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Signature Ronald L. Mogen
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NUTRITION AS IT RELATES TO MENTAL HEALTH

by

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A professional paper submitted to the Graduate Faculty in
partial fulfillment of the requirements for the degree

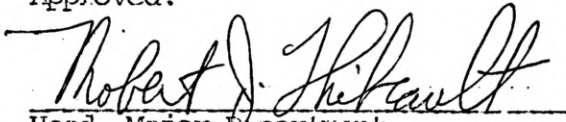
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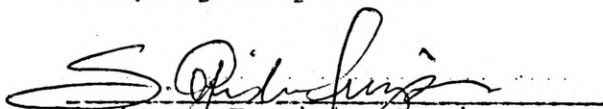
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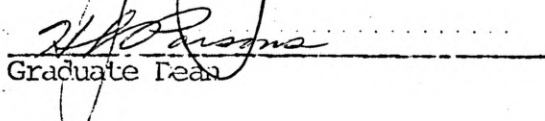
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ABSTRACT

The role of nutrition as a factor influencing mental health was explored in this paper. Experimental programs and research investigations involving the use of vitamins, minerals, and other dietary means for treating mental disturbances were reviewed and presented in an organized manner. Information sources were limited to books, journals, and magazines available in the immediate Bozeman vicinity.

The assortment of investigations reviewed included the following treatment procedures: the use of B-complex vitamins for treating schizophrenia, migraine headaches, and depression; the use of vitamin E for improving mentally retarded and emotionally disturbed youngsters, and correcting senility in the aged; the use of specific minerals for the treatment of anxiety and insomnia; and the use of various combinations of vitamins and minerals for treating hyperactivity and mongolism in children.

Studies involving the treatment of neurotic and psychotic disorders through the use of major diet revisions were also discussed. Such treatments pertained to a variety of disturbed behaviors including delinquency, drug abuse, alcoholism, and schizophrenia. Controlled fasting was also reviewed as a possible treatment for certain psychotic symptoms.

The presentation included a brief discussion of intrinsic and extrinsic causes of nutritional deficiency and consequent mental dysfunctions.

A major conclusion derived from the investigation was that a considerable amount of further investigation is needed in the area of nutrition as it relates to mental health. Recommendations were made for some pragmatic counseling implication, and further research was recommended regarding the use of vitamins, minerals, and general dietary changes as a means for correcting discomforting mental conditions.

CHAPTER I

INTRODUCTION

The individual reacts as a unified whole to a given situation, be it internal or external. In the field of counseling there is an increasing acceptance of the fact that one of the most basic characteristics of man, and indeed all organic life, is the tendency toward a total and purposeful, goal-directed response (31:486). Mental and emotional processes cannot be considered as components of the person, acting separately and independently from the physiological processes. "Whether we like it or not," said Andrew Salter, "the brain case has been permeated by the viscera" (34:35). In The American Journal of Psychiatry, Dr. Edwin Gildea stated (6):

. . . the capacity of man to function at all as a whole person is dependent on the continuous maintenance of delicate and complex homeostatic mechanisms. In other words, the well being of a person (i.e., his feeling of enthusiasm for life and his capacity to work) is as dependent on the maintenance of a continuous and delicate quantitative adjustment of hormonal and metabolic substances in blood and other body tissues as it is on the maintenance of a well balanced psychological state.

Abundant evidence has proven that bodily changes can have profound effects on the emotions and reasoning. Likewise, intense emotional excitement has been shown to include

bodily changes in the glands, muscles, and nerves, as well as chemical modifications of the blood.

The concept of the total person should be kept continually in mind by professional people who work in a helping relationship with others. Yet in an age of specialization, where professional people may choose any area from feet to fornication in which to specialize, the treatment of the total functioning person is sometimes easily ignored. The professional counselor, of course, is not immune to this tendency. Counselors may become so engrossed in the psychological aspects of the person that they fail to recognize or even become aware of physiological factors that may be equally influential in affecting the mental health of clients. Carl Rogers cautioned against such tendencies some 30 years ago in one of his early writings (30:15):

The individual's behavior, outlook on life and ability to cope with adjustment problems may be directly affected by medical measures.

It becomes evident, then, that if we look upon the whole field of readjustment techniques with a proper perspective, we see counseling as important but as by no means the only approach to the individual who finds himself out of harmony with his life situation. We need this perspective if we are to avoid the pitfalls which so often lie across the path of the over-enthusiastic . . . we should keep in mind the fact that counseling is but one of a number of avenues

through which we may help the maladjusted person to develop a more satisfying life.

A major factor affecting human physiology (and consequently psychology), and one which fortunately can be altered relatively easily by the individual himself, is the factor of nutrition. However, the area of nutrition and its effects on mental health go virtually unexplored by many in the professional helping areas. The mental health establishment in general seemingly rejects the idea that some mental illness can be cured by physical means as simple as changing the diet. Dr. W. D. Currier, medical director of the Lancaster Foundation for Scientific Research has stated (41:xii):

At present, the biochemical and nutritional aspects of mental illness are almost completely neglected. This newer approach to treatment . . . places in the hands of psychiatrists and other practioners a tool of utmost importance. It is an addition to their own specialized knowledge and an indispensable adjunct to their modes of treatment. The more secure among them will approach this biochemical and nutritional therapy with an open mind. A whole new field of therapy may be his for managing one of the greatest medical problems on earth, the mentally ill patient.

Purpose and Value of the Study

In light of the above considerations, the purpose of this paper was to investigate recent research and claims

regarding nutrition as it affects mental health, and to present an organized synopsis of this information.

A primary value of this paper was the learning experience which it provided for the investigator. A greater knowledge and appreciation of the subject of nutrition and its relationship to mental health was gained. The awareness of possible dietary problems in clients is a valuable supplement to the investigator's major field of counseling as a tool for more effectively treating the total person.

A second major value of this compilation of recent research was to provide the investigator's advisor with a readily available source of nutritional information to be used as an aid in his teaching endeavors. Some of the research findings reported herein are indeed thought provoking, and should be of considerable value for use in seminars and discussion groups. The findings are also worthy of critical consideration in determining the optimum program of treatment for certain counseling clients and for youngsters with certain types of learning disabilities.

Hopefully, the study may prove to be of considerable value to others in the field of education, counseling, nursing, social work, and related areas who may wish to expand their own knowledge on nutrition and its effect on

mental health. A concise up-to-date synopsis of information such as is presented herein should also be an incentive for encouraging others to conduct further exploration and research in the relatively new and uncertain field of psychochemistry.

Procedures and Limitations

The procedures used in the present study consisted of reviewing the available literature pertaining to mental health as affected by nutrition and presenting these findings in a logical, organized manner. The sources of material used for the review included primarily the resources available at the Montana State University library and various other magazines, journals, and books available from staff members and friends. A major secondary source of information for the study was the Prevention magazine. Though not a "professional" journal, the articles in Prevention provided information on much of the recent exploration and research being conducted to prevent human disease and malfunction, including, of course, nutrition and its relation to mental health.

Whenever possible, the primary sources of information (original research reports) were located, reviewed, and cited in the presentation. However, at the request of the

investigator's advisor, even though primary sources were not available, or located, the various research claims are still reported with the secondary source cited as the reference. For example, if the original publication of a research mentioned in Prevention could be located, the original source was reviewed and cited as a reference. If the original research was not available, Prevention was cited.

The lack of a primary reference source for some of the studies presented might be considered a limitation since questionable results cannot be adequately analyzed. However, the investigator felt that an awareness of the various possible nutritional influences on mental health was valuable, even though not all evidence was completely supported by acceptable scientific data.

A second limitation of this study was that the sources of information were limited to the Montana State University library and the immediate Bozeman vicinity. Several of the major professional journals in the pertinent areas of nutrition, medicine, and psychology were unavailable.

Finally, the literature reviewed in the present study was limited to recent research. Research findings and studies conducted prior to the mid-1950's pertaining to the effects of nutrition on mental health were reviewed extensively

by Elizabeth Bell in 1958 in the Journal of Psychology (1). Bell cited some 182 references dealing with nutritional deficiencies and emotional disturbances. Since the reference source containing Bell's study is generally readily available, the scope of the present paper was limited to research conducted since the mid-1950's.

Summary

In the opinion of the investigator every effort should be made to provide total treatment for the total person in the counseling relationship. Such treatment includes any one or a combination of medical, physiological, (nutritional) and psychological help. The purpose of this investigation was to review recent information regarding ways in which physiological processes as affected by nutrition can influence the mental health and attitudes of the individual.

Formulation of definite conclusions about nutrition and its effect on mental health was not the intent of this study. Such is a problem for more extensive research. The intent of the review was to explore the research in these areas and present the findings in a logical and pragmatically useful manner.

CHAPTER II

SELECTED PERTINENT LITERATURE

An increasing amount of information has been drawn to public attention in the area of human treatment labeled as "orthomolecular therapy," "megavitamin therapy," or psychochemistry, the study of nutrition and body chemistry as it affects the brain and nervous system, and consequently mental health. For example, an article in the April, 1972 edition of McCall's magazine entitled, "How Your Diet Can Affect Your Mind" called the psychochemical approach "revolutionary " (32). David Rorvik, the author of the article, pointed out that a few years ago a mere dozen psychiatrists were active in the field. Yet in the period of the 1970's several hundred psychiatrists were using megavitamin therapy (administering very large doses of vitamins) in an effort to help patients with such diverse mental problems as alcoholism, drug abuse, senility, infant psychosis, autism, depression, and schizophrenia. In the book, Low Blood Sugar and You, the authors stated that according to their studies, one out of every ten persons in the United States is suffering from a condition of low blood sugar which can be reflected in a hundred distressing physical symptoms as well as neurotic or even psychotic behavior (4).

The following passage is a quote from still another popular book written by the late J. I. Rodale, former editor of Prevention magazine (14:67):

In contrast to psychogenic theories of mental illness, there is a growing amount of experimental evidence which indicates the possibility that some of the psychoneuroses and the functional psychoses are part of biochemical disorders of the body, and not illnesses of the mind as such Lack of thiamine at times result in ideas of persecution, mental confusion, and loss of memory; lack of riboflavin (one of the B vitamins) sometimes causes depression, visual disturbances, disorderly thinking, inability to concentrate or perform mental work, and forgetfulness; lack of niacin (another B vitamin) causes weakness, depression, anxiety, irritability, loss of memory, mania, hallucinations, and dementia (mental deterioration); lack of pyridoxine (B vitamin) causes epileptiform (epileptic) convulsions, general irritability, and weakness; in addition, lack of cyanocobalamin, biotin, and ascorbic acid (vitamins) are reported to cause similar types of mental disorders.

Reports such as these are worthy of further investigation by psychotherapists and counselors concerned with helping their client toward becoming a more fully functioning person. The present chapter will attempt to present an organized review of some of the more recent research and findings in the area of mental health as affected by nutrition.

Chapter II will be organized around the following salient points: A brief discussion of some possible basic causes for nutritional deficiency or malfunctioning is first

presented, followed by a cursory physiological discussion which points out some of the general internal conditions that can occur to upset the normal metabolic processes of the brain. Next a short section of background information is presented regarding the nutritional approach to correcting mental illness. The individual research studies reviewed are then discussed as they pertain to the following major sections: the B-complex vitamins; vitamins A, C, D, and E; minerals; combinations of vitamins and minerals; other protein substances; major diet modifications; drugs and alcohol; and fasting. A final section summarizes the entire chapter.

Reasons for Nutritional Deficiencies

Critics to the concepts of vitamin therapy and nutritional treatment of mental disease have questioned the likelihood of nutritional deficiency, particularly in a prosperous and well-fed country like the United States. According to Dr. Miles Atkinson several causes for deficiency were possible (25):

For instance, it is common knowledge that the diet of a great many people is far from ideal--the rich eat too much fat, and the poor eat too little protein, and the inbetweens eat too many carbohydrates. Some eat too much in order to comfort themselves; others eat too little in order to fashion themselves. The diet record of most of the patients I see in my office make dismal reading.

General food abundance, then, is not the criterion for determining whether individual bodies are receiving sufficient and balanced amounts of the necessary nutrients. Poor individual diet habits are common and lead to less than optimum physical and mental functioning.

Modern methods of food processing was suggested as another reason for the probability of vitamin deficiency. J. I. Rodale referred to the problem when he stated that (14:49-52):

Over refinement of food makes it lose much of its nutritive value. This includes the removal of the living germ from wheat . . .

and white polished rice. The whole brown rice contains about 300 to 400 percent more of the B vitamins than the polished variety. Eggs for the market are produced without the benefit of roosters and are infertile, lacking important hormones and other living elements. Instead of sugar being consumed in the wholeness of raw sugar cane, it is refined into a chemical compound with all its vitamins removed.

Cooking destroys vitamins, and if salt is placed in the water, there is a greater loss of vitamin C. In some foods a single cooking destroys more than 50 percent of the vitamins. In the factories food is bleached, colored, dehydrated, hydrolized, homogenized, emulsified, pasteurized, gassed, preserved chemically, and canned.

The public is consuming food products of marginal quality, and if they do not get extra vitamins and minerals they are bound to become weakened both physically and mentally.

Drugs and alcohol may interfere with the proper absorption of necessary nutrients. Alcoholism is a chief cause of vitamin deficiency among civilized people with adequate food supplies (10). Alcohol interferes with the intake of sufficient amounts of protein and vitamins, reduces the absorption and storage of ingested vitamins, and decreases the body's ability to convert vitamins into metabolically active forms. The antibiotic drugs are significant offenders because of their widespread use. Many doctors, for example, are now recognizing the necessity for introducing colonies of bacteria in the intestine following use of drugs such as pencillin in order to reestablish the production of certain vitamins (8).

Continued stress or emotional inhibition can alter normal body physiological processes which in turn may demand considerable adjustments in the diet, including much larger quantities of certain food factors than normally required. A disturbance in sugar metabolism can occur when a person finds no challenge or sense of achievement, and individuals are described as showing a deficit in fuel for the brain and nervous system which is not great enough to yield the dramatic mental symptoms. The chief complaint of the victims of sugar imbalance is "pernicious inertia." Apathy, loss of zest, and feelings of aimlessness characterize their behavior (4:38-40).

The body responds to the deficit in mental and emotional challenges by not attuning itself to the demands made upon it. The result may be an imbalance between the function of the adrenal glands which elevate blood sugar and the pancreas which lowers it, producing chronic half starvation of the brain. The whole reaction is a rebellion against monotony and tedium and unwanted tasks that give no sense of achievement. The resulting "emotional sit-down strike" favors the victims tendencies towards withdrawal, impairs his efficiency, and discourages new effort. The failure can be rectified with the proper diet and vitamin

supplements, but the basic cause will not be removed, obviously, and the fatigue will return if the emotional disturbance is not identified and psychologically treated.

A final factor to be mentioned which may indirectly result in a nutritional deficiency or upset is the factor of genetics. Genetics influences can cause abnormal nutrient requirements which if left unsatisfied, can result in physical and mental handicaps. A reasonable theory suggested that since there does seem to be a heredity relationship associated with a considerable amount of mental illness, possibly genes may in many cases regulate the metabolism of vital substances such as the vitamins and other essential substances. Success in treating mental disease with massive doses of certain vitamins may have been the result of treating a localized brain deficiency disease involving the vital substance, thus leading to a decreased effectiveness of the gene (11).

All the essential nutrients represents a potential molecular disease which our distant ancestors learned to control, when it began to afflict them, by selecting a therapeutic diet, and which has continued to be kept under reasonable control in this way. Perhaps in some cases,

modern mankind is not yet fully adapted to his present nutritional habits because of an "evolutionary lag."

Brief Physiological Discussion

All the mental processes of man--thinking, attending, perceiving, conceptualizing, remembering, verbalizing, feeling,--virtually all mental activity requires energy. The energy is produced in the individual cells of the brain. The brain has a higher metabolism rate than the rest of the body and consequently has an increased need for oxygen and food materials. Minor brain dysfunctions may occur before any other physical signs of malnutrition are evident. If the energy production in the brain cells is in some way decreased below the amount needed for proper mental activity, mental disturbance represented by any of a number of symptoms such as depression, weakness, irritability, overconcern, and anxiety may be the result (6).

The blood supplies the brain with all the basic substances needed for the energy producing process. The essential substances include primarily oxygen and food (for fuel) as well as other substances which are required in only minute amounts in order for proper cell metabolism to occur. The cells of the brain must receive all the necessary substances from the blood in adequate amounts before optimum

mental functioning can proceed. However, several conditions can occur which may drastically interfere with this optimum level of functioning. The general conditions which are influenced by nutrition will be described briefly since at least some understanding of them is important in order to better understand some of the research studies discussed in the chapter.

With the exception of oxygen (which is carried to the cells by the blood from the lungs) all the materials needed for cell metabolism must either be obtained in the diet or synthesized in the body itself. The materials not produced in the body must come from the foods ingested, suggesting a most obvious reason for reduced ability of the brain to function--the only means of obtaining a particular substance necessary for the brain cells is in the food intake, but the diet does not contain adequate amounts.

If all the substances necessary for cell metabolism were utilized in the same form as they occurred when first absorbed from the food, the problem of psychochemistry would be greatly simplified. However, there may be many intermediate reactions which occur in various other organs and tissues of the body before food substances as they are absorbed are converted to forms of food usable by the individual cells.

The pancreas, kidneys, liver, and thyroid glands are most important in this respect. If these glands or tissues are not functioning properly, or if the body lacks certain necessary enzymes, the intermediate food conversion reactions cannot occur. The body, then, is unable to convert raw foods into usable forms and a second general condition which prevents the brain from receiving an adequate food supply results.

Various physiologocal reactions can occur in the body which may have mechanical effects on the circulatory system resulting in lowered ability of the brain cells to receive food substances. Two such conditions are important to consider here. The walls of the blood vessels and capillaries may contract and constrict the flow of blood to the point that the arteries are not able to supply food, oxygen, and other necessary substances at a sufficient rate. Or the walls of the capillaries may become less permeable resulting in a decrease in the degree to which oxygen and food substances can move from the blood into the cells. Specific diets may be lacking the essential factors needed for proper regulation of these processes.

A final condition, but one of great importance to consider, is the interactions which occur between the

various major types of food substances, the carbohydrates, proteins, and fats. An imbalance between these foods can result in effects similar to severe malnutrition, even though all the necessary foods are present. An overabundance of one may, because of other inherent conditions in the person, result in a decrease in ability to utilize other foods, or may result in adverse effects on glands, the importance of which has been mentioned above.

In summarizing this brief physiological discussion, the proper food in the proper form must be delivered to the brain cells in adequate amounts in conjunction with other minute but necessary substances before optimum brain cell metabolism and the resultant production of mental energy can occur. The level of mental functioning may be decreased by any or all of the following conditions:

1. Inadequate dietary supply of a necessary substance which must be obtained in the diet.
2. Inability of the body to synthesize or convert a necessary substance to usable form.
3. Mechanical changes in the blood vessels which restrict the degree to which necessary substances can be delivered to or enter the brain cells.
4. Imbalance of basic food types in diet resulting in inefficient functioning.

In examining the research pertaining to nutrition and mental health, the effects of the various vitamins, minerals,

and other factors can generally be understood in light of their influence on one or more of these basic conditions.

Background Information

Among the men who have pioneered the relatively new field of treating mental health by nutritional means were Abram Hoffer, M. D., president of the American Schizophrenia Association and former professor of psychiatry at Canada's University of Saskatchewan; his co-worker, Dr. Humphrey Osmond, also of Saskatchewan; Allen Cott, M. D., of New York, a psychiatry expert who specializes in children's diseases; F. Glen Green, M. D. of Associate Medical Clinic in Prince Albert, Canada; and Dr. Robert Meiers, M. D., professor of psychiatry at Stanford University and staff psychiatrist at Twin Pines Hospital, Belmont California (35).

Doctors Hoffer and Osmond began their investigation into a biochemical approach to schizophrenia in 1952 in Saskatchewan. The treatment advocated by Hoffer and Osmond is generally termed megavitamin therapy, and involves the daily use of massive doses of vitamins, principally B-complex vitamins, vitamin C, and vitamin E. Hoffer and Osmond have dedicated the last 20 years to the treatment of mentally ill. Almost singlehandedly, these two doctors have established "Schizophrenics Anonymous" centers in the United States and

Canada, and have been instrumental in founding the American Schizophrenia Foundation. The research and the tremendous amount of medical articles produced by Hoffer and Osmond have had considerable influence in increasing the interest and respectability of megavitamin therapy.

The recent Nobel prize-winning chemist, Dr. Linus Pauling, has also been active in the field of vitamin research, and suggested calling the approach to mental health "orthomolecular therapy." Pauling defined orthomolecular therapy as: "the treatment of mental disease by the provision of the optimum molecular environment for the mind, especially the optimum concentration of substances normally present in the human body" (11).

According to Dr. Pauling mental disease, usually associated with physical disease, may result from a low concentration of amino acids which make up protein, essential fats, vitamins or minerals. If these are present in correct quantities in the brain, it will function properly. But in the same way that individuals differ in height, weight, color and temperament, so do they often differ in the amounts of each nutrient they need. Orthomolecular medicine tries to determine which nutrients are needed in what quantities and for how long. Pauling suggested that orthomolecular

treatment of mental disease, to be successful, should involve the thorough study of and attention to the individual such as is customary in present psychotherapy (11).

The dominant interest in the field of orthomolecular therapy initially appeared to be concerned with vitamin research, partly because vitamins more directly and immediately affect the nervous system than do some of the other nutrients, and partly because vitamins yield more readily to experimentation. However, other important nutritional therapeutic factors have also been researched.

The use of vitamin therapy up to the 1970's covered a spectrum of problems including the hyperactive child, disturbed children, delinquent adolescents, drug problems, adult schizophrenics, and even old age problems of senility. Experimental work pertaining to the relationships between nutrition (vitamins, minerals, etc.) and emotional disturbance has been of four principal types: (a) the purposeful creation of single vitamin deficiencies in human, with consequent psychological results, (b) the intentional creation of a general state of malnutrition in subjects, with accompanying psychological disturbances, (c) the nutritional treatment of subjects with psychological disturbances also show obvious physical signs of malnutrition, and (d) the

nutritional treatment of psychologically diagnosed mentally ill subjects who exhibit no chemical or physical signs of being undernourished (41).

The B-Complex Vitamins

Vitamin B actually consists of a whole complex of vital nutrients including thiamine (B_1), riboflavin (B_2), niacin or nicotinimide (B_3), pyridoxine (B_6), cyanocobalamin (B_{12}), and several other important substances essential to the proper functioning of the body. The vitamins of the B-complex have profound effects on the brain and nervous system as is shown in the following incomplete list of some metabolic roles of various individual vitamins within this group (12):

thiamine - essential for energy release, participates in intermediary carbohydrate metabolism, and acts as a catalyst for disposal of certain metabolic wastes.

riboflavin - indispensable in energy metabolism, important in tissue synthesis, essential constituent of yellow enzyme present in all living cells, and functions in oxygen transportation.

niacin - component of enzymes necessary for intermediary sugar and carbohydrate metabolism, and has been identified with more than 40 oxidation-reduction reactions involved in energy release and tissue synthesis.

pyridoxine - required in at least 15 known enzyme systems, necessary for production of

nerve impulse, participate in neutralization reactions, and necessary for proper functioning of other B-complex vitamins.

cyanocobalamin - essential in proper regulation of cell functioning, and probably exerts a significant influence on energy metabolism, tissue synthesis, and detoxification.

In research studies, the individual B vitamins were often tested separately, but the consensus is that a diet so inadequate as to produce a deficiency of one vitamin is generally lacking in others (1). In addition the B vitamins have all been found to work synergistically so that the combined effect is greater than the effect of each vitamin taken individually.

In an article in the 1954 journal of Clinical Nutrition, R. A. Pettermen and others summarized research conducted up to that time pertaining to vitamin therapy and its effects on nervous and mental diseases (12). Pettermen and his coworkers stated that a lack of thiamine brought ideas of persecution, mental confusion, and bad memory. A deficiency of riboflavin caused depression, visual disturbances, disordered thinking, and inability to concentrate. Not enough niacin resulted in unreasonable fears, anxiety, mania, hallucinations, and dementia, and insufficient pyridoxine produced convulsions, irritability, and general weakness.

The B vitamin which has recently received the most attention and research is niacin or nicotinic acid (B_3). When niacin's use was first introduced decades ago, it cured thousands of pellagra patients of their psychoses, as well as the physical manifestations of their diseases (11). The niacin treatment of pellagra patients in mental institutions produced relief of mental symptoms such as loss of memory, disorientation, confusion, and depression (36). Recent studies have shown that pellagra, or niacin-deficiency disease, is still quite common in the United States, not in it's more obvious form with painful blotches on the skin, inflamed tongue, and raving madness, but rather in a sub-clinical form whose symptoms are being mistaken for mental illness.

Schizophrenia, a chronic mental disease characterized by distorted perceptions and heightened fears and suspicions, has long puzzled the psychiatric profession, but is being successfully treated as niacin deficiency by a group of psychiatrists in the U. S. and Canada (26). Prominent among them are Hoffer and Osmond, previously mentioned. Since 1952, they have advocated and used nicotinic acid in large doses in conjunction with other vitamins as a treatment for adult schizophrenics. More recently these researchers began

began treating anti-social, disturbed youngsters with large doses of niacin.

According to Dr. Abram Hoffer, both the hyperactive problem child who fails to do well in school and the schizophrenic confined to an asylum, are victims of vitamin B₃ (niacin) deficiency (29). Hoffer cited the example of a nine-year-old boy who had suddenly become hostile, irritable, and fearful about a month before seeing him. The boy complained of visions and other perceptual illusions, and, was even afraid to take a bath for fear he might be drown. Hoffer prescribed a large dose of vitamin B₃, and vitamin C daily, and reported that the boy was slightly better after one month. School performance improved substantially, and after seven months the boy was normal.

After 24 similar successes, Hoffer became convinced that many mentally disturbed children are simply vitamin B₃ deficient. According to Hoffer, it is not well known that long before pellagrins become psychotic they suffer from tension, depression, personality problems, fatigue, and other symptoms which could easily be mistaken for mental illness.

In another of Dr. Hoffer's studies, 24 of 38 disturbed children recovered while taking niacin, but relapsed within

a month when a placebo was substituted. The children then recovered when the vitamin therapy was renewed. The children were free of symptoms, were performing well in school, and were getting on well with their families and with the community. Improvement was achieved without the benefit of any traditional psychotherapy, but in every case good nutrition was emphasized. According to Hoffer, without exception, every psychiatrist who has used the orthomolecular approach as described has become very impressed.

Hoffer believed the disturbed child syndrome is inherited since his studies of families showed the occurrence of vitamin B₃ deficiency to obey general principles of genetics. Osmond and Hoffer summarized the advantages of nicotinic acid by stating that it is safe, cheap, and easy to administer, and is a well-known substance that can be taken for years on end, if necessary, with only small probability of incidence of unfavorable side effects (7).

Positive findings on the ability of niacin to alleviate the symptoms of schizophrenia stimulated interest in Dr. R. Glen Green to develop a simple test for diagnosing niacin deficiency. Dr. Green recommended that physicians ask the following questions of children suspected to have

pellagra and also adults who have become mysteriously miserable and almost unable to work (21):

1. Does your face seem to change when you look in a mirror?
2. Do words move when you try to read?
3. Does the ground move when you walk?
4. Do you feel you walk on the ground or off the ground?
5. Do pictures move when you look at them?
6. Do you hear someone calling your name when you are alone?

If patients claimed to have experienced some or all of these sensations even sometimes, Dr. Green recommended they take the Hoffer Osmond Diagnostic (HOD) Test, which is a battery of 145 true and false response questions. Originally developed by Drs. Hoffer and Osmond to diagnose schizophrenic patients, this instrument reveals perceptual difficulties in sight, hearing, taste, smell, and attitudes.

The use of vitamin B₃ (niacin treatment) in the patients in Dr. Green's research brought about disappearance of their hallucinations and alleviation of the symptoms that would normally have been considered reason for psychiatric treatment. Green said of the significance of this discovery (21):

For the past 20 years, I have been diagnosing such patients as neurotic, having flu, sore

throat, backache, etc. for want of something better. In a seven month period since November, 1968, I have diagnosed well over 100 cases of subclinical pellagra; 65 percent of the cases were under 16 years of age. They all responded to vitamin B₃ within a few days or weeks. The chief criterion for diagnosis of this disease is the presence or absence of perceptual changes.

In an interview with three other doctors prominent in orthomolecular therapy, Dr. Green described a specific case which was treated with vitamin B₃ (35):

I had an Indian mother in the office with her three children. She was the patient. Her five-year-old boy never said a word, but was all over my office. The mother wasn't complaining about the child, but I was curious and discovered that the boy had stopped learning to talk at about the age of three. He just quit--something that did not bother the mother, the kind of thing Indians will just accept sometimes. This child, I discovered had changed a great deal over the past two years. He was miserable, cranky and very hard to live with. We put him on the vitamin preparation and the boy was talking by the time she came back the following month.

