

July 6, 1940

Mr. H. H. Mitchell
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Urbana, Illinois

Dear Mr. Mitchell:-

I hasten to reply to your letter of July 3rd and to point out why I considered that a mistake had been made in not referring specifically and directly to our articles in presenting a general picture of the lead intake of a city dweller. I was surprised that the significance of our data had not been pointed out, but I realize from your frank statement of your point of view, and from your further statement concerning the difficulty of attempting to assess the average or usual intake of lead "not only in water, but also in food", that we have been somewhat inept in the presentation of our observations, since otherwise their real meaning could hardly have been missed.

In going a bit into the implications of some of our studies, I wish to deal only with the clarification of the facts and to withdraw any suggestion that you and your associates were guilty of any professional carelessness or deliberate neglect of us, in citing your references. I am not unduly sensitive on that subject, and even if I were it would be a matter of little consequence, since although recognition is pleasant, it is somewhat beside the point. I realize, moreover, that we have been remiss in having published little of our information in recent years, and we cannot hold our colleagues responsible for what has not been clearly presented. On the other hand I thought that both Mr. Ruth and Mr. Shields were rather fully informed as to much of our unpublished data. That apparently is not the case. Regardless of these matters, the factors at issue are the only things of importance.

I think it is fair to say that our data on the intake and output of lead of experimental subjects on a variety of freely chosen diets (including all beverages), when checked against a considerable number of observations on the fecal and urinary lead output of persons in all parts of the United States and Canada, entitle us to say with great assurance that the usual daily intake of lead in food and beverages, including water, on the part of North American adults ranges from

somewhat less than 0.1 mg Pb to something over 2.0 mg. with a mean value of approximately one third of a milligram.

Our experimental observations as reported in J.I. H. 15: 273, (1933), showed that the quantities of lead evacuated in the feces were almost identical with the quantities ingested over any considerable period of time. Subsequent observations which included the determination of the lead in the water on numerous occasions, J.I.H. 18: 42, (1936) confirmed these data, and gave the frequency distributions of the results on a number of experimental subjects, in such a way as to define the probabilities for lead ingestion. The only fault with these data, as indicated in J.A.M.A.: 104, 1935, and referred to in the article in J.I.H. 18: 42, (1936), was that they were uniformly low by reason of an analytical method which involved a loss of ± 0.07 mg. Pb per sample. We pointed out the necessity and the validity of this correction. Since that time a large number of analyses, made by very precise chemical and physical methods, and only recently published, have confirmed the approximate accuracy of the corrected figures.

In view of the relation which exists between the lead in the food and drink, and that in the feces, a relationship which has been amply demonstrated, one can obtain random samples of feces from large numbers of persons, and on the basis of the analytical results can evaluate the daily lead intake in food and water with a very high degree of accuracy. We pointed this out in J.I.H. 15: 277, (1933) and gave figures which require only the correction indicated above to make them accurate. Other observations made since, confirm these data. Although these latter results are only just now in press, the point I wish to make is that the essential truth of this matter was to be found in our data of 1933, 1935 and 1936. Also, our article on the sources of lead J.I.H. 15, 295 (1933) specifically referred to the low lead content of the drinking water in most American cities, and our statement was based on analyses which we had carried out. I believe, therefore, that there is a considerable body of information to justify the statement made in my letter to Dr. Ruth, and that what was required was their interpretation. Such an interpretation, we attempted to give in our articles but evidently did not succeed, partly because we referred only briefly to the contribution made by drinking water to our total lead intake by ingestion. Briefly, an interpretation would be as follows. The lead in the food and beverages of our experimental subjects, exclusive of water, had a mean value of approximately 0.30 mg. daily, while the lead in the water was about 0.02 to 0.03 per day, making a total intake by ingestion of about 0.33. The mean lead content of the feces of these subjects per day was slightly in excess of 0.33, but did not differ to a statistically significant degree from that in the food and drink. Daily samples of feces correlated closely with the food samples

for the previous day, with respect to their lead content. Obviously, therefore, fecal lead is a direct and accurate measure of the ingested lead. The fecal lead output of normal persons in all parts of the United States and Canada corresponds to that of our experimental subjects. That is, statistically, the values are almost identical for large numbers of people. Therefore the conditions of daily ingestion of lead in both food and drinking water are very much the same in all parts of the country. This fact has been confirmed, so far as we have gone in the study of food and beverages, including drinking water, in various areas. From a statistical point of view, the results obtained on single individuals over a period of time are very significant in relation to random observations on large numbers of persons, in that the same range of values repeats itself over and over. It is scarcely possible, therefore, that they can be seriously in error.

It is quite apparent that there may be localized areas in which different conditions exist. It is known, for example, that a number of New England towns have lead carrying lines for their water, and that this water in some instances is a good solvent for the pipelines. Generally speaking, however, this is true only of old towns and not the towns and cities west of the coast. Also in the apple-growing and vineyard areas, the lead intake of residents is undoubtedly increased during certain periods of the year. On the other hand the methods for general distribution of foods in the United States brings about a high degree of uniformity, while the generally careful preparation of public water supplies serves to control the lead intake from that source.

In contrast with the latter situation, that in Great Britain is lacking in uniformity and control. Lead water pipes are very commonly used, and much inside plumbing consists of large stretches of lead pipe. In the lake areas of Scotland and their environs, water is piped into the cities and towns and stored in lead-lined tanks in the upper floor of the houses. Food, also, is often considerably higher in lead. In fact, our observations, while not numerous enough to establish the facts in a general way, indicate that the lead intake in food in France, Germany and Great Britain is measurably higher than ours, while that in Mexico is considerably lower.

The article which I enclose, and to which, of course, no reference could be made in your paper, gives some new data on water as well as many other materials. These data are not comprehensive, but owe their importance to the fact that they were obtained by methods of recent application and are, therefore, a check on the essential accuracy of previous figures.

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In conclusion, it is my opinion that our results on the lead content of the food and drink as chosen for consumption by actual human adults, and the corresponding results which we have obtained on the excreta of these persons, as well as of a large number of random individuals in various parts of the country, are virtually the only source of precise information on this question in so far as North America is concerned. They are, I think, quite accurate, fairly comprehensive and are of the greatest practical value in determining just what is our likely and common experience with reference to the daily ingestion of lead in food and beverages. Thus, without giving all the details for all parts of the country, and without revealing all the individual sources of lead intake, they do assess the general situation and portray the chances for lead ingestion in the United States in a faithful and fairly adequate fashion. This, I may say, is exactly what we decided was badly needed a number of years ago, and we spent the time effort, and money to do the job only because it was necessary and because no one else had undertaken it. Perhaps, therefore, you will understand my disappointment when the figures, clearly the most valid and practically useful in existence, are not employed for what they are worth.

Very truly yours,

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Robert A. Kehoe, M.D.

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