ALCOHOLISM *as a* NUTRITIONAL PROBLEM

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IT HAS LONG been recognized that alcoholism may give rise to serious nutritional problems in its victims, but only recently have our observations revealed that nutritional deficiencies play an important role in the etiology of alcoholism itself.

It may be well to point out, since there is some room for misunderstanding, that I and my colleagues designate as "alcoholism" that type of alcohol consumption which *leads progressively to more drinking and to a partial or complete incapacity on the part of the individual to do useful work in society.* On the basis of this concept, alcoholism may be of varying severity; in mild cases the individual's capacity is interfered with only slightly—hence the difficulty in arriving at satisfactory statistics. Certainly, however, an individual whose drinking is *stabilized* (even if at a high level) and who is able to perform satisfactorily as a member of society, is not afflicted with what our group regards as typical alcoholism.

The conclusion that nutritional deficiency is a basic cause of this type of uncontrolled liquor consumption is based upon three lines of evidence: (1) that growing out of recent findings in the field of biochemical genetics; (2) that from direct animal experimentation; and (3) that from clinical findings.

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Based upon biochemical-genetic relationships brought to light largely through the investigations of Beadle and coworkers[1] is the inescapable fact that each individual human being must possess by inheritance a distinctive set of metabolic machinery in which the numerous enzyme systems vary somewhat in efficiency. This means that of the numerous transformations which are essential to life, some, in a given individual, are accomplished with comparatively greater and others with comparatively lesser facility. This in turn leads inevitably to the conclusion that the nutritional needs of individual people cannot all be the same from the quantitative standpoint. The building of specific enzymes, the flavoprotein enzymes, for example, does not take place with equal facility in all individuals and since riboflavin is a constituent of these enzymes it seems certain (and in accordance with laboratory findings) that different individuals require somewhat different amounts of dietary riboflavin.

The discovery by Mitchell and Houlahan[2,3] of "partial genetic blocks" adds another link to the chain of evidence in favor of individuation of nutritional needs. Genes which control a particular chemical transformation are not usually destroyed by mutating agents; they may be slightly or seriously impaired. A particular transformation therefore may take place slowly and require a larger concentration of substrate in order to keep pace.

Individual Patterns

Not only do these basic findings make individuation in nutrition inescapable, but extensive studies carried on in the author's laboratory[4] have demonstrated that the end products of metabolism, as determined, for example, by paper chromatographic analysis of urine, reveal the existence of distinctive individual patterns. These findings apply to experimental animals on identical diets, where the differences in patterns are clearly of genetic origin, and to human beings on self-selected diets, where the evidence also indicates that crucial differences are of genetic origin. These findings are in a sense an extension of the work of Garrod[5] on "inborn errors of metabolism" which are known to be inherited, except that our findings apply to all individuals, each of which exhibits his own individual pattern. These findings are completely in line with the concept of individuation with respect to the quantitative nutritional needs, and with the existence of patterns of nutritional requirements which are distinctive for each individual.

The animal experiments bearing upon the relationship between deficiencies and alcoholism have been described elsewhere,[6,7,8] but their essence can be given in a short space.

Individual rats on a stock diet exhibited markedly individualistic responses when they were offered a choice between water and 10 per cent alcohol. Some drank alcohol heavily from the start; some drank none over a period of months in spite of the fact that the positions of the bottles were interchanged daily, forcing them to make a deliberate choice. Others drank moderately; others spasmodically, still others drank progressively more as the experiment proceeded. If the performance of a group of rats had been averaged together as is customarily done, the entire significance of the experiment would have been lost.

Changing diets had a revolutionary effect on the drinking patterns of the rats. When a group was placed upon a marginal diet—marginal particularly with respect to the B vitamins—all of the rats drank heavily within a short period of time. On the other hand, when the rats were placed upon diets abundantly furnished with all the nutrients required by rats, none of them consumed alcohol beyond a low level. Furthermore when animals were drinking heavily on a marginal diet and were supplied with an abundance of the missing nutrients, their alcohol consumption often dropped to zero overnight and was maintained at this level as long as the nutrients were supplied.

