INTRODUCTION

Cough is a defensive reflex of the respiratory tract which is important to clear the upper airways and should not be suppressed indiscriminately. Cough is thought to be caused by a reflex. It occurs due to stimulation of mechano-or chemoreceptor in throat, respiratory passage or stretch receptor in the lungs. The sensitive receptors are located in the bronchial tree, particularly in the junction of the trachea. These receptors can be stimulated mechanically or chemically e.g. by inhalation of various irritants than nerve impulses activate the cough center in the brain. Traditionally cough is classified as either productive, i.e. producing mucus usually with expectoration or nonproductive (dry). Therefore, the use of an effective antitussive agent such as dextromethorphan or codeine to suppress the debilitating cough suffered by such patients seems appropriate. Non-Narcotic antitussive agents anesthetize the stretch receptor located in respiratory passages, lungs and pleura by dampening their activity and thereby reducing the cough reflex at its source. Narcotic antitussive agents depress the cough center that is located in the medulla, thereby raising its threshold for incoming coughs. Terminalia chebula, Mentha piperita, Adhatoda vasica, Ocimum sanctum, Zingiber officinale, Piper longum, Glycyrrhiza glabra and Withania somnifera are Perennial herb found throughout India also cultivated in some parts of Odisha. Fruits of Terminalia chebula contain chebulagic acid, chebulinic acid, corilagin & ellagitannin, Mentha piperita contain menthol, leaves of Adhatoda vasica contain vasicine, vasicinone, 6-hydroxy vasicine and adhatodic acid and commonly used as expectorant and bronchodilator. Leaves of Ocimum sanctum are contain 70% eugenol, carvacrol 3% and eugenol-methyl ether 20% and used as stimulant, aromatic, spasmylocic, stomachic and is a good immune-modulatory agent. Rhizomes of Zingiber officinale contain geranial and citral, zingirone, paradols, ginediols and used as stimulant, aromatic stomachic. Fruits of Piper longum contain 1-phellandrene and caraphyllene and used to treat respiratory infection such as stomachic, bronchitis, diseases of spleen, cough, tumour and asthma. Root of Glycyrrhiza glabra contain glycyrrhizic acid and traditionally used as expectorant, demulscent and as flavouring agent in formulation with nauseous drugs like ammonium chloride, quinine, cascara. Roots of Withania somnifera contain withanine and used as respiratory stimulant, and as an immune-modulatory agent. All these are used in skin eruption, skin infection, improve complexion and in cough. An attempt to prepare a poly herbal formulation were undertaken in the present study, after reviewing various literatures for each of these promising plants with a fore mentioned activities.

MATERIALS AND METHOD

Collection of plant materials

The fruits of T. chebula, leaves of M. piperita, A. vasica, O. sanctum and the Root of G. glabra and W. somnifera were collected from adjoining area of Barpali (Bargarh) in the month of February-2012. Fruits of P. nigrum and Rhizomes of Z. officinale were purchased from the local market, Barpali, India and were authenticated from department of Botany, Panchayat College Bargarh, India.

Preparation of extracts

The collected plant materials (2 kg) of each were dried under shade, size reduced into coarse powder and macerated separately with 4 L of water-ethanol mixture (1:1). After 7 days of maceration, all the extract was filtered out and concentrated under vacuum using rotary vacuum evaporator (Sunilson et al., 2008). The residue obtained was kept in a dessicator for further studies.

Preparation of herbal syrup

The simple syrup (66.67% w/v) was prepared as per Indian pharmacopoeia. 200 mg of each extracts of Terminalia chebula, Mentha piperita, A. vasica, Zingiber officinale and 400 mg of each extracts of O. sanctum, Glycyrrhiza...
Evaluation of formulated cough syrup

Physicochemical parameters like Specific gravity, Density, pH, Refractive index, Alcohol content and Acid value were analyzed as per the standard procedure mentioned in Indian Pharmacopoeia. The colour, odour and taste were also recorded as shown in table -1.

Table 1: Physicochemical parameters of formulated polyherbal cough syrup

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Reddish brown</td>
</tr>
<tr>
<td>Odour</td>
<td>Sweet aromatic</td>
</tr>
<tr>
<td>Taste</td>
<td>Sweet</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.25</td>
</tr>
<tr>
<td>Density</td>
<td>1.37</td>
</tr>
<tr>
<td>Refractive index</td>
<td>1.54</td>
</tr>
<tr>
<td>pH</td>
<td>4.8</td>
</tr>
<tr>
<td>Alcohol content</td>
<td>0.81</td>
</tr>
<tr>
<td>Acid value</td>
<td>0.118</td>
</tr>
</tbody>
</table>

PHARMACOLOGICAL SCREENING

Animals

Thirty healthy guinea pigs (300 - 400 g) of either sex were selected from the animal house of TPC, Barpali. They were kept in the departmental animal house under the conditions of light (14h light/10h dark) at 27 ± 2°C and relative humidity 44- 56%, for 1 week before and during the experiments. They were fed with standard diet and water was allowed to have ad libitum. All animals were handled according to the approval and current guidelines of Institutional Animal Ethical Committee.

