these injections may have chloroquine, the accurate dose is never given. If people are convinced that chloroquine tablets distributed by MPWs are identical to chloroquine injection in efficacy, more people would be expected to seek treatment from DDCs and health centres. Effective education on these issues should reduce malaria morbidity and the frequency of inadequate therapy. The widespread, inappropriate use of chloroquine could also influence the emergence of drug-resistant strains of *P. falciparum*.

Another point of concern is that many of the tribals depend on guniyas for treatment. This is because they believe that malaria convulsions are due to evil spirit. Their immense faith in traditional healers is unlikely to be replaced and probably many will continue to visit the guniya. Hence they should also be taught that if their symptoms do not respond within 24 h and they still believe they have malaria they should seek treatment at the nearest health centre. If residents are aware of the risk of having an untreated or inadequately-treated patient in their home or community, they would seek timely and appropriate treatment or might put greater pressure on infected patients to seek treatment without losing time.

NMEP in India, is redirecting its efforts from large-scale indoor residual spraying to other means of controlling the disease. Much emphasis is given on the selective use of insecticides and increasing involvement of the community in malaria control activities especially in those measures aimed to reduce man vector contact. Results of this study may well be used for developing information, education and communication programmes for greater acceptance of malaria control measures.

However, it may be mentioned that ethnic tribals depict sociocultural diversity from one tribe to another as also from one area to another. The state is divided into five tribal cultural zones, i.e. western zone, central zone, north-eastern zone, southern zone and north-western zone. The tribes living in one zone are culturally and socially distinct from those living in other zones. Therefore, this preliminary study carried out in central tribal zone does not reflect the awareness and attitudes of the entire tribal belt. Hence, there is a further need for similar KABP studies in other tribal zones of Madhya Pradesh for developing IEC programmes.


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Study on prevalence of hypothyroidism in women of reproductive age in Meghalaya, North-Eastern India

I. J. Kharkongor and B. B. P. Gupta*

Environmental Endocrinology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong 793 022, India

In order to study the prevalence of hypothyroidism in the women of reproductive age group (15–45 years) of Meghalaya, serum samples collected from non-pregnant and pregnant women were screened for total $T_4$ (thyroxine) and TSH (thyrotropin) with the help of radioimmuno assay and immunoradiometric assay. In the non-pregnant women of age group 36–45 years, the prevalence of hypothyroidism was found to be 3.33%, while among pregnant women, in the age group 15–25 years a prevalence of 3.70% was recorded. When all samples were considered together, a prevalence of 1.11% and 1.43% was noted in the non-pregnant and the pregnant women, respectively. An average prevalence of 1.25% was recorded among the women of the reproductive age irrespective of status. Thus, the prevalence of hypothyroidism in the women of Meghalaya seems to be very high as compared to that of the non-endemic goitre belt of India (0.07%).

IODINE has important effects on human health and social development and its deficiency constitutes one of the major international public health problems. Iodine in adequate amounts (RDA:150 $\mu$g) is a prerequisite for the biosynthesis of thyroid hormones (TH) by the thyroid gland. In case of deficiency of dietary iodine, the rate of TH biosynthesis is decreased resulting in a condition called hypothyroidism. Continued lack of iodine

*For correspondence.
in the diet leads to iodine deficiency disorders (IDD)\textsuperscript{1-5} like goitre (clinical hypothyroidism) and endemic cretinism associated with mental retardation, deafness and ataxia, lower IQ, etc.\textsuperscript{6-8}. Hypothyroidism during foetal/post-natal life interferes with the normal development and maturation of the central nervous system\textsuperscript{1,9} and increases the chances of infant mortality, congenital abnormalities\textsuperscript{1,10}, stunted growth and dwarfism\textsuperscript{11} associated with a waddling gait, etc.\textsuperscript{6,11}. Hypothyroidism during childhood results in impaired mental functions and psychology\textsuperscript{5,9}. Further, in hypothyroid individuals sexual maturation and the onset of puberty is also delayed. In adults, hypothyroidism is associated with reduced fertility\textsuperscript{12}, impaired mental function\textsuperscript{1,13}, coronary heart diseases and atherosclerosis\textsuperscript{6}, anaemia\textsuperscript{15}, pleural effusions of the respiratory system, reduced appetite, constipation, delayed muscle contraction and relaxation, decreased renal blood flow and glomerular filtration rate, etc. In pregnant women hypothyroidism leads to abortion and premature delivery\textsuperscript{1,14}, still birth\textsuperscript{1,10,14} or birth of congenitally defective babies\textsuperscript{1,4,12}. So far, epidemiological surveys have been conducted to study the prevalence of hypothyroidism in the population inhabiting the foothills of the Himalayas (Terai region) and Assam only, where the prevalence of hypothyroidism has been reported to be very high\textsuperscript{15-17}. There is practically no information on prevalence of hypothyroidism (either clinical or subclinical) in the state of Meghalaya. Therefore, keeping in view the severe adverse effects of TH deficiency among the general population, particularly in women and the lack of information about the status of hypothyroidism in the state of Meghalaya, we decided to study the prevalence of hypothyroidism in women of reproductive age in Meghalaya by measuring the levels of total thyroxine (T\textsubscript{4}) and thyrotropin (TSH) using radioimmuno assay (RIA) and immunoradiometric assay (IRMA), respectively.

