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Nutrient Deficiencies

The branch of psychiatry that deals with the psychological effects of common nutritional deficiencies is called orthomolecular psychiatry. The avant garde group of psychiatrists who use this approach evaluate and treat many mental symptoms and illnesses from a nutritional point of view.

Even Freud, if he were alive today, would likely recognize and commend these methods. In his later years, when vitamins and minerals were first being identified and studied in earnest, he wrote, "The future may teach us to exercise a direct influence, by means of particular chemical substances, upon the amounts of energy and their distribution in the mind. . . . I am firmly convinced that one day all these disturbances we are trying to understand will be treated by means of hormones or similar substances."

ORTHOMOLECULAR THERAPY

Nobel Laureate Dr. Linus Pauling coined the term "orthomolecular." He defines it as "the treatment of mental disease by the provision of the optimum mo-

lecular environment of the mind, especially optimum concentrations of substances normally found in the human body."

The rationale behind the orthomolecular approach is the following: there is ample evidence, as described in Part I, that some psychologically disturbed people have unusual or abnormal metabolism of one or more vitamins, minerals, amino acids or essential fatty acids. These people often have nutrient needs above the average and far above the "minimal" standards set in the RDA. Some researchers have described these states of increased need as a vitamin dependency syndrome.

Even the general so-called healthy population has demonstrated individual biochemical diversity and a consequent wide range of daily nutrient needs. You may flourish on 5 mg of vitamin B₆ daily, while your neighbor may need 500 mg to achieve the same results. The average American diet is deficient in several nutrients by RDA standards and even more so by optimum health standards. Many life habits or conditions either interfere with absorption or utilization or use up excessive amounts of certain nutrients.

There is sufficient clinical evidence that inadequate vitamin levels initially cause a depression of the vitamin enzyme activities. These enzyme activities facilitate most of the chemical reactions in our bodies. When they are malfunctioning, the first symptoms produced are those of subtle psychological and physical impairment rather than the full symptom complex of a frank deficiency syndrome.

RDA VERSUS OPTIMAL LEVELS

In using nutritional treatment, I make a clear distinction for my patients between the RDA and opti-

mal nutrient levels. The RDA is the *minimum* amount necessary to avoid a deficiency illness, but is not the recommended amount for good health.

Plain common sense tells us that what we need to keep from being ill is different from what we need for the best of health. The amount of food needed to keep us from starvation is quite different from that required for our ideal weight, in the same way that the amount of water and fertilizer which keeps a rose bush alive is hardly enough to produce a plant resplendent with aromatic, opulent bloom.

But the rose can receive too much water and fertilizer. Quantities and balance are extremely important. There are optimum dosages beyond which beneficial effects diminish, and even harmful effects can occur. It is wise not to exceed these dosages.

FOOD ALONE IS RARELY ENOUGH

Even by conservative RDA standards, the average American diet is commonly deficient in vitamins B₁, B₂, B₆, folic acid, C, E and iron. Naturally, other deficiencies also occur. Only the rare "balanced diet" of the best natural, unrefined, unprocessed, wholesome foods has a possible chance of meeting all of our nutritional needs. And how many of us daily eat the following traditional idea of a balanced diet?

1. Four portions of whole grain products
2. Four portions of fresh fruits and vegetables (with at least one of each being uncooked)
3. Two portions of meat products (or fish, poultry, eggs, beans, peas or nuts)
4. Two to three portions of milk or milk products

I know I would be fat if I ate this much every day, and such a diet excludes vegetarians, those who must restrict cholesterol, those on calorie-restricted diets, those with allergies and many others.

Computer analyses of hundreds of patients' food intake has revealed no diet with fewer than three to four nutrient deficiencies by RDA standards and even more deficiencies by optimum measurements. I personally have tried eating a variety of healthy, seemingly balanced diets only to find that my diet remains stubbornly deficient after all. Further, *I have never seen a single patient whose diet tested adequately in all the B vitamins at RDA levels.* Worse, they rarely test at the optimum level in even *one* of the several B vitamins.