Antitussive activity

The method described by (D. Marina et al 2008) was adopted to evaluate antitussive activity.

The animal was divided into five groups of six each

- **Group - I** control group
- **Group -II** received diphenhydramine hydrochloride (2.8mg/kg)
- **Group -III** received 1ml formulated cough syrup
- **Group -IV** received 2 ml formulated cough syrup
- **Group -V** received 3 ml formulated cough syrup

The animals were placed in a cylindrical glass vessel with two tubes at either ends. One serves as the entrance of the aerosol and the other for its efflux. The latter tube has a side arm connecting to a tambour, from which change in pressure can be registered. A pinch clamp with a variable screw was placed on the efflux tube beyond the side arm permitting the regulation of sensitivity of system so that the displacement of air in the enclosure caused by coughing of the animal was registered. The guinea pig was exposed to the aerosol of 7.5% citric acid in water for 10 min. Each animal was tested first to obtain the control response. The number of tussive response was registered. One hour later, the standard and test substances were applied orally and 30 min later the guinea pig was subjected to the aerosol again. The number of coughs during 10 min was recorded (Braga et al 1993) (vogel et al 2001) (vogel et al 2002) (16, 17, 18).

Statistical analysis

All the data are expressed as mean ± SEM. The values obtained for the above parameters were compared with standard and control group using one way ANOVA followed by Student’s test. The values of p < 0.05 and p < 0.001 were considered to indicate a significant difference between the groups.

RESULTS

Aerosol of 7.5% citric acid in water produced tussive responses on guinea pig ileum. Herbal formulation in the concentration range of 1, 2, 3 ml revealed significant p < 0.05 and p < 0.001 antitussive activity in a dose dependent manner in comparison to control and standard drug. It has been observed that the extract has produced 54%, 70%, 75% reduction in cough bouts at the dose level of 1, 2, 3 ml respectively after 1hr of drug administration. It is evident from the data that the highest dose of 3 ml was found to be more effective. Also the antitussive activity produced by the herbal formulation in the minimum dose was much better than the standard drug. The results were tabulated in Table -2, Figure - 1.

Table 2: Effect of polyherbal cough syrup on citric acid induced cough in guinea pig and treatment latency to citric acid induced cough

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Latency to citric acid induced cough</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Groups</strong></td>
<td>Before in min (mean ± SEM)</td>
</tr>
<tr>
<td>Control</td>
<td>16.1 ±2.79</td>
</tr>
<tr>
<td>Standard</td>
<td>20.8 ±1.21</td>
</tr>
<tr>
<td>Diphenhydramine hydrochloride (2.8mg/kg)</td>
<td>17.8 ±1.97</td>
</tr>
<tr>
<td>Test-I Formulated cough syrup (1ml )</td>
<td>20 ±2.89</td>
</tr>
<tr>
<td>Test-II Formulated cough syrup (2ml)</td>
<td>19 ±2.94</td>
</tr>
</tbody>
</table>

**P<0.01, P<0.05 shows statistical significance compared to control, n=6
DISCUSSION

Although, a number of synthetic preparations have proved to be effective for managing coughing symptoms, curative therapy for cough is lacking. The cough suppressant activity elicited by the formulated herbal syrup may also be attributed to the presence of some phyto constituents such as vasicinone and vasicinol1, Glycyrrhizin2, eugenol, carvacrol, geranial, citral, caryophyllene and withanine in the extracts of Terminalia chebula, Mentha piperita, Adhatoda vasica, Ocimum sanctum, Zingiber officinale, Piper longum, Glycyrrhiza glabra and Withania somnifera respectively. Many of the currently available cough suppressants like Codeine, Ephedrine, Bromhexine, Guaifenesin etc, produce significant depression, drowsiness and addiction which makes their use unsatisfactory9.

CONCLUSION

The present study has provided an experimental evidence for protection against cough by the formulated poly herbal cough syrup. All the above findings support the traditional claims in Ayurveda and Siddha for use of this formulation in the treatment of cough by virtue of its antitussive activity19. The Cough suppressant activity elicited by the formulated herbal syrup may also be attributed to the presence of some phyto constituents such as T. chebula, leaves of M. piperita, A. vasica, O. sanctum, G. glabra, W. somnifera, P. nigrum and Z. officinale.

CONFLICTS OF INTEREST:

There is no conflict of interest in relation to the publication on manuscript file.

REFERENCES:


