INTRODUCTION

Algae are the amazing sustainable resources in the marine ecology which have been used as a source of foodstuff and drug. It was estimated that the class of marine plant are algae about 90% and as regards 50% of the total photosynthesis is contributed from algae [1]. Microalgae make an extensive range of chemically active metabolites in their environments, potentially to protect themselves against the other organisms. These dynamic metabolites also identified as biogenic compounds, that are formed by numerous species of marine macro and microalgae and have antibacterial, antifouling and antifungal activities which are efficient in the avoidance of fouling and have other likely uses in therapeutics [2 & 3]. Antimicrobial resistance is the chief crisis with a considerable impact on death, morbidity and healthcare-associated expenses. Immediately researches should be carried out for alternatives to synthetic antibiotics. The evaluation of the discovery of novel antimicrobial peptides makes accepted antibiotics as the basic element of making new drugs for the management of fungal and bacterial infections [4 & 5]. Obesity is the sixth most important public health complications in both developed and developing countries because of a raise in entire fat accumulation. It happens since unilocular adipocytes have hyperplasia or hypertrophy and subsequent macrophage fat tissue infiltration [6]. A huge pool of pancreatic lipase inhibitors are present in natural products and offer possibility for being developed into clinical products. A variety of extracts and secondary metabolites, isolated from microalgae and plants that contain pancreatic lipase inhibitory activity was reviewed by Birari and Bhutani [7]. The present investigation was undertaken to investigate the antimicrobial and antiobesity actions of methanol extracts of Gracilaria corticata and Spirulina platensis.

MATERIALS AND METHODS

Antibacterial testing

Selection of microorganisms

In vitro antibacterial analysis was performed against bacteria for instance Proteus vulgaris (MTCC 426), Escherichia coli (MTCC 1687), Bacillus subtilis (MTCC 8114), Pseudomonas aeruginosa (MTCC 4996) and Staphylococcus aureus (MTCC 2940). The bacteria were inoculated on a nutrient agar (M001), slant for 24 h at 37 ± 2°C.

Agar cup plate method (ACPM)

The crude methanolic Gracilaria corticata and Spirulina platensis were analysed for their antibacterial activity by the agar cup plate technique [8].

Minimal inhibitory concentration

Minimum inhibitory concentrations (MIC) were measured by the micro dilution broth technique. The marine algae extracts were dissolved in methanol and successively diluted with Muller-Hinton broth to attain the preferred concentrations. For control Muller-Hinton broth with methanol (4%) and bacteria were used. Sample measuring 25μl of each bacterial suspension were added to the plant extract containing different concentrations of plant extract such as 250μl, 500μl, 750μl and 1000μl and they were incubated under aerobic conditions at 37±2°C. After 24hrs, the turbidity was measured. The MIC can be defined as the lowest antimicrobial concentration of the test samples that inhibits complete bacterial growth.

Antiobesity testing

Anti- lipase action of methanol extract of G. corticata and S. platensis were analysed for antiobesity studies.

Freshly slaughtered chicken were selected and pancreas of that chicken were dissected. Collected pancreas was cleaned and stored in 0.01M ice cold sucrose. The pancreas was grind using sucrose (0.01M), centrifuged and supernatant was taken to precipitate with 50% saturated ammonium sulphate. After centrifugation, the pellets were mixed in sucrose and repeated the procedure. Formed pellet was then mixed in phosphate buffer and taken further as enzyme for analysis.

Estimation of chicken pancreatic lipase activity

The activity of pancreatic lipase was examined through incubating a mixture of olive oil (8ml), 0.4ml of phosphate buffer and chicken...
pancreatic lipase (1ml) for an hour in rotary shaker. After that, response was terminated by way of adding 1.5ml of a combination comprising acetone and ethanol (95%) in 1:1 ratio. The fatty acids liberated were measured through titration of solution with 0.02M NaOH which is regularized by oxalic acid (0.01M) and phenolphthalein was used by means of an indicator [9].

**Lipase inhibitory action of methanol excerpts of G. corticata and S. platensis**

Lipase inhibitory action of various amount of methanol excerpt was analyzed by mingling oil emulsion (8ml), 1ml of chicken pancreatic lipase and 100μl of extract and it was incubated for 60 minutes for the reaction to carry out. The response was terminated by adding 1.5ml of acetone mixture and 95% ethanol with 1:1 ratio. The liberated fatty acids were estimated through titration of solution as mentioned above [10].

\[
\text{Inhibition of Lipase} = \frac{M - N}{M} \times 100,
\]

Where; M, N are the lipase activity without and with the extract respectively.