Interpretation

The obvious interpretation of these findings is as follows: Each individual animal has nutritional needs that are quantitatively distinctive. On the stock diet some rats were getting an abundance of everything, and because no deficiency existed for them, they had no marked tendency to drink alcohol. On the marginal diet all animals developed deficiencies and they all had a substantial appetite for alcohol. On the abundant diet, which contained generous amounts (several times the minimal needs) of many of the nutritional elements, none of the rats developed deficiencies and none drank appreciable amounts of alcohol.

Why various deficiencies should cause an appetite for alcohol is not understood; however, that deficiencies *do* induce alcohol consumption we regard as a fully established fact, as far as rats are concerned, since we have observed it hundreds of times. That the animals on a diet which does not furnish sufficient raw materials for the synthesis of various metabolic enzymes are seeking a source of easily derived calories seems a plausible explanation, but, regardless of the explanation, the fact remains that *dietary deficiency leads to greatly increased alcohol consumption.*

Deficiencies Differ

One of the complicating factors which arises in connection with this study is that the deficiences which arise in individual animals are not all the same. It is clear from our studies that in different animals, different deficiencies exist, but that they lead to the same increased alcohol consumption.

In the original colony of rats which we

investigated, we found it possible to control the amount of their drinking almost perfectly by the use of known dietary factors. Rats from this original colony breed true, and have maintained similar drinking patterns as influenced by nutritional supplements over a period of years. Rats of other strains—and a number have been investigated[9,10]—often develop deficiencies for unknown nutrients, and their alcohol consumption in some cases can only be alleviated by supplying nutrients of an unknown nature. This is in line with the finding of Murdones, *et al.*[11,12]

Effect of Vitamins

Our experience in this particular may be made clear by reporting composite results involving a large number of rats representative of all the strains which we have studied. On a marginal diet such as we used,[7] substantially all of the animals will drink at a high level. If ample supplies of the better known B vitamins (excluding B_{12}) are added to the diet, a significant number (but a small minority of the whole group) are "cured" and never drink substantial amounts of alcohol as long as the improved diet is maintained. If *in addition* vitamin B_{12} is supplied, the number of "cures" is greatly increased, so that now perhaps one half of the animals respond. By adding supplementary vitamins A, D, E, and a source of unsaturated fatty acids, the proportion of cures is substantially increased, but some of the animals still have an appetite for alcohol. When antibiotics (terramycin for example) and preparations of unidentified nature from yeast are added, a large percentage of the animals have their appetites for alcohol abolished or at least greatly diminished (unpublished data). Some of these unknowns are being investigated in our laboratories.

The exact results obtained will depend upon the make-up of the original rat population used, but in any case it is perfectly clear that on a marginal diet all animals will drink substantial amounts of alcohol, but that there will be progressively fewer and fewer animals which have an appetite for alcohol as the diet becomes abundantly supplied with additional nutritional factors.

Clinical Applications

In view of the clear-out relationship between nutrition and alcohol consumption in rats, the question as to the applicability of these findings to human beings becomes paramount. Certainly in human beings all sorts of psychological and sociological forces come into play, and the problem of alcoholism as it exists in human beings is far different from that involved in the consumption of alcohol by rats in individual cages. Before dismissing the parallel too lightly, however, it should be recognized that a vast proportion of what we know about human nutrition was learned by studying the nutrition of experimental rats.

A long-term, large-scale, controlled experiment is under way at the Harvard School of Public Health under the direction of Dr. Fredrick Stare, to determine the efficacy of a specific supplement of known vitamins in the treatment of alcoholics. This study will not be completed for about two years, but a preliminary report[13] indicates that the findings are in accord with the animal findings, and that nutritional supplements cause a decrease in alcohol consumption in human patients. Many patients experienced a diminished craving for alcohol as a direct result of vitamin administration, and most of them reported an improved sense of well being.

It is hoped that the above mentioned study, *in which the element of suggestion is eliminated by the use of placebos,* will establish in a definitive manner whether or not nutritional supplements will, *in some cases*, abolish alcoholic craving. If the principle is established, it will be in order to modify and improve the supplements, introducing new vitamins, etc., as they become available, to the end that all alcoholics may be helped.

Smith, *et al*, [14] have also reported on a few cases in which alcoholic patients have been greatly benefited by the same nutritional supplements.