Vitamin B₃ has also been reported to be effective in controlling and perhaps preventing the distressing symptoms of migraine headaches, according to Dr. Miles Atkinson (25). Some migraine sufferers were treated merely by replenishing their intestinal flora through the addition of yogurt or buttermilk to their diets. However, in many cases to obtain results Dr. Atkinson prescribed a dosage of niacin which was

much higher than that usually acceptable, even at the upper therapeutic level. Treatment included both injections and oral administration of niacin in conjunction with a sensible diet.

Another vitamin in the B complex which has received recent attention is cyanocobalamin, or B₁₂. A deficiency of B₁₂ results from pernicious anemia, a genetic defect leading to decreased transport of B₁₂ in the blood. Mental illness associated with this anemia often has been observed long before any physical signs of the disease appear. A pathologically low concentration of cyanocobalamin in the blood has been reported to occur in a much larger fraction of patients with mental illness than in the general population. In one study of mental patients, the incidence of low and subnormal levels of B₁₂ in these patients was 15.4% as compared with 0.5% in the general population (11). The corresponding high rate of B₁₂ deficiency in patients admitted to mental hospitals suggests that some mental disease may in part be due to this vitamin deficiency.

Vitamin B₁₂ is reported to have been used successfully in treating depression. In one case study, a 23 year-old woman became very depressed after the birth of her first baby. Although usually cheerful and emotionally stable, her mood changed drastically within a few days of delivery. The

mother was not depressed because of the new responsibilities of caring for her child, but apparently lacked one of the substances needed by her brain in order to function properly. The patient was given large doses of vitamin B₁₂ and within two days improvement was noticed. Within a week all symptoms had disappeared (17).

The neurological damage caused by a vitamin B₁₂ shortage usually involves the delicate protective covering of the spinal cord and other vital nerve centers. Though the part vitamin B₁₂ plays in this mechanism is not yet fully understood, when the vitamin is absent damage is inevitable and is rarely reversible. A group of British physicians have reported (17):

vitamin B₁₂ deficiency may cause severe psychotic symptoms which may vary in severity from mild disorders of mood, mental slowness, and memory defect, to severe confusional and hallucinatory states, and paranoid behavior. Occasionally these mental disturbances may be the first manifestations of vitamin B₁₂ deficiencies and may precede sometimes by several years the appearance of its more easily recognized expressions.

The lack of vitamin B₁₂ is not always the result of a deficiency in the diet. The vitamin can not generally be utilized in the body unless other necessary substances are also present. Recent evidence, however, suggested that vitamin B₁₂ if given in very large amounts, can be absorbed without the participation of other substances.

Studies have shown a third B vitamin, thiamine (B_1), to have marked effects on mental functioning. Typically the person whose diet is poor in vitamin B_1 lacks energy, is constantly tired, doesn't eat or sleep well, and is irritable (18). If thiamine deficiency is not corrected more pronounced symptoms develop. Memory may become faulty, concentration becomes poor, the person becomes unstable emotionally, and there is undue reaction to normal stresses and strains. Thiamine is an active portion of the co-enzyme necessary for the complete metabolism of carbohydrates. Since nervous tissue is especially dependent on carbohydrate oxidation for its functioning, the nervous system is one of the first to show the effects of vitamin B_1 deficiency.

However, not all research on thiamine deals with deficiency. In an experiment conducted by Dr. Ruth F. Herrel of the Department of Educational Psychology at Columbia University, the possibility that supplemental thiamine can improve mental ability was explored (18). Dr. Herrel selected two groups of children in an orphanage, ages nine to 19. The groups were closely matched according to age, sex, weight, educational status and mentality. One group was given a daily tablet containing thiamine; the other group received a placebo. The treatment was continued for a year and in

order to insure objectivity, neither the children nor the investigators knew which pill they were receiving.

Several categories of tests were used to measure mental response. Both groups were tested at the beginning and again at the end of the experiment and the percentage of improvement between the two groups was compared. Results showed that in all categories, the thiamine-supplemented group showed astonishing improvement as compared with the control group. Improvement ranging from approximately 25 to 3,200% was reported in the treated group. Mental achievement in children of presumably normal mentality appeared to have been increased through employment of dietary B₁ supplements.

Vitamins A, C, D, and E

Vitamin A, or carotene, is essential in fighting disease of the brain and nervous system, and is also an important facilitator in calcium metabolism.

Vitamin C, or ascorbic acid, is important in transmission of nerve impulse and has been used to some extent in the treatment of mental disease. Mental symptoms such as depression often accompany the vitamin C-deficiency disease, scurvy. Reports have also shown the blood serum of schizophrenics to have smaller concentrations of ascorbic acid

than the general population. In Pauling's opinion, many schizophrenics may have an increased metabolism of vitamin C, presumably genetic in origin, and the ingestion of massive amounts of ascorbic acid therefore has some value in treating mental disease (11).

Vitamin D is indispensable in promoting proper absorption of the minerals calcium and magnesium, the importance of which is reviewed in this paper in the section on minerals (28).

No recent investigations were found in which vitamins A, C, or D were studied singularly as the only substance used in treatment. Any one or all of these three vitamins were, however, a common constituent in many of the studies involving combinations of nutrients. These studies will also be discussed in a later section of the chapter.

Vitamin E has been called the "rejuvenation vitamin," though its use in therapeutic medicine is still controversial. M. Houze of the Ontario Hospital School reported considerable success in using vitamin E to change the attitudes of mentally retarded boys at that hospital. (39:145,146). In as little time as two weeks after treatment began, some intellectual and behavioral improvements were noted in half the patients.

Dr. A. del Guidice, Chief of Child Psychology at the National Institute of Public Health in Buenos Aires also claimed success with vitamin E in treating mentally and emotionally disturbed youngsters. According to Dr. del Guidice (39:146, 147):

We have treated many complications in our infantile psychotics . . . no child remained unimproved when properly treated. Generally we have begun treatment with 200 to 300 milligrams of vitamin E daily, increasing over a period of as long as 6 months to doses approximating 2 grams daily--depending on the age of the child and his type of disease.

Vitamin C was also given in daily doses of 100 to 1,500 milligrams. It was added because of my belief that it reinforces vitamin E--it being clear, always that the latter is the basic item.

Case studies are provided by del Guidice as evidence of his claims of success with vitamin E in children.

Vitamin E may also be instrumental in correcting "senility" in older people due to oxygen deficiency. Vitamin E has been found to be an excellent oxygen conserver, functioning by inhibiting oxygen from combining with other substances, and thereby increasing vital oxygen supply. Even though there is a reduction of blood flow to the brain because of narrowed arteries, due to age, or other causes, the total amount of oxygen reaching the brain can be kept adequate by enough vitamin E. According to A. L. Tappel of the University of California, continuing research should explore more fully the possibility that optimumization of vitamin E intake may slow the aging process. Tappel also pointed out that it is essential to take optimum amounts of vitamin C in conjunction with E because of the known relationship between the two nutrients (39:151).

Minerals

The emphasis on vitamins in the diet may result in neglect to consider the body's equally important need for minerals. Even a slight deficiency of certain minerals is known to have far reaching effects. Minerals are closely related to the vitamins since the presence of a given trace mineral may be absolutely necessary for the proper utilization of a particular vitamin by the body. If a definite deficiency or imbalance of the vitamins and minerals exists, an imbalance in the hormone system is also likely (413). In the research surveyed, the minerals magnesium and calcium were found to have the most important immediate effects on proper mental functioning.

A high intake of calcium has been shown to counteract anxiety caused by an excess of lactic acid in the blood. Though lactic acid is a normal metabolic product, periods of physical or mental stress can produce an overabundance of this acid which can in turn affect the nerve endings. Calcium enters into a chemical association with lactic acid which prevents high quantities of this substance from irritating the nerves.

The relationship between excess lactic acid and anxiety, nervousness, and irritability was demonstrated by two

psychiatrists at the Washington University School of Medicine (28). The two doctors, Ferris Pitts and James McClure, used nine patients diagnosed as suffering from anxiety neurosis and nine normal controls as their subjects. The patients accepted as anxiety sufferers displayed a variety of symptoms including feelings of impending doom, fears of insanity, fears of heart attack, smothering or choking sensations, and difficulty in breathing. All patients had been troubled by these symptoms for at least two years previous to the study. By injecting both patients and controls with lactic acid, the investigators found that without any psychic stimulus whatsoever, the lactic acid brought on an anxiety attack in all nine of the patients and also in two of the controls.

Since lactic acid is a normal metabolic product of the body, the researchers reasoned that the way to control excessive levels of the substance would be to introduce another substance which could neutralize its effects. In a subsequent investigation, Pitts and McClure tested this hypothesis by administering lactic acid to patients and controls as was previously done. However, in some cases calcium was added to the original substance. Results showed that the lactic acid alone caused attacks in 13 out of 14

patients within a few minutes after the infusion. Two out of 10 of the controls also experienced such attacks. When calcium was administered in conjunction with the lactic acid anxiety symptoms for the most part did not occur. Apparently calcium had the effect of binding the acid in a physiologically inactive form, thus reducing its ability to cause anxiety and nerve irritation.

The mineral magnesium has been found to greatly influence mental health. In just a few months of magnesium deficiency personality changes can begin to appear and a formerly active, cooperative and congenial person becomes tired, excitable, intransigent, uncooperative and confused (20). Magnesium activates an entire series of enzymes which are indispensable to the healthy functioning of the nervous system. According to the University of Iowa nutritionist, Willard Krehl, the effects of magnesium deficiency on neuromuscular functioning is manifest in clinical circumstances by irritability, nervousness, and convulsions (9). Among patients suffering from magnesium deficiency Krehl found that 22% were susceptible to convulsions, 44% were suffering from hallucinations, 78% were experiencing mental confusion, and 83% were disoriented and had tremors. Krehl pointed out

that clinical literature has suggested dietary magnesium deficiency to be far more prevalent than generally expected (28).