**RESULTS**

**Antimicrobial study**

**Agar cup plate method (ACPM)**

The antimicrobial activities of the methanolic extract of *Gracilaria corticata* and *Spirulina platensis* were studied for strains of 5 bacteria. The results were analyzed with that of regular antibiotic Gentamycin, and Tetracycline. The results got for the sensitivity are given in the table 1. *Bacillus* showed 10mm of zone when the marine algae extracts of *Gracilaria corticata* was loaded on the well like that, *S.aures, E.coli, Pseudomonas, P.vulgaris* showed the zone of about 8,10,7,5 and 3mm by *Bacillus subtilis, Staphylococcus aureus, E.coli, Pseudomonas, Proteus vulgaris* respectively (Fig. 1 & 2).

To study the minimum inhibitory concentration, the marine algae extract were treated with the specific microorganism and the results were observed. From that it was observed that 250μl of the marine algae extract was enough to inhibit the microbial growth. The concentration dependant variation was observed in the results (Table 2 & 3).

**Table 1: Antimicrobial activity of methanol excerpts from marine algae of Gracilaria corticata and Spirulina platensis**

<table>
<thead>
<tr>
<th>Test organism</th>
<th>Gracilaria corticata Diameter of zone (mm)</th>
<th>Spirulina platensis Diameter of zone (mm)</th>
<th>Standard Antibiotic</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E.coli</em></td>
<td>7±0.15</td>
<td>3±0.11</td>
<td>Gentamycin (13mm)</td>
</tr>
<tr>
<td><em>P.vulgaris</em></td>
<td>3±0.09</td>
<td>2±0.14</td>
<td>Gentamycin (14mm)</td>
</tr>
<tr>
<td><em>B.subtilis</em></td>
<td>8±0.17</td>
<td>1±0.13</td>
<td>Tetracyclin (16mm)</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>5±0.04</td>
<td>2±0.03</td>
<td>Tetracyclin (14mm)</td>
</tr>
<tr>
<td><em>S.aureus</em></td>
<td>10±0.12</td>
<td>8±0.14</td>
<td>Tetracyclin (12mm)</td>
</tr>
</tbody>
</table>

Fig. 1: Antimicrobial activity of methanol excerpts of S.platensis with positive control
Fig. 2: Antimicrobial activity of methanol excerpts of *G. Cortica* with positive control Minimal inhibitory concentration

Table 2: Minimum inhibitory concentration of *Spirulina platensis* at 540nm

<table>
<thead>
<tr>
<th>Test Organism</th>
<th>Control</th>
<th>250 μl</th>
<th>500 μl</th>
<th>750 μl</th>
<th>1000 μl</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E.coli</em></td>
<td>2.73</td>
<td>2.58±0.15</td>
<td>2.23±0.12</td>
<td>1.99±0.14</td>
<td>1.87±0.11</td>
</tr>
<tr>
<td><em>P.vulgaris</em></td>
<td>2.18</td>
<td>2.28±0.02</td>
<td>1.48±0.11</td>
<td>1.36±0.13</td>
<td>1.25±0.09</td>
</tr>
<tr>
<td><em>B.subtilis</em></td>
<td>2.43</td>
<td>2.28±0.03</td>
<td>2.03±0.08</td>
<td>1.89±0.05</td>
<td>1.68±0.01</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>1.80</td>
<td>1.80±0.04</td>
<td>1.64±0.11</td>
<td>1.53±0.12</td>
<td>1.00±0.12</td>
</tr>
<tr>
<td><em>S.aureus</em></td>
<td>2.24</td>
<td>2.04±0.08</td>
<td>1.88±0.12</td>
<td>1.67±0.14</td>
<td>1.44±0.11</td>
</tr>
</tbody>
</table>

Table 3: Minimum inhibitory concentration of *Gracilaria corticata* at 540nm

<table>
<thead>
<tr>
<th>Test Organism</th>
<th>Control</th>
<th>250 μl</th>
<th>500 μl</th>
<th>750 μl</th>
<th>1000 μl</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E.coli</em></td>
<td>1.24</td>
<td>1.08±0.12</td>
<td>0.95±0.13</td>
<td>0.837±0.13</td>
<td>0.72±0.09</td>
</tr>
<tr>
<td><em>P.vulgaris</em></td>
<td>1.08</td>
<td>0.98±0.12</td>
<td>0.86±0.16</td>
<td>0.66±0.12</td>
<td>0.34±0.08</td>
</tr>
<tr>
<td><em>B.subtilis</em></td>
<td>1.22</td>
<td>1.06±0.11</td>
<td>0.92±0.18</td>
<td>0.80±0.14</td>
<td>0.69±0.10</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>1.64</td>
<td>1.48±0.12</td>
<td>1.23±0.15</td>
<td>1.08±0.15</td>
<td>0.98±0.10</td>
</tr>
<tr>
<td><em>S.aureus</em></td>
<td>1.11</td>
<td>0.97±0.14</td>
<td>0.87±0.13</td>
<td>0.78±0.12</td>
<td>0.65±0.07</td>
</tr>
</tbody>
</table>

