The New England
Journal of Medicine

VOLUME 207 OCTOBER 13, 1932 NUMBER 15

NEW ENGLAND PEDIATRIC SOCIETY

A meeting of the Society was called to order by the President. Dr. Lewis Webb Hill, Boston, at 8 :15 P. M., on May 6, 1932 who spoke as follows:

This meeting represents an attempt to arrive at conclusions concerning the rational use of the vitamin preparations in pediatric practice. There is one man whose work on deficiency diseases and allied subjects has been so brilliant and so applicable to the everyday work of each one of us that any such meeting as this could not be complete without his presence—Dr. Alfred Hess of New York.

DIET, NUTRITION AND INFECTION*

-BY ALFRED F. HESS, M.D.†

IT is a commonplace that the relationship is intimate between composition of the diet and susceptibility to infection. However, the extent of this relationship and its importance in clinical medicine has only just begun to be realized ; in fact we are still uncertain as to the limits of altered susceptibility. From the standpoint of disease, diet, nutrition and resistance to infection should be regarded as an etiologie unit rather than as a triad. In appraising dietaries from this point of view, not only the several vitamins should be considered, but the various inorganic and organic constituents which likewise may be implicated in bacterial infection. It would lead too far afield, however, to consider these various aspects of the subject, so that I shall confine myself to the role of some of the vitamins, basing my conclusions mainly on observations made during the past ten to fifteen years in a child-caring institution. As my experience has been concerned chiefly with the antirachitic, antiophthalmic and antiscorbutic vitamins, in other words with vitamins D. A and C, I shall limit my comments to these specific nutritional factors. Furthermore, I shall take into consideration only clinical data, to -the exclusion of experiments on animals.

After an experience of several years with the effect of *ultraviolet rays* in the prevention and cure of rickets, an effort was made to lessen the incidence of infection in the institution by means of irradiation with the mercury vapor lamp. As is well-known, respiratory infections constitute one of the last vestiges of institutionalism in hospitals and asylums for children and. during the winter months, plague and torment their foster-parents. Our first attempt, undertaken in 1926[1] with the confidence born of inexperience, was most disappointing. In the course of the winter, in spite of irradiation carried out every other day for a period embracing four months, quite as many infections occurred among the group of infants who were irradiated as among those who lived under the same regime except that they were not irradiated. It may be added that the irradiated group evidenced an initial increase in weight which, however, did not continue during the subsequent months.

Two years later a similar investigation was carried out[2] with the only difference that a carbon arc lamp was used as the source of radiation, as it was thought that these rays might be superior because they more nearly resemble the spectrum of the sun. Again our efforts were fruitless. In spite of systematic exposures to these rays no relative diminution in the incidence of respiratory infections occurred during an observational period of three months.

The following year, 1929, the problem of infection was attacked in a different way[3]. Rickets was prevented by means of the usual doses of cod liver oil, in other words of three teaspoonfuls daily for babies three months or more of age. The diet was composed of full amounts of pasteurized milk, cereals, orange juice, and of vegetables for the older infants. In order to render exposure as infrequent as possible, what was termed "aseptic nursing" was carried out in one ward—physicians, nurses and attendants coming in contact with the infants were required to wear surgical masks which were changed daily; hands were scrubbed thoroughly and frequently; visiting was allowed but once a month and visitors were provided with masks; fondling and petting of infants were prohibited and nurses who had colds or infections were temporarily excluded from service. Once again our attempts at prophylaxis resulted in failure; infections

*Kead before the New England Pediatric Society at its meeting. May 6, 1932.

†Hess—Clinical Professor of Pediatrics, University and Bellevue Hospital Medical College. For record and address of author see "This Week's Issue," page 679.

contains a specific vitamin in exceptional concentration. It is sad to contemplate that this source of vitamin A could well have been at the disposal of Denmark during and immediately after the War period and could have averted the many cases of blindness which resulted from a deficiency of this specific factor. A similar comment is pertinent in regard to the bone disorders which occurred in Germany, Austria and Poland during the War which could have been prevented had the specific properties of solar and artificial ultraviolet rays been appreciated at that time.

In regard to *vitamin C,* I shall refer only to the bearing of this vitamin on infections, more particularly of the respiratory tract. In 1917, in a paper on the pathogenesis of infantile scurvy, I emphasized the fact that a lack of the antiscorbutic factor which leads to scurvy, at the same time predisposes to infections[23]. This enhanced susceptibility has been confirmed by Abels, Ludwig Meyer and many others. It exists even before the scorbutic signs are manifest in the stage which is better termed "latent scurvy" than " Praeskorbutus " as the abnormal scorbutic state already exists. Similar susceptibility to infections goes hand in hand with adult scurvy. This was pointed out years ago by Lind and others in connection with scurvy in the mercantile marine and among the soldiers in times of war, for example, in our Civil War and in the Crimean War.

But I wish to emphasize quite another aspect of infection in connection with infantile scurvy. In 1917, and again in 1920, I called attention to the "widespread occurrence of nasal diphtheria in infantile scurvy", remarking that "we have encountered nasal diphtheria—with typical bloody mucus discharge—so frequently in connection with scurvy that where this local infection occurs among a group of infants they should be carefully examined for latent or mild scurvy"[24]. At the same time I drew attention to the fact that "clinical tests showed that the blood contains sufficient antitoxin (diphtheria) to afford protection." These were the days previous to the use of toxin-antitoxin*. Much to our surprise, some of these cases gave a negative Schick test in spite of the definite clinical signs of nasal diphtheria. In two instances the diphtheria bacilli were tested on guinea pigs and found to be virulent. Not long after these observations an infant died from diphtheria of the larynx which developed although the Schick test was negative. At postmortem a typical membrane was found on the larynx.

Since this time, there has been little opportunity to investigate this subject, as diphtheria has been banished from our institution by the routine use of toxin-antitoxin. Recently, however, we have met with three cases of nasal diphtheria which developed soon after their admission to the institution. These cases were characterized by the typical bloody nasal discharge. In two instances the cultures showed avirulent bacilli, in one which was obtained in December, 1930, the bacilli from the nose were virulent. In spite of this fact, not only was the Schick test negative, but tests carried out in February, 1931, with increasing doses of toxin 1/50-1/40-1/30-1/20-1/10-1/5 M.L.D. all failed to induce a skin reaction. As the result of these experiences we infer that a lack of the antiscorbutic vitamin exerts a local effect on the mucous membrane which diminishes its immunity, but at the same time may not be accompanied by a lowering of systemic immunity. It is probable that a similar phenomenon holds true in connection with a deficiency of vitamin A and that the marked changes in the epithelium, described by Wolbach, bring about a local diminution in resistance. Susceptibility to infections of the skin and of the respiratory tract which occur when this deficiency is marked may be largely a manifestation of a local pathological change.

•The runabout children had a habit of pulling off the buttons of their ahoes and pushing them into their nostrils where they remained until they were removed some time later with forceps. This condition led to a bloody nasal discharge which on cultivation often showed diphtheria bacilli.

CONCLUSIONS

The antirachitic factor, whether given as ultraviolet irradiation, as irradiated ergosterol, or as cod liver oil does not increase the immunity of infants to respiratory infections.

Respiratory infections are not due to a lack of vitamin A and generally cannot be lessened by giving a diet rich in this factor even when supplemented with cod liver oil.

The average infant seems to receive an adequate amount of vitamin A in its milk, judging by the fact that xerosis of the eyes is exceedingly rare, and that no gain in weight or increase in immunity is brought about by adding vitamin to the diet. The same seems to hold true for older children and adults, in view of the infrequency of night-blindness, the first sign of this deficiency.

A lack of vitamin C may induce heightened susceptibility to infection of the respiratory tract. It may, however, induce merely local susceptibility without appreciable loss of systemic immunity. This peculiar phenomenon is manifested by the occurrence of typical nasal diphtheria, associated with virulent diphtheria bacilli, but a Schick reaction negative to highly potent solutions of toxin.

REFERENCES

1 Barenberg, L. H.; Friedman, I., and Green, D.: The effect of ultraviolet irradiation on the health of a group of infants. J. A. M. A. 87: 1114 (Oct. 2) 1926.
2 Barenberg, L. H., and Lewis. J. M.: The effect of carbon arc irradiation on the health of a group of Infants. J. A. M. A. 90: 504 (Feb. 18) 1928.
3 Abramson, H., and Barenberg, L. H.: Respiratory disorders in infants. J. A. M. A. 92: 2156 (June 29) 1929.
4 Bloch, C. E.: Carbohydrate starvation in infants. Ugesk. f. Laeger. 79: 279 (Feb. 22) 1917.
5 Barenberg. L. H., and Lewis. J. M.: Relationship of vitamin A to respiratory infections in infants. J. A. M. A. 98: 199 (Jan. 16) 1932.