FOOD AND NUTRITION NEWS

Volume Thirty-Eight February, 1967 Number Five

PROTEIN AND ORAL HEALTH

by *E. CHERASKIN, M.D., D.M.D.*
University of Alabama Medical Center
Birmingham, Alabama

Introduction

This is a summary of the research activities of the Department of Oral Medicine at the University of Alabama Medical Center as they relate to protein metabolism in oral health and disease. The contents of this report have appeared or will appear, in more detailed form, in a series of publications.*

The Importance of Protein in Health and Disease

Proteins are carbon, hydrogen, oxygen, nitrogen, with few exceptions, sulphur compounds. In assigning the designation *protein* (meaning first or preeminent) the importance of these complex organic nitrogenous substances was recognized over a century ago. There is no question but that the proteins occupy a central position in metabolism. In the first place, many proteins serve as vital structural ingredients. Thus, they are the basic units of all the connective tissues. This applies to the dental apparatus. Secondly, proteins are fundamental components of the enzyme systems. All physiologic phenomena (e.g. muscular contraction, nerve conduction, renal excretion) are inextricably linked to and dependent upon enzyme activity. This applies equally to the oral machinery. Thirdly, protein compounds are essential components of most of the hormones. It is known that the endocrine mechanism influences the oral tissues. Simple organisms depend upon diffusion from the environment to provide the needed oxygen and to remove the carbon dioxide. However, the metabolism of mammalian tissues, obviously remote from the atmosphere, can only come to pass because of a mechanism which allows the constant delivery of oxygen and the systematic removal of carbon dioxide. This system is dependent upon the protein complex, hemoglobin. Hence, fourthly, protein also plays a role in the transportation of the respiratory gases. Finally, it is now well-established that most of the antibodies, a vital part of the immunologic defenses, are of a proteinic nature. Obviously, the immune systems are most important in protecting the host against the many and varied environmental challenges. It is fair to conclude, from these and other data, that protein plays a significant role in the maintenance of homeostasis.

With this as background, an attempt will now be made to answer the following *three* questions:

1. What is the protein state of the American public?
2. Do relationships exist between protein metabolism and oral health and disease?
3. On the assumption that significant correlations exist, is there cause-and-effect in the parallelisms which prevail between protein metabolism and the stomatologic state? In other words, what changes in the oral picture follow protein supplementation?

*Write to Food and Nutrition News Editor for list of publications.

The Protein State of the American Public

The Expert Committee on Medical Assessment of Nutritional Status of the World Health Organization has summarized the complexities involved in nutritional assessment. Under ideal circumstances, food balance sheets, socioeconomic data, food consumption patterns, dietary surveys, studies of the biologic value of foodstuffs, morbidity and mortality rates, anthropometry, clinical signs and biochemical information all serve to provide a multifaceted picture of nutritional state. Each of these tools has its merits and limitations.

For purposes of this discussion, a biochemical analysis of total serum protein in 598 routine dental clinic patients will be employed. Table 1 summarizes the scores for the group under fasting and two-hour postprandial conditions. The Interdepartmental Committee on Nutrition for National Defense (ICNND) recognizes less than 6.4 as low and below 6.0 grams per cent frankly deficient. Most investigating groups accept 6.5 to 7.5 grams per cent as the physiologic range. Utilizing this standard, approximately 17 and 13 per cent of the subjects show levels either below or above the recommended range under fasting and postprandial conditions respectively. Other authorities prefer more restricted limits. If one regards, for example, 6.6 to 7.4 grams per cent as a more realistic measure of protein state, then 34 and 25 per cent of the subjects demonstrate abnormal findings. *Hence, within the limits of these observations and supported by others, it is reasonable to answer the first question with the statement that a significant segment of the American public demonstrates suboptimal biochemical reflections of protein metabolism.*

(Continued on Page Four)

ABOUT THE AUTHOR

Dr. Emanuel Cheraskin received his A.B. and M.A. degrees from the University of Alabama, his M.D. at the University of Cincinnati College of Medicine and in 1952, his D.M.D. at the University of Alabama School of Dentistry. He is currently professor and chairman of the Department of Oral Medicine, University of Alabama School of Dentistry.

Dr. Cheraskin holds membership in both the American Dental Association and American Medical Association as well as in many other professional organizations. He has received numerous honors and world-wide recognition in related scientific areas, has authored and co-authored currently-used medical and dental textbooks and published many scientific articles and reports.