These dietary analyses have also revealed the following trends:

1. Low complex carbohydrates
2. High refined carbohydrates
3. High protein (but unbalanced amino acid intake)
4. High fat
5. Low fiber
6. Low vitamin B complex
7. Low vitamin C and bioflavonoids
8. Variable amounts of minerals, but generally low magnesium

Any one of these trends is undesirable. Put several of them together, as is usually the case, and we're just a short step from creating the biochemical imbalance that can cause mood changes and other health problems. Many of us are more careful about giving our animals the proper diet than we are about what we feed ourselves. It is truly a tribute to the adaptive capacity of the human organism that we do as well

as we do, although several large population studies have revealed that 80 percent of us suffer from some sort of "dis-ease."

There is a tremendous amount of scientific data to support these observations and it has frustrated me at times to see bestselling books by novices in the field saying the opposite, that what you eat is sufficient for your needs. There really should be no controversy. In lieu of faddish reading, please refer to the appendix for a list of excellent books on nutrition written by experts with years of training and experience in biochemistry, clinical practice and research.

Rarely does food alone supply an "adequate," let alone "optimal" amount of all the different essential nutrients. Also, there are many "elective" circumstances that necessitate greater than usual amounts of certain nutrients, circumstances that interfere with absorption and metabolism, procedures for food growth and processing that deplete the nutrients in your food, and so on. For instance, if you are a smoker each cigarette causes your body to utilize 25 mg of vitamin C—at one and a half packs daily that would be 750 mg of vitamin C just to break even, without having any left over for the multitude of bodily functions related to vitamin C. When you consider that the average diet I see contains from 100 to 300 mg of vitamin C, you get some idea of the potential for deficiency.

HABITS AND CONDITIONS

Any of the following can create a similar increased need for one or more nutrients and hence can lead to deficiencies.

1. Stress (who is excluded from this?)
2. Excess caffeine (more than one cup of coffee a day—see page 144) or alcohol (more than two drinks daily)
3. Excess sugar or other refined carbohydrates such as white flour, pastas, etc.
4. Tobacco use
5. Street drug use (such as cocaine, heroin, amphetamines, marijuana)
6. Regular use of aspirin, sleeping pills or tranquilizers
7. Use of birth control pills
8. Use of certain prescription medications (See page 150)
9. Dieting for weight loss, exclusion diets for food allergies or special diets for various illnesses
10. Vegetarianism
11. High fiber or phytate diets
12. Exposure to pesticides via water, air or food, and other pollution
13. Work with chemicals (painting, gardening, photo developing, etc.)
14. Drinking chlorinated or fluoridated water
15. Pregnancy or nursing
16. Puberty
17. Old age
18. Physical illness, especially: cancer, anorexia nervosa, burns, post-surgery or post-trauma, diabetes, chronic kidney or liver disease, any kind of gastrointestinal disorder, infections and inflammations, psoriasis, AIDS or ARC, and intestinal parasites

WHICH NUTRIENTS CAN INFLUENCE YOUR MOOD?

It is probably safe to say that all of the essential nutrients needed by our bodies are also needed by our brain cells. An inadequate supply of any will cause some aberration in brain function, however

subtle. Still, as we saw earlier, certain substances are more related to mood control than others. Especially important are:

- The amino acids tyrosine or phenylalanine, and tryptophan
- The B vitamins—in particular, B₆, folic acid and biotin
- Vitamin C
- The minerals (as enzymes)—magnesium, zinc, iron, copper, and manganese
- Pancreatic enzymes

In addition to the above brain amine forming nutrients, vitamins B₁, B₂, B₃, B₅ and B₁₂ also influence your mood by different mechanisms.

Each nutrient has multiple bodily effects, but our focus is on the role of these particular nutrients in orchestrating your moods, on how to determine if you have specific deficiencies, and how to go about correcting them. The charts beginning on page 241 in the Appendix summarize this information.

VITAMINS AND MOOD

The B Vitamins

The first clinical effects of insufficient vitamin B complex are mood changes, insomnia, changed appetite, sugar craving, impaired drug metabolism and a decrease in immune function.

The B vitamins are “synergistic” with each other, which means that each one works best in the presence of an adequate amount of all the others. Therefore, a distinct deficiency of any of the B vitamins can partially impair the effectiveness of the rest. Also, an excess or toxicity of any B vitamin is more likely to occur if it is taken singly, without the addition of the entire vitamin B complex group. Different manufac-

turers use varying ratios of B's in the vitamin B complex supplements. What is important is that the vitamins all be present in sufficient workable quantities, rather than in absolutely equal amounts.