Magnesium is especially important as an activator of enzymes through which proteins and some vitamins are processed. When magnesium deficiency occurs improper regulation of the hormone system may occur. People suffering from such a condition are reported to have metabolic rates up to 125% higher than normal. Mind and body are overactive causing constant irritation. Magnesium deficiency has also been found to be an important factor in the three million clinical as well as 10 to 15 million subclinical epilepsy cases in this country (15).

An interesting experiment pertaining to effects of common table salt (sodium chloride) on insomnia was conducted by Michael Miller of Saint Elizabeth Hospital in Washington, D. C. Miller was able to help patients who were getting only one or two hours of sleep a night by prescribing low-salt diets. After only three weeks on the low-salt diets 17 out of 20 patients reported that they were sleeping eight hours every night. To check the results for psychological causes, Dr. Miller restored salt to the diets of 13 of the subjects

without their knowledge of the change. Within a few days 10 of the 13 were again complaining of being tense, nervous, and unable to sleep (22).

Combinations of Vitamins and Minerals

A considerable number of studies reviewed involved a treatment consisting of more than one dominant vitamin or mineral. As stated previously, many of the vitamins and minerals act in a synergistic relationship. One such study should be of particular interest to educators and counselors working with hyperactive children.

Educators and administrators in various school districts have been advocating the use of drugs to "calm" hyperactive children who are unable to sit and concentrate in the classroom. Drug treatment involves the risk of possible psychological and physical dependency. A prominent New York psychiatrist, Dr. A. Allen Cott reported an alternative means of treating hyperactive youngsters. Cott administered large therapeutic doses of certain vitamins to children with learning disabilities, and claimed better results than have ever been claimed for the amphetamines (23). Reductions in hyperactivity and behavioral problems, and a corresponding increase in learning ability are reported results in children who were given large doses of specific vitamins.

Dr. Cott, who is also psychiatric consultant to the New York Institute for Child Development, claimed that hyperactivity is but a symptom of an internal biochemical disorder that responds to massive doses of vitamins B, C, and E as well as a change in diet. According to Cott (23):

I've been treating psychiatric disorders, that is, mental illness, with the use of massive doses of vitamins for years. I found such good results in the treatment of adults that I extended its use to the children in treating childhood mental disorders. The improvements were more marked than in adults and produced more dramatic results.

Cott explained that vitamins may initially take a longer time for effects than do the drugs commonly being used to control hyperactivity, because the vitamins are building up a healthy body, step by step, and not just eliminating symptoms as drugs do.

Harry S. Valentine, director of the New York Institute for Child Development considered megavitamin therapy to be important in their holistic approach to helping children with learning disabilities and brain injuries. In the course of working with these children, the Institute staff found vitamin supplementation to be helpful in establishing a favorable internal environment for learning. Using the orthomolecular therapy recommended by Dr. Cott, the staff

adjusted the patients' diets and gave high doses of vitamins. Results were in many cases a gratifying acceleration of development (24).

Another equally impressive research involved the use of a combination of vitamins and minerals and other substances for treating mongoloids. By using a medication consisting of 50 different ingredients, Dr. Henry Turkel, of Detroit, Michigan, produced a treatment which has brought phenomenal changes in mongoloid children (19). The treatment consisted mainly of vitamins, minerals, enzymes, and some drugs. By largely nutritional means some 200 mongoloid children were reported to have been improved in physical health, intelligence, and appearance. In the treatment, vitamins, minerals, and enzymes were administered in very small doses. As Dr. Turkel discovered early in his investigations, only small quantities are able to reach the intended destination in the mongoloid.

According to Turkel, the extra chromosome present in each cell of the mongoloid child triggers a tremendous chain reaction. The chromosomes contain genes, the genes produce enzymes, and the enzymes produce metaboloids that have no function. These extra metaboloids, primarily calcium compounds, clog up the tissues and blood vessels, and eventually

aggregate into larger quantities causing calcification of the soft tissues. The result is the prevention of growth, improper assimilation of nutrients, and impaired elimination of waste products. The blockage in the cells and tissues also causes retardation, both of the brain and body. Turkel described the mongoloid child as being like a car whose gas line is clogged; giving it more gas will not help until the gas line is cleaned out. The problem then, in Turkel's view, was to eliminate the accumulation of these metabolids which the mongoloid cannot utilize, clean out the tissues to provide free passageways, and then supply the nutrients, vitamins, and minerals, each of which had a specific purpose in relation to what he had discovered about the unique mongoloid metabolism. At least 50 different substances which the mongoloid is unable to properly metabolize were isolated and 50 countervailing substances were included in the medications. Turkel kept a constant check on the blood and tissue specimens of the children being treated. Tests showed that the clogging deposits of calcium in the lungs and around the aorta of the heart were greatly reduced. Medical examinations revealed that the patients were breathing easier and more normally, and a more regular heartbeat was reported.

Improvement in the child's ability to learn, take care of himself and accept other training was also noticed.

Positive results were reported for the 200 cases treated with the Turkel formula. However Turkel admitted that while 200 cases are certainly significant, they are too few to represent irrefutable scientific proof of the effects on his formulations, and much more research is needed. Perhaps only part of the treatment is responsible for success, and those ingredients in a concentrated form might be even more successful.

The results of another recent study conducted in Europe suggested that what is considered to be a failing mind is often a failure to get adequate nutrition. M. L. Mitra reported work done in England with the problem of senility in older people. Mitra stated (27):

Among elderly people in countries like Great Britain it is not uncommon to see "subclinical" vitamin deficiency, in contrast to the frank avitaminosis seen in less affluent countries. Like people in some developing countries, many of the elderly tend to live entirely on a diet consisting of potatoes and a few slices of bread and jam.

Mitra presented 28 case histories of patients admitted to a hospital geriatric units in a confused state over a six month period. After measuring the level of ascorbic acid and the B-complex vitamins he found that all the patients

had at least one thing in common, a vitamin deficiency. Many were 80 years of age or older, and had been living alone, and fixing a balanced hot meal alone every day was too much trouble. Of the patients studied, 17 were found to be suffering from thiamine deficiency, two had pellagra (niacin deficiency), seven had low amount of vitamin C, and two others had mixed vitamin deficiencies. Mitra administered mixed vitamins to his patients and reported that in case after case confusional states improved or disappeared. According to Mitra, confusion in older people is often due to a physical illness rather than an underlying psychiatric disorder.

Nathan Masser, a psychaitrist with years of successful experience of treating mental illness caused by an over-active thyroid gland claimed that without the inclusion of a number of vitamins the effectiveness of the thyroid treatment is markedly curtailed(16). Typically the patients suffer from headaches, dizziness, tremors, depression, irritability, forgetfulness, loss of concentration, drowsiness, insomnia, hot flashes, and perhaps impotence. Patients were given a test to determine the level of thyroxine in the blood stream. If the level was more than the patient was able to properly metabolize, thyroid treatment in conjunction

with vitamins B₁, B₂, B₃, B₁₂, and vitamin C was administered. Although Masser was not precisely sure of the role of the vitamins with thyroid extract he claimed that the inclusion of the B-complex and C vitamins was decided upon after trial and error with numerous combinations in many hundreds of cases.

Other Protein Substances

In addition to the vitamins and minerals, certain specific protein acids have been reported to influence brain metabolism. The possibility of such amino acids being important for proper brain activity is suggested by the fact that glutamic acid is metabolized by slices of brain, and that it seemed to increase the activity of mentally deficient children (6).

In discussing the function of glutamic acid, William Vogel and his coworkers pointed out that a considerable amount of evidence indicates a role for this amino acid in proper cognitive behavior. Increased intelligence in both normal and retarded children has been reported (38). According to these investigators there is more sound experimtnal evidence for the positive effects of this amino acid than appears to exist for many of the psychotropic drugs now in common therapeutic use.

Another protein, ribonucleic acid (RNA) has been used to partially correct memory loss in the aged. In a study by Cameron and his coworkers, a group of 38 aged patients suffering from mild to advanced memory defect each received a large dose of RNA intravenously (3). Prior to administration, memory was measured with a battery of instruments including the Wechsler Memory Scale, a counting test, and a test designed to measure several variables of the conditioned reflex. Testing subsequent to the RNA administration revealed that the patients had improved in ability to retain a series of numbers in the counting test and had significantly increased their scores on the Wechsler Memory Scale. The patients also showed a tendency toward acquiring new conditioned reflexes with fewer trials after RNA, and the retention of the reflex was higher. The extension of the reflex, once established, required more trials after RNA. The authors noted that improvement in all the instruments was greater in those cases of mild to moderate memory defect as compared to cases where memory loss was far advanced.

Excessive amounts of certain proteins can be equally as harmful as deficiencies. The disease, phenylketonuria, occurs in children due to a genetic defect that leads to decreased effectiveness in metabolizing the specific amino

acid phenylalanine. Patients on a normal diet have abnormally high concentration of the amino acid causing symptoms of mental deficiency. According to Dr. Linus Pauling, a change in diet to decrease the amount of phenylalanine ingested resulted in alleviation of both the mental and physical manifestation of the disorder (11).

