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IODIZED SALT FOR THE PREVENTION OF GOITER
A LIFELONG INTEREST OF DR. ROY D. McCLURE

BROCK E. BRUSH*

Chairman Iodized Salt Committee
Michigan State Medical Society

The State of Michigan, situated as it is in the Great Lakes endemic goiter belt, offers an unusual opportunity for the study of the disease and the effects on its incidence of iodized salt used as a prophylactic measure. This challenge was accepted by the Michigan State Medical Society and the Michigan Department of Health thirty years ago, and the story of their accomplishments in goiter prophylaxis since that time is comparable to the classical discoveries of preventive medicine in many other fields. A review of their experience clearly shows that endemic goiter is truly one of the easiest known diseases to prevent.

In 1812, Courtois of France isolated the element iodine and described its unusual color and vapors. It was soon recommended for the treatment of goiter and Switzerland used iodized salt as a prophylactic measure as early as 1840. Chatin,1 in 1850, showed the iodine content of the soil and water to be low in goiter areas and noted also that goiter was improved by sea sponge ash, and in 1896 Bauman2 discovered that iodine was concentrated in the thyroid gland.

The work of Marine3 and his associates begun in the year 1907 in the study of goiter and its relation to iodine marks the beginning of the newer and more practical knowledge of this relationship. They showed that when brook trout were maintained without iodine, goiter invariably developed and that the addition of a small amount of iodine to the water caused the goiters to decrease in size. This was shown to be true also in the case of cattle, sheep, pigs and other animals.

Marine4 (1928) as a result of his studies believed that goiter is a compensatory hypertrophy of the thyroid gland resulting from a relative or absolute deficiency of iodine. This deficiency of iodine may be due to: (1) factors which bring about an abnormally low intake of iodine; (2) factors which interfere with absorption or utilization of an otherwise adequate intake; (3) factors which increase the needs of the body for the iodine containing hormone. The chief factor under 1 is the lack of iodine in the food and water supply. Factors under 2 are becoming better known as the complex inter-relationship of the glands of internal secretion is becoming better understood. Under 3, it is well known that the thyroid is prone to enlarge at puberty, during menstruation, during pregnancies and with certain infections. Enlargement in these instances may demonstrate the need for more thyroxin when an inadequate supply of iodine for its manufacture is available.

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ENDEMIC GOITER STUDIES IN MICHIGAN

The studies of endemic goiter in Michigan\(^5\) begun in 1923, have been a co-operative effort of the Michigan State Medical Society and the Michigan Department of Health with the guidance of Dr. O. P. Kimball and the co-operation of salt manufacturers and wholesale and retail grocers. The Medical Society has had an iodized salt committee for the purpose of continuous study of the problem and the early work of Drs. D. M. Cowie, Roy D. McClure, O. P. Kimball, C. C. Slemons, R. M. Olin and H. Towsley is noteworthy.

In 1923, a survey of ground water supplies in Michigan was made to determine their iodine content. On the basis of the findings of this survey, four counties were chosen for study. These counties showed the greatest differences in iodine content of their ground waters and were considered representative of a cross-section of the population of the state. They were Houghton, Wexford, Midland and Macomb Counties, located on a line running diagonally from the northwest to the southeast corners of the state.

Fig. 1—Four Counties chosen for survey.

The total number of boys and girls examined in the four counties was 31,612. Of these, 14,914 (47.2 per cent) showed goiter (Table I). While the incidence was high in all counties, it was greatest in Houghton County (64.4 per 100 examined) and least in Macomb County (26 per 100 examined).
The results of the survey showed beyond a doubt that there was a correlation between a lack of food iodine and the incidence of simple goiter, as the goiter incidence was inversely proportional to the iodine content of the ground water supply in the areas studied.

At the completion of the survey, a program of goiter prevention was undertaken by the State Medical Society and the State Department of Health. Iodized salt was selected as the medium of correcting the iodine deficiency because it was felt that a household necessity like salt would solve the problem for both urban and rural areas. The co-operation of the Salt Manufacturers Association was enlisted and the iodized salt committee of the State Medical Society worked with them on the many technical problems involved in manufacturing an iodized salt acceptable from the standpoints of content, stability and cost.

In the resurveys in 1928, 1935 and 1951, information was also obtained as to whether the children had been using iodized salt regularly, irregularly or not at all.

The resurveys in 1928 and 1935 showed a remarkable reduction in goiter among those using iodized salt with an over-all reduction of the incidence from 38.6 per cent to 8.2 per cent. In those who had used iodized salt the incidence was reduced to between 2 and 3 per cent, while in the group who had not used it the incidence remained at from 25 to 35 per cent. A valuable study was possible in the mining town of Calumet where in 1932-35 during the depression two-thirds of the families were on relief and used non-iodized bag salt. There was an increase of 43 per cent in the number of goiters.

In 1951, the school children in the same four counties (Houghton, Wexford, Midland and Macomb) were examined for abnormal enlargement of the thyroid gland. This was a co-operative activity between the goiter committee of the Michigan State Medical Society and the Michigan Department of Health. Six physicians, again using standardized criteria, examined 53,785 pupils. The results of these examinations showed 1.4 per cent (787) with abnormal enlargement of the thyroid. This varied from 8.3 per cent in Houghton County to 0.2 per cent in Midland County.