As a group, the B vitamins play an important role both in alleviating depression and in relieving the anxiety and restlessness which often accompanies it, perhaps partly because of the effect of the B vitamins on lactic acid. Exercise and certain metabolic processes cause the formation of lactic acid when there is inadequate vitamin B complex or oxygen. It is this accumulation of lactic acid in your muscles that makes them sore if you strenuously exercise without gradually building up to it. Excess lactic acid can also produce anxiety.

Vitamin B₆ (Pyridoxine)

Vitamin B₆ has major importance in regulating your moods, and is the most implicated of all the vitamins in the cause and treatment of depression. Depressed persons show evidence of insufficient vitamin B₆ as commonly as they show decreased tyrosine, phenylalanine or tryptophan.

Without adequate vitamin B₆, the amino acids are not much use to you. Vitamin B₆ literally controls all the amino acid metabolism and transformations in your body. It also regulates amino acid absorption from your gastrointestinal tract and directly participates in carbohydrate and fat metabolism as well as in the formation of red blood cells and antibodies. It is also required for the proper functioning of over sixty enzyme systems in our bodies.

As previously mentioned, the American diet tends toward high protein and high fat. This creates a greater requirement for vitamin B₆. But the average daily diet only contains about 2 mg of this vitamin. This supply is further depleted by stress, alcohol,

tobacco, birth control pills, pregnancy, antibiotics and many other medications.

It is important to take the active coenzyme forms of the B vitamins for these vitamins to function adequately. Many supplements contain the inactive pyridoxine, or pyridoxine hydrochloride, form of B₆, which your liver must convert to a usable form. If, for whatever reason, this conversion does not take place, B₆ cannot be used by your body.

In 1983 there was an uproar in the press about so-called toxic problems with vitamin B₆. These were reported in a few self-medicated individuals who took 1000 to 6000 mg daily over a period of two to forty months, without adding in other B vitamins or a multivitamin mineral. This amount of B₆ taken alone over that period of time would create a severe imbalance and interfere with the other B vitamins. The reversible neurological side effects experienced with these megadoses were theorized to be the result of vitamin B₆ toxicity, yet toxicity was never proven, and more likely contributors were the multi-B vitamin deficiencies and magnesium depletion, which would occur on such a lopsided program. Some researchers also feel the symptoms were related to taking the B₆ in the inactive pyridoxine form rather than in the usable coenzyme form mentioned above.

The message is simple: only take vitamin B₆ when you are also taking vitamin B complex and keep the dosages somewhat proportionate. If you stay within the limits recommended in this book, you should have no problems. Remember the rule is one of *balance*.

Vitamin B₁ (Thiamine)

This vitamin is essential for nerve stimulation, and for metabolism of carbohydrates to give brain energy

as well as body energy. It is also needed for the synthesis of the neurotransmitter acetylcholine.

Vitamin B₁ is commonly deficient because stress, alcohol, sugar, refined carbohydrates, and particularly caffeine, deplete our bodies of this nutrient. For instance, research on rats showed that daily consumption of tea for twenty-five weeks produced a 60 percent decrease in total brain B₁.

You can suspect a deficiency of vitamin B₁ if, in addition to low mood, you have at least five of the following: chronic fatigue, irritability, memory loss, personality changes (including aggression), insomnia, anxiety, restlessness, night terrors, appetite loss, sensitivity to noise, numbness and tingling in your hands and feet, and circulation problems—and no other explanation for your symptoms has been found.

If you have five or more of these symptoms, consider doubling the vitamin B complex dosage on page 56, and add an extra 200 to 500 mg of daily vitamin B₁ for the first three months of the program. Carefully follow the whole program as outlined.

Vitamin B₂ (Riboflavin)

Vitamin B₂ is important in all the cell energy systems in your body, especially in assisting in the metabolism of proteins, carbohydrates and fats. Together with vitamin B₁, it promotes the effectiveness of thyroid hormone and insulin, both of which can influence your mood. It is also related to the stress response.

Although vitamin B₂ itself has not generally been associated with emotional states, researchers find that diets restricted only in riboflavin produce adverse personality changes, including aggressive personality alterations, as the first symptom of dietary inadequacy.