Table 4: Lipase inhibitory activity of methanol extract of *G. corticata* and *S. platensis*

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Inhibition of lipase activity of <em>G. corticata</em></th>
<th>Inhibition of lipase activity of <em>S. platensis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1</td>
<td>25±0.12</td>
<td>30±0.18</td>
</tr>
<tr>
<td>0.25</td>
<td>25±0.14</td>
<td>32±0.07</td>
</tr>
<tr>
<td>0.5</td>
<td>20±0.11</td>
<td>25±0.06</td>
</tr>
<tr>
<td>1</td>
<td>30±0.11</td>
<td>35±0.07</td>
</tr>
<tr>
<td>25</td>
<td>27±0.13</td>
<td>32±0.16</td>
</tr>
<tr>
<td>5</td>
<td>30±0.16</td>
<td>33±0.17</td>
</tr>
<tr>
<td>10</td>
<td>35±0.18</td>
<td>38±0.15</td>
</tr>
<tr>
<td>15</td>
<td>40±0.17</td>
<td>50±0.18</td>
</tr>
<tr>
<td>20</td>
<td>45±0.21</td>
<td>55±0.23</td>
</tr>
</tbody>
</table>
Most of the compounds of marine algae show anti-bacterial activities. DISCUSSION activity was seen having 5mg/ml extract and higher (Fig. 3 & 4).

Production of antimicrobial activities was measured to be a sign of the marine algae to produce bioactive secondary metabolites [23, 24 & 25].

The Antibacterial function of the marine algae

Antibacterial activity has been proposed in a number of marine algae which are collected from the coast of Mandapam to Kanyakumari. The maximum antibacterial activity was reported in the class Rhodophyceae (80%) followed by the Chlorophyceae (62.5%) and the Phaeophyceae (61.9%) [26].

The antibacterial screening of chloroform hexane and alcoholic leaves extracts of Finlaysonia obovata was conceded out for fresh water fish pathogenic bacteria via, Aeromonas hyaethophila, Vibrio alginolyticus, Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, Edwardsiella tarda and Micrococcus sps by disc-assy technique [27]. Extracts of marine algae and sponge were analysed for various bacterial pathogens by well-cut agar diffusion method. The brown algae Cysostoria compressa had broad spectrum antimicrobial effect against different bacterial pathogens [28].

The antibacterial activities of four vital marine algae specifically Ulva lactuca, Sargassum wightii, Padina gymnospora and Gracilaria edulis were examined for the human bacterial pathogens Vibrio cholerae Staphylococcus aureus, Salmonella paratyphi, Shigella dysenteriae, P. aeruginosa and Klebsiella pneumonia. The greatest activity (8.8 mm) was noted in G. edulis compared to S. aureus and minimum by U. lactuca (1.2 mm) compared to P. aeruginosa. The 1H-NMR analysis exposed the signals present concerning with polyunsaturated esters in Gracilaria edulis, Sargassum wightii and poly saturated alcohols in Padina gymnospora [29].

To date, in spite of the availability of numerous reviews are outstanding for anti-obesity agents in the literature, there is no reviews regarding summarizing actual, natural-product information on anti-obesity action, dynamic compound varieties, and way of action. In 2000, The The use of some renowned medicinal marine algae that had claimed to be helpful in treating obesity was reported by Moro and Basile [30].

The pancreatic lipase inhibitory action of 54 marine algae was reported and lipase inhibitory activity in their methanol or ethyl acetate extracts was showed [31]. Various amount of different extracts of Gracilaria sps and Spirulina sps were examined for their medicinal property and spirulina was reported to have antiarthritic activity [32,33].

CONCLUSION

Microbicidal activities observed in the crude methonolic extracts of gracilaria sps from the southwest coast of India provide good evidence that algae maintain effective antimicrobial chemical resistance, and this anti-bacterial property is due to the presence of active bio molecules. From the present study, it can be concluded that the red alga Gracilaria corticata is a potential source of bioactive compounds. These compounds maybe utilized for the development of natural antibiotic against multitherapy resistant bacteria. The results of the antiobesity study again have revealed that medicinal marine algae still play vital role in the primary healthcare of the people.

Further ethanopharmacological and phytochemical of these algae may be investigated to explore possible agents in the marine algae.

REFERENCES

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