For this study, blood samples (5 ml from each individual) were collected with the help of disposable needles and syringes in the morning (9 to 10 am) from fasting normal (non-pregnant) and pregnant women of different age groups (Table 1).

The collected blood samples were allowed to clot at room temperature. Then the samples were rimmed and centrifuged at 2000 g (3000 RPM) for 15 min and the serum was collected in pre-numbered capped tubes. The serum samples were stored in a freezer (−15°C to −18°C) for measurement of hormones. The working group of the European Society for Paediatric Endocrinology has recommended measurement of the circulating levels of TSH and total T\textsubscript{4} as the best parameters for monitoring hypothyroidism and to assess thyroid status\textsuperscript{10}. Therefore, the levels of total T\textsubscript{4} and TSH were measured in the serum samples using RIA and IRMA, respectively. The RIA and the IRMA kits were obtained from the Board of Radiation and Isotope Technology, Mumbai. The serum samples from different age groups and status were randomly selected and processed for RIA and IRMA following the instructions and protocols provided by the manufacturers. The data were analysed statistically with the help of Student’s t test and regression analysis.

The data are presented in Table 2. In non-pregnant women, the serum concentration of total T\textsubscript{4} ranged between 47.08 ng/ml and 216.60 ng/ml (normal physiological range of T\textsubscript{4} is 48–120 ng/ml). The average concentration of total T\textsubscript{4} was significantly lower in the age group of 36–45 years as compared to age groups of 15–25 years and 26–35 years (Table 2). The average concentration of total T\textsubscript{4} of all 90 samples from non-pregnant women was found to be 100.54 ± 25.11 ng/ml. The concentration of TSH in non-pregnant women ranged between 0.1 µIU/ml and 6.106 µIU/ml (normal physiological range of TSH is 0.40–7.00 µIU/ml). The average concentration of TSH of all samples from non-pregnant women was found to be 1.17 ± 0.09 µIU/ml. There was no significant difference in the concentration of TSH between the different age groups. On the basis of the level of total T\textsubscript{4} and TSH, 3.33% women in the age group of 36–45 years were found to be hypothyroidic. In addition, several euthyroidic non-pregnant women had total T\textsubscript{4} concentration at the border of the lower physiological limit.

In the pregnant women, the serum concentration of total T\textsubscript{4} ranged between 29.44 ng/ml and 321.99 ng/ml (average: 167.73 ± 48.27 ng/ml), and that of TSH between 0.1 µIU/ml and 6.0 µIU/ml (average: 1.29 ± 0.09 µIU/ml). There was no significant difference in the average concentrations of T\textsubscript{4} and TSH of different age groups of pregnant women. However, among the pregnant women of 15–25 years age group, out of twenty seven, one individual (3.70%) was found to be hypothyroidic.

In order to find out the correlation, if any, between age and the level of total T\textsubscript{4} and TSH, the data was analysed using ‘regression analysis’ (Table 2). It was found that there was an insignificant negative correlation between age and T\textsubscript{4} concentration of non-pregnant women ($r = -0.12$). However, there was a significant positive correlation between age and the concentration of TSH in non-pregnant women ($r = 0.52$). In pregnant

<table>
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<th>Group</th>
<th>Status</th>
<th>Age (years)</th>
<th>Sample number</th>
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<td>15-25</td>
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<tr>
<td>Group 2</td>
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<td>26-35</td>
<td>30</td>
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<tr>
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<td>36-45</td>
<td>30</td>
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<tr>
<td>Group 6</td>
<td>Pregnant</td>
<td>36-45</td>
<td>21</td>
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</tbody>
</table>

Table 1. Blood samples from women of different age groups and status

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women, a significant positive correlation was found between age and the levels of T₄ (r = 0.87) and TSH (r = 0.95).

A survey conducted in 1966 by the National Goitre Control Program reported goitre prevalence to be 23.0% in Garo hills and 7% in composite Khasi and Jaintia hills of the erstwhile Assam (now Meghalaya)¹⁹. After this study, no other survey has been conducted in the state during the last three decades. Therefore, there is practically no information about the actual status of hypothyroidism in Meghalaya. Despite the fact that the incidence of hypothyroidism is more dangerous in women of reproductive age group, no attention was focused on hypothyroidism in women in any of the earlier studies conducted. To the best of our knowledge, this might be the first study of its kind in India in which women (both pregnant and non-pregnant) in the reproductive age group (15-45 years) were screened for hypothyroidism by measuring the levels of T₄ and TSH.