Riboflavin indirectly participates in amino acid

metabolism because it is necessary for your liver's activation of vitamin B₆ into the form your body can utilize. Taking a large amount of the pyridoxine form of B₆ without having sufficient B₂ for this conversion will do you little good and is another example of the need for balance among the B vitamins.

Vitamin B₃ (Niacin)

Niacin deficiency has been associated with depression and anxiety. One link may be that niacin can be formed from tryptophan. If there is a dietary deficiency of niacin or an unusual need for it, tryptophan may be used to make niacin, leaving less of it available to form serotonin, one of the neurotransmitters implicated in depression.

Niacin works with vitamin B₁ to help with the oxidation of sugar and to promote proper brain metabolism. It helps to maintain our energy by degrading carbohydrates, fats and proteins and participates in the manufacture of certain hormones and proteins. It helps with irritability and other mental disturbances, binding to the same "receptor sites" in the brain as do the tranquilizers Librium and Valium, and producing a similar calming response.

With mood disorders I generally do not prescribe any more vitamin B₃ than is present in the vitamin B complex and multivitamin mineral capsules, unless an individual is severely agitated, anxious or has an associated form of schizophrenia. In some cases high dose niacin in the niacinamide form can actually create a side effect of depression, so it is important to avoid daily doses of niacinamide over 500 mg unless there is a clear indication for it. Vitamin B₃ in very high doses is one of the basic orthomolecular therapeutic agents successfully used in treating schizophrenia, together with other nutrients, especially vitamin C and the other B vitamins. There are many

publications available on this treatment that can be obtained through sources in the appendix.

Supplemental vitamin B₃ comes in both a niacin and a niacinamide form. The niacin form can cause nonharmful temporary skin flushing, itching and nausea in some individuals. These side effects can be decreased by using a time-release pill. It can also slightly raise blood sugar and aggravate ulcers, so if you have diabetes or ulcers, refrain from large doses of niacin. The niacinamide form does not cause flushing or stomach irritation or other side effects at this dosage of 500 mg.

Vitamin B₅ (Pantothenic Acid)

Vitamin B₅ is a precursor essential for the formation of certain hormones and for certain biochemical reactions. Vitamin B₅ also promotes amino acid uptake and antibody synthesis. It is active in the formation of the neurotransmitter acetylcholine, which can be involved in some depressions. A deficiency can cause depression, fatigue and allergies. This vitamin is particularly prone to depletion with chronic stress.

Vitamin B₁₂ (Cyanocobalamin or Hydroxycobalamin)

This vitamin is important for the health and maintenance of your nerve cells and of the nerve tracts in your spinal column. The mental changes caused by a deficiency of vitamin B₁₂ can range from difficulty in concentrating or remembering, mental fatigue and low moods, to a severe stuporous depression, intense agitation, hallucinations and manic or paranoid behavior. There can also be neurological problems and anemia.

You can only absorb about 1 percent of the vitamin B₁₂ in your diet or in supplements. Fortunately, under optimal conditions you only need 1 to 3 mcg daily and

you would have to take only 100 to 300 mcg to get this, allowing for the poor rate of absorption.

Because of the poor stomach absorption, I usually do not give vitamin B₁₂ orally except for what is present in the vitamin B complex combination. Instead, I give it in a "sublingual" form available in most health food stores. You dissolve the tablet under your tongue upon arising in the morning. Since the substance goes into your blood stream through the blood vessels under your tongue, you absorb more than you would by the gastrointestinal route.

If you are over fifty-five, vegetarian or alcoholic, have extreme fatigue, poor memory, low thyroid or weight loss, I recommend you take 1000 to 2000 mcg of the sublingual form every morning.

Though it is extremely rare, an untreated vitamin B₁₂ deficiency can ultimately be fatal.

Folic Acid

Folic acid is needed to form brain norepinephrine and serotonin. It also helps maintain the secretions of steroids from your adrenal glands and so is particularly useful in times of stress. It has a major function in DNA and RNA synthesis and helps form antibodies as well.

Perhaps one reason that folic acid is one of the most commonly deficient vitamins is that alcohol interferes with its metabolism. If you drink regularly, you probably need extra folic acid. The elderly also commonly lack folic acid. In one study of elderly people unable to care for themselves, 67 percent had a folic acid deficiency. Besides the elderly and those using alcohol, those on anticonvulsant drugs, birth control pills and certain other medicines are at high risk for deficiency.