<table>
<thead>
<tr>
<th>TABLE I. THYROID AND SALT SURVEYS</th>
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<tbody>
<tr>
<td>Houghton, Wexford, Midland and Macomb Counties 1924 and 1951</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>County</th>
<th>Total Examined</th>
<th>Abnormal Thyroids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1924</td>
<td>1951</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Houghton</td>
<td>13,723</td>
<td>6,930</td>
</tr>
<tr>
<td>Wexford</td>
<td>5,984</td>
<td>3,811</td>
</tr>
<tr>
<td>Midland</td>
<td>3,645</td>
<td>8,751</td>
</tr>
<tr>
<td>Macomb</td>
<td>10,258</td>
<td>34,293</td>
</tr>
<tr>
<td>Total (4 counties)</td>
<td>31,612</td>
<td>53,785</td>
</tr>
</tbody>
</table>

787 | 1.4 |
The results of the studies in Wexford County are shown in Fig. 2, and the results of the 1924 and 1951 surveys are shown in Table 1.

### WEXFORD

**Iodine Content of Water**

![Graph showing Wexford Iodine Content of Water with values in 1924 and 1951.](image)

**Fig. 2—Comparative Incidence of Goiter in Wexford County Before and After the Introduction of Iodized Salt.**

**DISCUSSION**

The fact should be emphasized that at no time has there been a law in Michigan requiring that all salt sold be iodized. The Michigan Department of Health and the Michigan State Medical Society have carried on a program of education and advice in the form of news articles, radio programs, placards, pamphlets and health talks. Experience has shown that unless this problem is kept continually before the people there is a great tendency for the sale of iodized salt to decrease. The survey of grocery stores indicated that iodized salt is not always displayed prominently and in some instances has to be especially ordered. This problem has been met in Switzerland and Canada by having all table salt enriched with iodine. The report of J. F. McClendon showed the remarkable results of goiter prophylaxis with iodized salt in Switzerland.

Curtis and Firtman have performed iodine balance studies and as a result of these the Food and Nutrition Board of the National Research Council gives the daily requirement of iodine for an adult as 0.15 to 0.30 milligrams. Iodized salt meets this requirement and is especially important in adolescence and during pregnancy.
No ill effects have been noted from the use of iodized salt. The small amount of iodine used has not, according to the American Dermatological Society, caused any difficulty in those with a tendency to acne, an objection which was once raised. The stabilizers used by the manufacturers insure a uniform mixing of the iodine, and the Canners’ Association has stated that there is no disadvantage in using iodized salt in all types of food canning.

Arnold Jackson in 1926 stated that “simple adenoma is one form of endemic goiter which closely follows colloid goiter in regional distribution. The incidence of adenoma of the thyroid is decreased by the prophylactic treatment of colloid goiter.”

Levin, using draft board statistics, has shown that the incidence of exophthalmic goiter throughout the United States is proportional in every locality to the incidence of endemic goiter. McClure reported that since the introduction of iodized salt in Michigan coincident with the great dropping off in the number of enlarged thyroids there has been a dropping off in the number of operations for hyperplasia and adenomata of the thyroid in seven large Michigan hospitals.

Roy D. McClure, M.D. was one of the early pioneers in this work, being a member of the Iodized Salt Committee of the State Medical Society since its inception, and Chairman of the committee for 10 year prior to his death.

W. H. Sebrell, Director of the National Institutes of Health, has cited surveys made by the Public Health Service which show that goiter is quite prevalent in areas outside the so-called “goiter belt”—“In Mitchell County, Georgia, 31 per cent of women had an enlarged thyroid gland and in Alachua County, Florida, 25.6 per cent of the negro females between 13-20 years of age were affected.”
Natural salt deposits contain varying amounts of iodine. An incidence of conversion from a nongoiter area to a goiter area occurred in the Kanawha River Valley of West Virginia. Kimball\textsuperscript{12} reported that prior to 1900 a local crude, coarse, brown salt was used and goiter was exceedingly rare. After this, a sparkling white salt containing no iodine was shipped in and preferred. The goiter rate rose sharply and in 1922 a survey showed that 60 per cent of adolescent girls in the valley had goiter.

It is well known that there are present in some areas certain goitrogenic agents, such as are present in cabbage and other vegetables. Webster and Chesney\textsuperscript{13} and Helwig\textsuperscript{14} have shown that when additional iodine is given to rabbits receiving an otherwise goitrogenic diet, goiter does not develop.

The wide use of an enriched block salt by stock farmers has undoubtedly been a factor in some of these essential elements finding their way into the food and thus has helped reduce the incidence of endemic goiter.

**CONCLUSIONS**

1. Endemic goiter has become practically non-existent in Michigan since iodized salt was put on sale in 1924.
2. Salt can be iodized accurately, efficiently and inexpensively.
3. Experience in Michigan indicates that no ill effects result from the use of iodized salt.
4. Experience in Michigan also indicates that toxic nodular goiter and diffuse goiter are less apt to occur when there has been no previous enlargement of the gland as occurs in endemic goiter.
5. It is essential that departments of health and medical societies continually remind the public of the importance of this prophylactic measure.

**ACKNOWLEDGMENT**

Acknowledgment is gratefully made to the Michigan Department of Health, who conducted these surveys, and especially to Dr. J. R. Altland who has directed this work.


**REFERENCES**