Major Diet Modifications

A considerable amount of recent research deals with the effects which the total diet (including the relative amounts of the major foods--fats, proteins, and carbohydrates, as well as vitamins and minerals) can have on the mental state of the individual. For the optimum total functioning of the individual, the different types of food must be ingested in the proper relative proportions. Evidence also has shown that the optimum proportion of food types varies considerably between different individuals (41:104). Certain individuals characterized by a condition known as hypoglycemia or low blood sugar can experience abrupt and serious consequences because of the wrong types of food in their diet, specifically too much sugar and carbohydrates. Hypoglycemia is due to an overabundance of insulin in the blood which results in a low amount of sugar available for cell metabolism. Although the role of the diet in causing

this condition is uncertain, there is conclusive evidence that an improper diet can aggravate the condition, and, if left uncorrected, can cause any or all of a number of mental symptoms. According to Carlton Fredericks and Herman Goodman, authors of the book Low Blood Sugar and You (4:2):

Low blood sugar causes an unbelievable array of symptoms. It can make a psychiatric wreck out of a normally well-adjusted individual. It can turn a balanced person into an apprehensive hypochondriac. It creates intolerable anxiety, driving the sufferer to the use of tranquilizers or the ministrations of the psychiatrist. It manufactures unjustified fears, internal feelings of shakiness, and adds intolerable nightmares to its own kind of insomnia. The symptoms of low blood sugar not only resemble neurosis of psychosis, they also perfectly imitate epilepsy, migraine headache, peptic ulcer, rheumatoid arthritis, juvenile delinquency, insomnia, asthma, and other allergies. Low blood sugar can create some of the "side reactions" blamed on drugs. It can directly cause alcoholism, and could possibly lead to drug addiction.

Fredericks and Goodman pointed out that hypoglycemia is present in many people but physicians often fail to recognize it. The blood test for identification of hypoglycemia takes up to six hours to administer, and consequently is not a part of the usual medical examination. An investigation of 275 psychiatric patients showed that about one in three suffered from hypoglycemia (17). The complex

changes produced in the human personality by insulin hypoglycemia may be observed daily in almost any service concerned with the treatment of schizophrenia (6). The hyperactive children in Cott's study referred to earlier were found to have a high incidence of hypoglycemia. Cott warned against cola drinks, which may be devastating to the child who tends to be hyperactive (23).

Fredericks and Goodman claimed that their investigations have shown that one out of every ten persons in the general population, and four out of every ten persons with neuro-psychiatric illnesses were suffering from the condition of hypoglycemia. The investigators presented the case of a physician who unknowingly had hypoglycemia (4:16-18):

The physician's name . . . was Stephen Gyland. He practiced medicine in Tampa, Florida, until he fell ill . . . he consulted a specialist, hoping for an explanation for his unprovoked anxieties, tremors, weakness, dizziness, faintness . . . and difficulties with concentration and memory.

The diagnostician told him he was a neurotic . . . Dr. Gyland refused to accept this verdict and consulted another diagnostician, and then another, until he had visited fourteen specialists and three nationally known diagnostic clinics. He now had an assortment of diagnoses and could take his choice among neurosis, brain tumor, diabetes, and . . . (hardening of the arteries of the brain).

Still sick, still unable to work, still without treatment, Dr. Gyland finally happened upon the original paper written on low blood sugar,

learned that he had it, went on the appropriate diet, and watched his symptoms fade away.

Dr. Gyland then went on to diagnose and treat more than 600 of his own patients for hypoglycemia (4:18).

The basic cause for low blood sugar is still not positively known. Fredericks and Goodman suggested it may be any one or a combination of factors including emotional stress, possible genetic influences, or gross overstimulation of the pancreas with too much sugar. The vast overconsumption of sugar in the United States is vividly illustrated by the fact that the steel used in soda-bottle caps in any given year outweighs the steel used in automobile bodies (4:73)!

R. H. Hoffman and E. M. Abrahamson conducted an experiment which demonstrated the role of hypoglycemia as a simulator of neurosis (4:36). The investigators administered a six-hour glucose-tolerance test to 220 patients diagnosed as neurotic, but with certain physical symptoms that suggested the possibility of low blood sugar. Results showed that many of the subjects did in fact have hypoglycemia. Following treatment with a major diet revision three dividends occurred. The physical symptoms faded; the "genuinely" neurotic symptoms also lessened, and the patients

feeling better on both counts, became more amenable to psychiatric treatment.

After demonstrating hypoglycemia to be a complication of genuine neurosis in patients who show physical symptoms of low blood sugar, Hoffman and Abrahamson extended their investigation to neurotics with no physical complaints suggesting low blood sugar. The second group of subjects, unlike the first group, had no craving for sweets, no omnipresent fatigue, and no blackouts. The subjects did have the full panoply of neurotic complaints including depression, fears, and compulsions. The six-hour glucose-tolerance test in this group also revealed an astonishing incidence of mild hypoglycemia. Diet modifications helped these people with their purely emotional symptoms as much as it had aided those in the first group.

The first group of patients, who were neurotic with physical signs of low blood sugar, numbered 220, of whom 205 were found to be suffering from hypoglycemia, and all improved with the dietary treatment. The second group, involving neurotic patients with no physical signs of hypoglycemia, encompassed nearly 700 subjects. In the second group 600 subjects proved to have low blood sugar and similarly responded to the dietary therapy.

In another study, Dr. Harry Saltzer used 300 mental patients as subjects for his experiment in hypoglycemia (17). Patients had previously been treated with sedatives, tranquilizers, and even electro-shock therapy without improvement. Saltzer's treatment consisted of simply changing the diet. In place of sweets and starches the patients ate broccoli, cabbage, brussel sprouts, cauliflower, carrots, and similar vegetables. Some unsweetened fruits such as apples, apricots, berries, and grapefruit were permitted. Soft drinks were forbidden along with coffee since caffeine has considerable effects on sugar metabolism. Saltzer claimed that 85% of the institutional inmates were either greatly improved or entirely recovered because of diet revision.

An impressive and far-reaching approach to the treatment of mental disease by nutritional means has been advocated by George Watson, researcher at the Lancaster Foundation for Scientific Research (41). Watson, who has been involved in psychochemical research for some 20 years, proposed the theory that there are actually two basic psychochemical types of individuals, the slow oxidizers and the fast oxidizers, a particular diet which causes beneficial effects in one type may result in detrimental effects in the opposite type.

Watson's initial research was similar to much that has already been reported in the present paper. The basic assumption was that the absence of one or more vitamins and minerals could play either a primary or secondary role in some neuroses and psychoses. In one of the earlier studies conducted by Watson and Currier, out of 30 emotionally disturbed subjects, 24 improved, five remained unchanged, and only one subject became worse following treatment with a nutritional formula (40). However, the fact that clinical treatment with vitamins and minerals did in some cases make mentally ill patients more ill, was still apparent. Watson stated (41:150):

It was frequently found that two Ss (subjects), paired as closely as possible for age, sex, duration of illness, clinical symptoms and psychological test scores, would respond differently to an identical combination of vitamins and minerals, one improving markedly with the other becoming much more ill. In the latter case, discontinuing the treatment generally resulted in improvement within a few days.

Concern over such contradicting responses led to trial-by-error clinical tests to determine the possibility of separating the major vitamins and minerals into groups. Groups were decided according to the effects on major symptoms such as anxiety, depression, or paranoid reactions. Certain individual substances were also found to both worsen

or improve various symptoms in different individuals. Extensive exploratory trials were performed over a period of several years with the principal vitamins and minerals, utilizing over 200 mentally ill subjects who had various psychological disorders. Based on the research results, two basic types of mentally ill subjects and two basic classes of vitamins and minerals were established. "Type I" subjects responded favorably to "Type I" vitamins and minerals and unfavorably to "Type II" vitamins and minerals. "Type II" subjects had just the opposite response.

More recent studies conducted by Watson have shown that Type I individuals have a significantly lower concentration of carbon dioxide in the blood than do Type II individuals, suggesting a basic difference in rate of metabolism between the two. In one study involving 10 Type I individuals (treated with Type I formula) and 10 Type II individuals (treated with Type II formula), 55% (11 of the total 20 subjects) were classified as showing clinical remission of symptoms, 25% showed marked reduction in intensity of symptoms, and the remaining 20% showed noticeable reduction in intensity of symptoms.

The Type I individuals benefiting from the treatment showed an increase in carbon dioxide content of the blood,

suggesting that the combined effect of the Type I treatment was to increase the rate of metabolism. The original mental symptoms were therefore assumed to be related to a low rate of metabolism and the Type I individuals were labeled as "slow oxidizers." Improvement in the Type II individuals was accompanied by a decrease in carbon dioxide in the blood suggesting an initial high rate of metabolism which was reduced by the Type II group of vitamins and minerals. The Type II individuals were referred to as "fast oxidizers."

According to Watson, both the slow oxidizers, who do not metabolize foods fast enough, and the fast oxidizers, who burn up sugars rapidly but inefficiently have serious metabolic upsets which result in a number of physical and mental symptoms. Psychological stress further decreased the oxidation rate in slow oxidizers and had the opposite effect in fast oxidizers.

Watson recommended vitamins and minerals in conjunction with major diet revisions as the principal means for alleviating the symptoms which accompany these conditions. A high-protein, high-fat, and low-carbohydrate and sugar diet was recommended for the fast oxidizer, pointing out the obvious similarity to the condition of hypoglycemia. Watson stated that persons suffering from low blood sugar are

included in the fast oxidizers. Watson's hypothesis on the two distinct psychochemical types, though still controversial, is rapidly gaining more interest in the fields of medicine, nutrition, and psychology.

Alcohol and Drugs

As mentioned earlier in this paper, alcohol and drugs can interfere with the intake of sufficient nutrients. Poor eating habits are likely to drastically reduce the heavy drinker's vitamin intake. A study of 3,000 alcoholic patients showed that dietary deficiencies occurred during periodic bouts of excessive alcohol intake in about 40% of the subjects, prolonged dietary deficiency alternating with a normal dietary period was present in 25%, and the remaining 35% were characterized by continuous dietary deficiency (10).

Alcoholics are severely threatened by thiamine (B_1) deficiency. According to Tomasulo, thiamine deficiency syndromes in the United States occur almost exclusively in alcoholic patients and can usually be attributed to poor dietary intake of the vitamin. However, Tomasulo conducted one study to determine if thiamine deficiency can occur, even though apparently adequate amounts were present in the diet of alcoholics. The subjects for the study were 20 patients and 10 non-alcoholic controls. A highly significant

impairment of thiamine absorption was found in the alcoholics as compared to controls, suggesting that malabsorption of thiamine is also of considerable influence in causing deficiency of this vitamin in alcoholics (37).

