids, glycosides, phenols and steroids in the methanolic extract of *Sargassum wightii* Greville and *Maydis stigma*. GC-MS analysis of the methanolic extract of *Sargassum wightii* Greville showed the presence of components with C=O (carbonyl), ester, nitrogen hetero atom, -CH₂ and OH groups whereas the methanolic extract of *Maydis stigma* revealed the presence of components with C=O, -C=O, OH, -NH, C=N, nitrogen and straight chain acid.

UV-visible analysis of the methanolic extract of *Sargassum wightii* Greville showed n → σ* transition indicating the possibility of OH group in the extract. UV-visible analysis of the methanolic extract of *Maydis stigma* showed n → π* transition due to OH group. FT-IR analysis of the methanolic extract of *Sargassum wightii* Greville revealed the presence of OH or -NH group, free OH group, intramolecular H bonds, free NH group, H bonded NH group, C-CH₃.
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group, CH₂ group, phosphorus acid and ester P-H stretching, C=CH, non-conjugated group, CN and C-C stretching, acetates, -CH=CH and C-O stretching. FT-IR analysis of the methanolic extract of *Maydis stigma* inferred the presence of possible functional groups such as intermolecular H bonds, C-CH₃, CH₂, nonconjugated, -CN and C-C stretching, secondary cyclic alcohols and C-O stretching.

Characterization of bioactive components in the methanolic extract of *Sargassum wightii* Greville (brown algae) showed the presence of components with C=O (carbonyl), C-N, N-H, ester, acetate, CH₂, C-CH₃, OH and phosphorus groups which may be due to the presence of alkaloids, flavonoids, amines, steroids and phenols.

Characterization of bioactive components in the methanolic extract of *Maydis stigma* (sweet corn silk) showed the presence of components with C=O (carbonyl), C-N, N-H, CH₂, C-CH₃ and OH groups which may be due to the presence flavonoids, alkaloids, amines, glycosides and phenols.

This phase of the study indicated that *Sargassum wightii* Greville and *Maydis stigma* are rich source of antioxidants and bioactive components.

In phase III of the study the effect of methanolic extract of *Sargassum wightii* Greville and *Maydis stigma* were tested in experimentally induced hypo and hyperthyroid rats.

33 male Swiss albino rats were taken and separated into six groups for hypo and hyperthyroid experiments. Normal rats without induction of hypo or hyperthyroidism served as control (group I). Hypothyroidism was induced in rats using methimazole. Group II served as hypothyroid induced group. Hypothyroid induced group III was treated with standard drug thyroxine and group IV, V and VI were treated with 200, 300 and 400 mg/kg body weight of methanolic extract of *Sargassum wightii* Greville orally for 21 days.
For hyperthyroid experiment, hyperthyroidism was induced in rats using thyroxine. Group II served as hyperthyroid induced group. Hyperthyroid induced group III rats were treated with standard drug methimazole and group IV, V and VI were treated with methanolic extract of *Maydis stigma* in 200, 300 and 400 mg/kg body weight respectively for 21 days.

Hypothyroid rats showed a significant increase in body weight whereas hyperthyroid induced group showed a decrease in body weight. The changes in body weight were brought to normal when treated with standard drugs and the extracts. Hypothyroid induced animals showed a significant decrease in $T_3$ and $T_4$ while TSH was increased compared to control group. The decrease in thyroid hormone and increase in TSH was brought to normal after treatment with standard drug thyroxine and methanolic extract of *Sargassum wightii* Greville for 21 days.

Hyperthyroid induced group showed a significant increase in $T_3$ and $T_4$ while TSH showed a significant decrease when compared to the control. The increase in thyroid hormone and decrease in TSH was brought to normal after treatment with standard drug methimazole and methanolic extract of *Maydis stigma*.

Thyroid hormones have their effect on lipid metabolism. Hypothyroid induced group showed a significant increase in lipid profile (total cholesterol, triglycerides, HDL-C, LDL-C and VLDL-C) while hyperthyroid induced group showed a decrease in lipid profile. The changes in lipid profile were brought to normal after treatment with standard drugs and the extracts. Highest concentration (400 mg/kg body weight) of methanolic extract of *Sargassum wightii* Greville (brown algae) and *Maydis stigma* (sweet corn silk) showed a better result in controlling the experimentally induced hypo and hyperthyroidism in rats.

At the end of the experiment rats were sacrificed and wet weight of thyroid gland of different experimental groups were noted. Hypothyroid induced group
showed a significant decrease in thyroid weight while hyperthyroid induced group showed a significant increase. All the treated groups reached normal weight after treatment.

Histopathological studies of the thyroid section of different experimental groups were carried out. The thyroid section of normal control group showed numerous follicles some of which contain colloidal material (40-50%). Thyroid section of hypothyroid induced group II rats showed many follicles with luminal obliteration and some were devoid of colloid. Follicles appeared with smaller size. Section of thyroid gland of hypothyroid induced thyroxine treated group and the methanolic extract of *Sargassum wightii* Greville treated group showed follicles with 30-40% colloid. The follicular epithelial cells appeared normal.

Thyroid section of thyroxine induced hyperthyroid rats showed a reduction in the number of its follicles which were observed with more or less cuboidal or flattened epithelial cells. Sections of thyroid gland of hyperthyroid rats treated with methimazole and the methanolic extract of *Maydis stigma* showed follicles lined by follicular epithelial cells which appeared normal. 30-40% of the follicles showed colloid.

From the results it was clear that hypothyroid condition was reverted to normal when methanolic extract of *Sargassum wightii* Greville was given to experimental animals. *Maydis stigma* extract could control hyperthyroidism in experimental animals.

Hence, from the present study it could be concluded that adverse effects were noted in 1-3% of the patients undergoing treatment for hypo and hyperthyroidism. *Sargassum wightii* Greville (brown algae) could be used to control hypothyroidism and *Maydis stigma* (sweet corn silk) for hyperthyroidism. Both the samples were found to be rich in antioxidants and bioactive components.
**Recommendations**

Nationwide programme regarding the awareness of thyroid disorder should be conducted on regular basis. Thyroid function tests should be performed as routine diagnostic tests. More studies are to be carried out on thyroid disorders in order to understand the root cause of the disease.

Further studies could be carried out with *Sargassum wightii* Greville and *Maydis stigma*. 