Protein and Oral Health

(Continued from Page One)

Relationship of Protein Metabolism and Oral State

The problem now to be faced is to learn whether protein metabolism and oral state correlate. Limited work, particularly in lower animals, suggests significant parallelisms. For example, apparently protein deprivation invites alveolar bone loss. This is quite understandable when one realizes that bone is a vital tissue, constantly undergoing formation and resorption. When these two forces are equal, there is neither bone loss or gain (the physiologic pattern in the adult). Bone loss follows either an increase in bone resorption, a decrease in bone formation, or both. Whether bone formation lags is a function of either reduced matrix formation and/or a decrease in matrix mineralization. Historically, emphasis has been directed largely to mineralization. However, there is reason to believe that a disturbance in osteoid matrix formation may be more common. Of relevance here is the well-established fact that protein is one of the essential ingredients in the fabrication of the osteoid matrix. It is, therefore, not without some justification that alveolar bone loss was studied in 100 presumably healthy policemen and firemen and correlated with serum albumin (another measure of protein state). Table 2 shows that the 22 subjects with serum albumin levels of 4.1 to 4.4 grams per cent had a mean alveolar bone loss of 8.7 per cent. The 55 individuals with the slightly higher albumin level (4.5-4.8 grams per cent) had slightly less (7.3 per cent) mean bone loss. The percentage decreases to 6.6 and 3.0 in the 21 and 2 men with progressively higher serum albumin levels. *Hence, within the limits of these brief observations and in answer to the second question, there do appear to be significant parallelisms between oral health and protein metabolism.* While these correlations are of interest, in themselves they do not prove cause-and-effect. For this reason, we turn our attention to the third and last question.

Protein Supplements and Oral Health

Eighty presumably healthy junior dental students participated in an experiment to observe the effect of protein supplementation upon gingival state. The gingiva of the anterior maxillary and mandibular teeth was graded on a four-point system and a mean gingival score derived. On a random basis, 22 students were given daily a specially prepared soybean protein supplement. Another group of 22 received 40 grams daily of an indistinguishable placebo consisting of methylcellulose. Eighteen subjects were supplied with a 40 gram tripe flour cookie; the remaining 18 received a relatively indistinguishable sugar cookie supplement. The mean gingival score was redetermined four days later by the same examiner with no knowledge of the previous gingival values or the nature of the supplement. Table 3 summarizes the percentage improvement in the four groups. It is evident that there were striking changes with the protein supplements (89 and 87 per cent improvement), that the responses to the two protein supplements are quite similar, and that no such change was observed under placebo conditions (17 and 9 per cent improvement). *In answer to the last question, therefore, the evidence presented here appears to indicate that protein supplementation, in the amount given and for the short period administered, exerts a beneficial effect upon the gingiva (and other measures of oral state as listed in the references) by virtue of a reduction in gingival score.*

Summary

The evidence keeps pyramiding that disease is a multicausal problem. While different authorities differ on the precise mechanism, there is agreement on two points. Firstly, it is generally recognized that two major groups of factors are operative. It appears clear that disease occurs only in the presence of one or more environmental challenges. But, to complete the story, one must recognize that health or disease is the end-result of the capacity of the organism to meet successfully (via host resistance) or unsuccessfully (via host susceptibility) the many and diverse environmental threats. Secondly, while there are undoubtedly classical expressions of disease states, the common experience is that health and disease are relative states which exist in a graduated series. There is considerable published information to indicate that protein metabolism plays a cardinal role in host resistance and susceptibility.

While the nutritional state of the nation is not completely known, there is some evidence that protein metabolism may not be adequate in a segment of the population, due, in part, to poor intake, absorption and utilization. Incomplete but highly presumptive data suggest that protein metabolism and oral health are related. However, this correlation, in itself, cannot be regarded as proof that a protein deficit is the cause of the oral pathosis. Finally, limited studies in this report indicate that protein supplementation is followed by beneficial gingival changes. This is in agreement with other stomatologic studies listed in the bibliography.[2]

Table 1
Serum protein determinations in 598 routine dental patients

Serum protein levels (grams per cent)	Fasting	Two-hour postprandial
6.0	7	2
6.1	6	1
6.2	16	3
6.3	22	10
6.4	6	5
6.5	21	11
6.6	40	18
6.7	24	11
6.8	25	14
6.9	32	28
7.0	40	38
7.1	27	39
7.2	42	23
7.3	19	27
7.4	5	13
7.5	16	25
7.6	2	5
7.7	0	2
7.8	1	1
7.9	0	1
8.0	0	0
8.1	0	3
total	388	310
< 6.5 & > 7.5	17%	13%
< 6.0 & > 7.1	5%	23%

Table 2
Relationship of protein metabolism alveolar bone loss

Serum albumin level (grams per cent)	Sample size	Percentage alveolar bone loss
4.1-4.4	22	8.7
4.5-4.8	55	7.3
4.9-5.2	21	6.6
5.3-5.6	2	3.0
total	100	

Table 3
Effect of protein versus placebo supplementation upon gingival state

Supplement	Sample size	Percentage improvement
tripe flour	18	89
soybean concentrate	22	87
sugar cookie	18	17
methylcellulose	22	9