Vitamins are also needed in greater amounts to repair alcohol-damaged tissues. The B vitamins are necessary for cell replication, and vitamin E helps to diminish liver upsets that occur during heavy ethanol intake. A marked deficiency in either nicotinic acid or riboflavin interferes with alcohol oxidation rate and removal from the body (10).

Though excessive alcoholism can cause dietary deficiencies, research conducted by Roger Williams of the Clayton Biochemical Foundation suggested that alcoholism may merely be a perverted response to a drastically deficient diet caused by abnormal metabolic requirements (4:101). Williams administered high doses of vitamins to alcoholic subjects and reported that following the treatment, some were able to refuse drinks or even take one drink and yet refuse a second. Fredericks and Goodman also reported that in treating patients for hypoglycemia, they encountered several alcoholics who responded with an ability to reject alcohol entirely following the use of a low-blood-sugar diet.

A prominent American educator, Reverend George von Hilsheimer reported of his success in using megavitamin therapy, with emphasis on niacin, for the treatment of drug abuse and other behavioral problems in clinical environments. Von Hilsheimer and his associates have been involved in crisis centers for alcohol and drug abuse since 1957. Supportive care which included the administration of vitamins has been used extensively. Since 1967, megadoses of niacin have been recommended to all centers and all consultations.

In Reverend von Hilsheimer's opinion juvenile drug abusers have a better chance of breaking their habit if their internal chemical balance is restored to normalcy. In attempts to treat drug addicts an often overlooked fact is that internal damage is likely to have already been done, and the bodies of the abusers may be in dire need of repair before normal development can be resumed. Many LSD users are aware that a bad hallucinogenic experience or "trip" can be alleviated and possibly dispelled completely by taking a megadose of the vitamin, niacin, suggesting that a possible way of fighting drug abuse is to saturate the body with ingredients that will return it to a state of proper functioning.

At Reverend von Hilsheimer's Green Valley Schools, the use of niacin has given dramatic results in detoxification and reduction of post intoxication reactions. Particularly in the cases of LSD psychoses, maintenance on niacin has discouraged repetition of drug abuse. Diet control plus the administration of megavitamin doses of vitamin C, E, and the B complex is considered a valuable asset in the drug program. According to Reverend von Hilsheimer (42):

Our position is that so-called addiction is a learned response which can be unlearned . . . That response can be replaced by a new learned response, and this new response will be enhanced if the body is made healthy. In addition many of the drugs are themselves toxic, and users cannot be completely rehabilitated without megavitamins.

Though confident of the effectiveness of large doses of vitamins for drug abusers, von Hilsheimer pointed out that such therapy is given in conjunction with psychological encouragement so that the effects of the vitamins alone cannot be precisely measured. Von Hilsheimer reported personal observations of megavitamin therapy aiding recovery from drug addiction, or from an individual drug experience, involving amphetamines, the hallucinogens, heroin, and sometimes barbiturates, with little or no indication of withdrawal symptoms. While some of the drugs were not addicting

in the common sense, they had become a psychological crutch, and megavitamins afforded both immediate and short term relief from the distress.

The cases mentioned by von Hilshemier included a 17 year-old boy who had begun to use heroin at the age of twelve. Within two years under intense dietary restrictions and megavitamin therapy, the boy was responsible enough to hold down a job, and became a successful businessman. Another boy 16 years old, hypoglycemic and highly allergic, came under von Hilshemier's supervision after having used amphetamines steadily for about four years. Within two years of starting the dietary approach, the boy was released and became a student at a prestigious eastern college.

When drugs are abused or even when excessive sugar is eaten, body chemistry is upset and the result is abnormal mental and physical functioning. Every child entering Green Valley Schools undergoes a glucose-tolerance test along with many other tests for salt, ascorbic acid, and allergies. Research at the school has shown that 86% of the inmates show blood sugar curves indicating hypoglycemia.

Fasting

While Americans have been attempting to correct abnormal metabolism by administering vitamins and minerals and adjusting diets, a Russian scientist has pursued a different path and has also claimed satisfactory results. Dr. Uri Nickolayev's treatment for schizophrenia by controlled fasting is reported to have improved many of the patients treated. A prominent American doctor and practicing psychiatrist, Allen Cott, M. D., reported his findings after a trip to the Soviet Union to interview the Russian physician, who had been using and refining the fasting technique through 23 years of research and clinical experience (26).

According to Dr. Cott's report, fasting therapy required that the patient stop eating solid foods for 20 to 30 days. The fasting was done under close medical supervision and included other necessary measures. The patients could drink as much water as desired, but no less than a quart a day. Breathing exercises, outdoor walks, and other exercises were an essential part of the treatment, and were performed for a minimum of three hours every day. Baths, showers, enemas, and massages were also part of the daily regimen.

The typical patient, after 28 days of fasting, lost 15 to 16% of his starting weight, but was not starved. Skin color and muscle tone improved, and mental outlook became healthier. Professor Nickolayev claimed that the effects of the therapy were (26):

While leading to acute exhaustion, fasting serves as a powerful stimulus to subsequent recuperation.

Fasting ensures rest of the digestive tract and the structures of the central nervous system which receives stimuli from the chemo and interoceptive analyser. The rest helps to normalize function.

Acidosis provoked by fasting and its compensation reflects a mobilization of detoxifying defense mechanisms which probably play an important role in the neutralization of toxins associated with the schizophrenic process. As the acidosis decreases, the blood sugar level rises.

Dr. Nickolayev found more than 64% of the schizophrenics treated to be helped by this therapy. After their release, patients ate a restricted diet or else suffered a relapse. When patients left the hospital, they were advised to fast from three to five days, but not more than a total of 10 at various times throughout the month. A patient, stopped fasting, when appetite was regained, the tongue became clean, and symptoms disappeared.

Summary

A review of numerous investigations and findings pertaining to the successful treatment of mental illness with nutritional means has been presented. The array of treatments explored ranged from near starvation to the use of complete diet alterations, with a variety of treatments on a continuum, involving one or a group of vitamins and minerals. Among the mental problems treated in the studies reviewed, were neurotic and psychotic behaviors (including depression, anxiety, irritability, insomnia), senility in aged people, drug abuse, alcoholism, and mongolism, hyperactivity, and learning disabilities in children.

While many of the investigators claimed conclusive evidence of their results based on scientifically conducted research endeavors, some of the findings presented were primarily professional's opinions based on years of personal experience. A brief discussion of some possible reasons for nutritional deficiencies and some physiological conditions associated with decreased mental functioning were also presented as an aid to better understanding the studies reviewed.

CHAPTER III

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A considerable amount of literature pertaining to nutrition and its effects on mental health has been presented. In Chapter III the highlights of the literature reviewed are summarized. The summary is followed by a section on pertinent conclusions derived from the investigation. Several personal recommendations by the investigator are given in the final section.

Summary

A substantial body of evidence has been presented regarding the beneficial effects of vitamins, minerals, and proper nutrition on mental functioning. Information was derived from primary sources, such as professional journals and original research reports, as well as secondary sources which included magazine articles and various books. The research sources were limited to the Montana State University library during the summer of 1972. The primary purpose of the investigation was to present an organized review of recent research and experimental endeavors in the area of psychochemistry, and in megavitamin therapy as it relates to mental health.

Studies reviewed included a large number of individual treatment procedures and an equally diverse assortment of mental symptoms that were treated. The B-complex vitamins were reported to have greatly improved such conditions as schizophrenia, migraine headaches, and depression. Increase in mental ability also was claimed as a result of B vitamin intake. Vitamin E reportedly had beneficial effects on the attitudes of mentally retarded children and was instrumental in correcting senility in aged individuals. Anxiety, insomnia, and other undesirable mental symptoms were effectively treated with various mineral supplements, and formulas containing both vitamins and minerals were claimed as valuable in treating mongoloid and hyperactive children.

General diet revisions, involving major changes in the relative amounts of proteins, fats, and carbohydrates, in conjunction with large doses of certain vitamins and minerals, were reported to beneficially change the behavior of neurotic and psychotic subjects. Behavior of the subjects included juvenile delinquency, alcoholism, drug addiction, and schizophrenia. Controlled fasting was also discussed as a treatment for certain psychotic symptoms.

Evidence was presented which indicated that mentally ill adults and children may have markedly atypical metabolism

with regards to the vitamins, minerals, and other food substances. Possible causes for the abnormal metabolic processes, including genetic, emotional, and dietary reasons, were presented as an explanation for the frequency of nutritional deficiency.

Conclusions

The late and greatly-admired psychotherapist, Abraham Maslow, remarked that the best way to obscure the higher motivation, and self-actualizing potential of a man is to keep him chronically hungry (2:74). Maslow's statement has profound implications for anyone concerned with the total development of either the individual or mankind as a whole. Man's basic physiological needs must be satisfied before his creativity, understanding, and unique spirituality can become fully evident.

Literature reviewed in this paper has illustrated Maslow's statement with conclusive evidence. Inadequate nutrition can have profound effects on the physical, and consequently the mental, processes of the individual. Mental illness can frequently result from physiological as well as psychological causes, and neglecting the somatic elements essential to the existence of the whole person can only

result in a further separation between the science of psychotherapy and the physiological sciences.

The results of the investigations reviewed herein are extremely impressive. A major proponent of the orthomolecular approach to mental health, Abram Hoffer, stated frankly (29):

Without exception, every psychiatrist who has used the orthomolecular approach as described . . . has become very impressed. Any psychiatrist who begins with a cohort of 100 acute schizophrenics and follows the orthomolecular approach for a sufficient period of time, say three years, will find that 90% of his patients are well, the rest are improved, none will be worse.