The present study recorded 3.33% prevalence of hypothyroidism in non-pregnant women of 36-45 years age group, and 3.70% prevalence of hypothyroidism in pregnant women of 15-25 years age group. Since hypothyroidism was found in individuals belonging to 15-25 years age group and 36-45 years age group, ideally pregnancy should be avoided during the early and late years of reproductive age of women. When considering the total number of samples, 1.11% prevalence of hypothyroidism was recorded among non-pregnant women and 1.43% prevalence of hypothyroidism was recorded among pregnant women. When considering all (both pregnant and non-pregnant) the samples together, 1.25% prevalence of hypothyroidism seemed to be evident in the screened population. When we compare the 1.25% prevalence of hypothyroidism in the women of Meghalaya with that of Delhi and Kerala (non-endemic goitre regions where risks of hypothyroidism is negligible (0.071%)) (ref. 15), it is about 18 times higher. However, the prevalence rate recorded in the present study is only about one-third of prevalence rate reported for the goitre districts of Uttar Pradesh¹⁵. Since information on prevalence of hypothyroidism in men and children remains unknown, there seems to be an urgent need to screen the population of Meghalaya and other adjoining states of North-Eastern India so that remedial steps can be taken up by the concerned agencies.

Microbial antagonism to Neovossia indica, causing Karnal bunt of wheat*1

G. A. M. Amer†‡, D. V. Singh,
Rashmi Aggarwal** and Prem Dureja*

Division of Plant Pathology, and  *Division of Agricultural Chemicals, IARI, New Delhi 110 012, India

The potentiality of fungal, bacterial and actinomycete biocontrol agents isolated from soil was investigated against Neovossia indica. Culture filtrates of Trichoderma pseudokoningii, T. lignorum, T. koningii, Gliocladium roseum, G. deliquescentes, G. virens, fluorescent pseudomonad isolate (FP-VII), bacterial isolate Bact-II and an actinomycete isolate act-V, inhibited germination of teliospore and secondary sporidia of Karnal bunt fungus. Bioassay test of the chloroform extracts of antagonists spotted on TLC plates indicated the presence of bands of different Rf values. Three bands showing involvement of atleast three antifungal compounds in case of T. lignorum, T. koningii, T. pseudokoningii, FP isolate (FP-VII), Bact-II and actinomycete isolate act-V were observed. Bioassay of one of the purified compounds of T. koningii and T. pseudokoningii inhibited the mycelial growth of N. indica at 1000 and 500 ppm respectively while the compound from T. lignorum showed inhibition at 100 ppm.

KARNAL bunt of wheat caused by Neovossia indica (Mitra) Mundkur (Tilletia indica (Mitra)) not only causes reduction in yield but adversely affects the grain quality1. The disease is difficult to manage due to its complex nature. Although fungicide sprays are effective2, their extensive use in controlling the disease is not environmentally safe and also not economical. Therefore, attempts have been made to prevent this disease by eco-friendly methods. In a study some antagonists like Trichoderma viride, T. harzianum and G. deliquescentes have shown biocontrol potential3, but the present investigations were undertaken to search for antagonistic micro-organisms with more potential against N. indica.

Fungal, bacterial and actinomycete cultures were isolated on selective media from soil samples of wheat rhizosphere collected from various locations and maintained on specific media4,5. Potato–dextrose poured petriplates inoculated with sporidial suspension (106 spordia/ml) and seeded in the centre with the test organism were incubated at 18 ± 1°C and observations on inhibition zone, over growth and lysis were recorded when colony growth of N. indica became visible. Petriplates inoculated with N. indica without any test organism served as control.

The selected fungal biocontrol agents were grown on potato–dextrose broth, bacteria and actinomycetes in nutrient broth in 100 ml conical flasks containing 40 ml media. The flasks were incubated at 25°C for 20 days in case of fungal cultures and 7 days for bacteria and actinomycetes. Cell free extracts were stored in McCartney's bottles at low temperatures (4°C) for undertaking further studies on antagonism.

A drop of culture filtrate of each antagonist was mixed with a drop of spore suspension (103 teliospores/ml and 106 sporidia/ml) on sterilized cavity slides and incubated at 18°C in moist chambers. The observations on percent teliospore and sporidia germination were recorded after 15 days and 4 h respectively.

About 1 litre cell free culture filtrate of each selected antagonist was raised and antifungal compound was ex-

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1Part of Ph D thesis submitted to PG School, IARI, New Delhi 110 012.
2For correspondence.