Before the above mentioned clinical experiments had been reported, my associates and I became fully convinced, on the basis of personal observations, that for some individuals nutritional supplements may bring about dramatic results. It is fortunate, as far as

generating enthusiasm for the possibilities of the treatment is concerned, that the first patient (who had been a heavy drinker for 20 years and an alcoholic for 10, and had not reacted favorably to psychiatry or the Alcoholics Anonymous program) should have been transformed, over three years ago now, into a moderate drinker who has no difficulty as long as he takes the nutritional supplements. As described elsewhere,[15] some individuals have had their difficulties completely removed within about two weeks; for others it has taken longer to produce benefits; and for still others the beneficial effects have been fleeting or questionable. Personal talks with several individuals who now can drink or not as they choose, and who previously could not, together with the background information and observations with animals, have convinced me of the validity of the principle.

Need for Investigations

It is important, however, that the nutritional treatment we have devised (or improved versions of it) should be tried out as widely as possible, so that the potential benefits will be available to the vast numbers of people who have more or less difficulty in controlling their drinking, and to the oncoming generation who may be prevented from falling into the morass of alcoholism by judicious nutritional supplements. One study[16] has indicated strongly that there are recognizable characteristics present in the metabolic patterns of potential alcoholics, which should make it possible to identify and forewarn vulnerable individuals.

The fact that the treatment or prevention of alcoholism by nutritional supplements has been emphasized does not deny the importance of psychological and sociological forces. It is well known that psychological stresses alter body chemistry, and it could be that these stresses help to create or at least to accentuate body deficiencies by impairing absorption or assimilation or by direct effect on particular enzyme systems. There is no hope of understanding completely all the factors involved in alcoholism until we understand human beings in their entirety, but the nutritional factors appear at present to constitute an important key.

Genetic Factors

The nutritional approach to alcoholism may have very widespread implications because of its bearing on the concept of genetotrophic diseases.[17,18] These diseases, of which alcoholism appears to be an example, are those which arise because the genetic pattern of the individual calls for an augmented supply of a particular nutrient or nutrients, which is not supplied by the food consumed. Such a disease can presumably be completely obviated by suitable nutritional supplementation. As has been indicated elsewhere, there may exist a multitude of such diseases.

If the nutritional treatment of alcoholism is valid, there is hope that a vast number of other obscure diseases may yield to nutritional treatment when the genetotrophic principle is applied intelligently, using all of the modern and currently discovered factors in nutrition.

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Resumen

El alcoholismo como problema nutritivo

Una deficiencia nutritiva es sugerida como la base para el alcoholismo. El autor expone su tesis con tres lineas de evidencia: (1) descubrimientos recientes en el campo de la genética bioquímica, que muestran la individuación del mecanismo metabólica, y de ahí de los requerimientos nutritivos; (2) experimentación directa en animales; (3) datos clínicos.

Experiencias en una colonia de ratas mostraron: (1) que la respuesta al alcohol de los animales alimentados con una dieta básica varió marcadamente según el individuo; (2) que los alimentados con una dieta marginal (pobre, sobre todo, en vitaminas B) bebieron excesivamente; (3) que los ofrecidos una dieta abundante—rica en todos los principios alimenticios esenciales a la rata—no bebieron sino moderadamente; y (4) que los que habían bebido con afán durante el curso del régimen deficitario, *dejaron de beber* al recibir los principios alimenticios que les habían faltado. Se concluye que con la dieta básica las variaciones individuales de la respuesta al alcohol se determinaron por las variaciones metabólicas individuales; que con la dieta marginal la aparición de carencias provocó en todos los animales el deseo de alcohol; que con la dieta abundante no se desarrolló ninguna deficiencia y por eso ningún deseo excesivo de alcohol.

Se examina la aplicabilidad de estos datos al hombre, refiriéndose algunos casos individuales que parecen los confirmen y señalándose una experiencia ahora en curso (Harvard School of Public Health), cuyos resultados preliminares indican que los suplementos nutritivos ocasionan una disminución de la cantidad de alcohol consumido por el hombre, así como por los animales de experimentación.

El autor no quiere excluir del cuadro del alcoholismo los factores psicológicos y sociales, pero cree que el nutritivo, sea primario, sea secundario—nos proporciona una "clave" importante para el mejor conocimiento de tan grave problema.