Hoffer's confidence and enthusiasm seem typical of many of the megavitamin therapists.

However, the critical reader may be faced with the question: How much of the claimed success for the nutritional treatment of mental disturbance is actually scientifically sound? Admittedly, in many of the investigations discussed, results were not supported by adequately designed experimental data, an obvious shortcoming of the paper. In some cases the original experimental procedures and results simply were not available. However, a major value of the investigation lies in the interest which it, hopefully, may stimulate in others. The uncertainty of some of the results

reported may prove to be an incentive for further exploration in the sincerely interested reader.

The fact that both physical and mental deterioration results from situations of extreme malnutrition is obvious and needs no further proof. Severe early nutritional deficiencies can even reduce total brain weight. Whether permanent damage results from such malnutrition is still questionable (5,33). In the research endeavors reported in the present paper, however, the malnutrition situations were generally a subtle, less obvious physiological hunger due to deficiencies of a few specific essential substances. Yet in light of the evidence presented, there is substantial proof that certain vitamins, minerals, and proteins must also be present in adequate amounts in order for the brain and nervous system to function to its fullest capacity.

The information reported herein is in no case sufficient justification for using any specific treatment as a means of correcting mental symptoms in patients. Any practitioner considering such an approach should make a much more extensive review of the research. Overmedication of any kind can be harmful. For example, a person can be killed from drinking too much water, an ancient Chinese method of execution.

The counselor willing to take the time and effort to become knowledgeable in the area of nutrition can find in such knowledge a valuable tool to be included with his psychological means for helping the total person. There are millions of emotionally sick and mentally discomforted people who need psychotherapeutic help. There are also many physically sick people who have been told that their illnesses are all in their minds. Practitioners must not forget that "psychomatic" is a word that has its reverse: "somatopsychic." But rather than spend time worrying about which came first, the "psycho or the somato" professional people will do well to remember that the two are so interdependent that their effects cannot possibly be separated, even though attempts are made to treat them as independent aspects of the person. The healthy person is the one whose organismic oneness and unity is radiated in his entire physical, emotional, intellectual, and spiritual existence.

Recommendations

In consideration of the literature reviewed, and in an effort to encourage further investigation into the area of nutrition as it relates to mental health, a number of recommendations are presented by the author. General recommendations are as follows:

- that continued scientific investigations dealing with the effects of nutrition on mental health be conducted.
- that further exploration into the available research on megavitamin therapy and psychochemistry be undertaken by persons interested in the optimum functioning of the individual.
- that anyone considering the use of vitamin therapy as a tool to their professional treatment of people do so only after they have a thorough understanding of nutrition and physiology.
- that a community-information program on nutrition be instigated to better inform citizens of the value of proper diet as it relates to mental health.
- that the original research of the studies regarding megavitamin therapy be located and carefully analyzed on a statistical basis.

Specific recommendations are as follows:

- that counselors personally discuss nutritional status and eating habits with all clients.
- that counselors become aware of physicians and other specialists in the community who are sympathetic to the use of vitamins and nutrition as a means of treating patients.
- that counselors recommend a complete medical examination including the six-hour glucose-tolerance test, to any client whose case even remotely suggests possible dietary deficiencies.
- that the counseling procedures common to orthomolecular therapy be thoroughly investigated and applied to selected clients and the results be subjected to proper analysis.
- that the various dietary habits of specific clients in geographically deficient areas be described in detail in order to determine possible mental health implications.

- that an extensive investigation be conducted concerning the effects of emotions on metabolic processes, in particular the long term effects of excitatory assertive exercises on blood chemistry.

A final and sincere recommendation is given:

- that those students still dreading their professional paper as an insurmountable task would do well to remember the words of Cinderella's little fat fairy godmother: "Impossible things are happening every day" (43).

SELECTED REFERENCES

1. Bell, Elizabeth C., "Nutritional Deficiencies and Emotional Disturbances," The Journal of Psychology, 45:47-74, January, 1958.
2. Blocher, Donald H., Developmental Counseling. New York: Ronald Press, 1966, viii-250 pp.
3. Cameron, Ewen D., and Others, "Effects of Ribonucleic Acid on Memory Defect in the Aged," The American Journal of Psychiatry, 120:320-325, October, 1963.
4. Fredericks, Carlton, and Herman Goodman, Low Blood Sugar and You. New York: Constellation International, 1969, xvii-190 pp.
5. Frisch, Rose E., "Present Status of the Supposition that Malnutrition Causes Permanent Mental Retardation," American Journal of Clinical Nutrition, 23:189-195, February, 1970.
6. Gildea, Edwin F., "Biochemical Research in Psychiatry," The American Journal of Psychiatry, 105:308-310, October, 1948.
7. Hoffer, Dr. Abram, as transmitted to Joseph T. Desilva, "A Project to Demonstrate the Superiority of the Orthomolecular Treatment of Schizophrenia," Saskatoon, Canada, May 4, 1971 communication.
8. Kline, Nathan S., "The Practical Management of Depression," The Journal of the American Medical Association, 190:732-740, November 23, 1964.
9. Krehl, Williard A., "Magnesium," Nutrition Today, 2:16-20, September, 1967.
10. Leevey, Carroll M., and Herman Baker, "Vitamins and Alcohol," The American Journal of Clinical Nutrition, 21:325-328, November, 1968.
11. Pauling, Linus, "Orthomolecular Psychiatry," Science, 160:265-271, April 19, 1968.

12. Peterman, Robert A., and Others, "Current Status of Vitamin Therapy in Nervous and Mental Disease," The Journal of Clinical Nutrition, 2:11-21, January and February, 1954.
13. Roberts, Sam E., "Minerals and Vitamins as They Function in the Human Body," Prevention, 22:133-145, August, 1970.
14. Rodale, J. I., Rodale's System for Mental Power and Natural Health. New York: Pyramid Books, 1966, 157 p.
15. ———, Editor, "Traces of Beryllium Can Kill," Prevention, 21:68-71, June, 1969.
16. ———, Editor, "Detoxified Thyroid Helps Mental Illness," Prevention, 21:57-60, August, 1969.
17. ———, Editor, "Proper Diet--Best Known Approach to Depression," Prevention, 21:61-67, August, 1969.
18. ———, Editor, "B₁ and Mentality Go Together," Prevention, 22:35, 36₁, 38, 44, and 46, March, 1970.
19. ———, Editor, "Magnesium Finally Attracts Attention," Prevention, 22:90-92, March, 1970.
20. ———, Editor, "A Treatment for Mongolism--Stymied by FDA," Prevention, 22:61-67, March, 1970.
21. ———, Editor, "Vitamin B₃ (Niacin) Aids Subclinical Pellagra," Prevention, 23:130-132, January, 1971.
22. ———, Editor, "Eating Right Will Help You Sleep at Night," Prevention, 23:142-144, 146, 147, 150, and 151, April, 1971.
23. ———, Editor, "A Hyperactive Child Needs Nutrients, Not Drugs," Prevention, 23:167-176, April, 1971.
24. ———, Editor, "How Children Are Cured of Learning Disabilities," Prevention, 23:177-184, April, 1971.
25. ———, Editor, "Migraine, Menier's, and Mealtime," Prevention, 23:116-125, August, 1971.

26. Rodale, J. I., Editor, "Fasting Can Control Schizophrenia," Prevention, 23:197, 198, 200, and 201, August, 1971.
27. ———, Editor, "Senile or Merely Vitamin B Deficient," Prevention, 23:175, 178-180, 182-184, 186, and 187, October, 1971.
28. ———, Editor, "Bone Meal Can Relieve Anxiety," Prevention, 23:69-74, November, 1971.
29. ———, Editor, "The Vitamin for Disturbed Children," Prevention, 24:212-221, January, 1972.
30. Rogers, Carl R., Counseling and Psychotherapy. Cambridge, Massachusetts: Riverside Press, 1942, xiv-450 pp.
31. ———, Client-Centered Therapy. Cambridge, Massachusetts: Riverside Press, 1951, xii-560 pp.
32. Rorvik, David M., "How Your Diet Can Affect Your Mind," McCall's. 99:39, 41, 42, 44, 46, 154, and 155, April, 1972.
33. Rosso, Pedro, and Others, "Changes in Brain Weight, Cholesterol, Phospholipid, and DNA Content in Marasmic Children," The American Journal of Clinical Nutrition, 23:1275-1279, October, 1970.
34. Salter, Andrew, Conditioned Reflex Therapy, New York: Capricorn Books, 1961, x-340 pp.
35. Spencer, Mike, Managing Editor, "Niacin: Hope for Schizophrenics," Let's Live, September 1971, pp. 11c, 12c, 13c 15c, 16c, 36c, 37c, and 47c.
36. Spies, Tom D., "Some Recent Advances in Nutrition," The Journal of the American Medical Association, 167:675-690, June 7, 1958.
37. Tomasule, P. A., and Others, "Impairment of Thiamine Absorption in Alcoholism," The American Journal of Clinical Nutrition, 21:1340-1344, November, 1968.

38. Vogel, William and Others, "The Role of Glutamic Acid in Cognitive Behaviors," Psychological Bulletin, 65:367-382, June, 1966.
39. Wade, Carlson, The Rejuvenation Vitamin. New York: Award Books, 1970, x-188 pp.
40. Watson, George, and W. D. Currier, "Intensive Vitamin Therapy in Mental Illness," The Journal of Psychology, 49:67-81, January, 1960.
41. _____, Nutrition and Your Mind--The Psychochemical Response. New York: Harper and Row, 1972, xiv-170 pp.
42. Wolf, Ray, "He Treats Addicts by Building Health, Prevention, 24:99-103, March, 1972.
43. Zover, Thankgodit, and I. M. Stilaleiv, "Nothing is More Precious than this Moment," Amen, Montana State University, July, 1972.