Folic acid deficiency can create depression, memory problems, fatigue and anemia. Since a similar

anemia is also caused by vitamin B₁₂ depletion it's important, to avoid further complications, to use them both as supplements. Vitamin B₁₂ and folic acid are present in vitamin B complex preparations. Those in the high risk groups for deficiency should double their vitamin B complex dosage.

A person in depression with easy fatigability may respond well to folic acid therapy, because folic acid is energizing. However, excess amounts of more than 5 mg daily can create the side effect of a hyperexcited, overactive, irritable, insomniac, euphoric state and may aggravate seizure problems.

Folic acid helps increase estrogen levels, so it can be useful for those with menopausal symptoms, but since female hormone administration may be associated with breast and uterine cancer, those with cancer should avoid large doses of folic acid. In these conditions 600 to 800 mcg daily would be the top supplemental limit.

If you are on anticancer chemotherapy, ask your doctor if the chemotherapy drug is an agent which blocks folic acid metabolism. If it is, do not exceed a total dose of 600 to 800 mcg. Your multivitamin mineral and your vitamin B complex added together will supply this amount.

Biotin

Biotin is one of the coenzymes helping to form brain serotonin. It is essential for normal metabolism of fat and protein. Known biotin deficiencies are not common, but a group of human volunteers placed on a biotin-deficient diet developed depression, weakness, hallucinations and panic. Generally, skin and hair problems also develop with biotin deficiency.

Raw egg whites contain a substance which destroys biotin, so someone eating a great many whole raw eggs could encounter a deficiency. Also, those on

high doses of antibiotics can develop a biotin deficiency.

Vitamin C

Vitamin C is needed to form both norepinephrine and serotonin. It also helps to protect against the oxidation or breakdown of norepinephrine.

Vitamin C has a profound stimulating effect on the adrenal glands, so that, during times of stress, our bodies require more vitamin C.

Few diets have enough of this vitamin for its basic uses in the first place, without considering that extra amounts are needed when we are exposed to dietary and inhalant chemicals, alcohol, smoking, drugs, stress, mercury, lead, cadmium and a myriad of other toxins. This is because vitamin C acts as a detoxifier to actually help remove these unwanted substances from our bodies. With low vitamin C, the toxins are free to accumulate gradually, finally contributing to many disease states.

Magnesium

Magnesium, another of the coenzymes needed to form the brain amines, is active in the metabolism of amino acids and carbohydrates, and aids in your body's utilization of vitamins C and E. Magnesium also helps convert the B vitamins into a form your body can use; thus a magnesium deficiency could indirectly lead to a vitamin B complex deficiency. Very large amounts of vitamin B complex, or vitamin B₆ without sufficient magnesium, tend to deplete available magnesium as well as limit the usability of the B complex vitamins. Put simply, the more vitamin B complex you take, the more magnesium you need.

Magnesium deficiency can create depression, restlessness, irritability, an increased sense of hearing accompanied by a pronounced startle response, agi-

tation, anxiety, insomnia, disorientation, confusion and even hallucinations. Researchers have found significantly lower levels of magnesium in the blood and cerebrospinal fluid of depressed patients, and the lowest levels in suicidal patients. (It's interesting that lithium, the well-known antimanic and antidepressant drug, helps increase the magnesium level in the blood; we can wonder if this contributes to its effectiveness.)

Deficiency is common because the typical American diet only provides one half to one third of the 400 mg RDA. Alcoholics have particularly depleted magnesium, and its lack is one of the causes of delirium tremens, or DT's. Extra magnesium is also required when its absorption and retention are decreased by other factors such as physical and mental stress, a moderate intake of sugar, alcohol and caffeine, and a high intake of protein, fat, calcium, salt, refined carbohydrates and phosphates. The blood concentration of magnesium varies in relation to that of calcium, and this ratio in turn affects nerve transmission and muscle contraction. Excess calcium such as you would get with a high intake of dairy products would tend to decrease your magnesium levels. For this reason, given the American lifestyle, the RDA would be more accurately increased to 500 to 800 mg daily.

People living in soft water areas such as the southeastern U.S. tend to have much lower magnesium levels than those in "hard" water areas such as the southwest. It would be interesting to know if there is a greater percentage of depression in the soft water areas, because these regions do have a high rate of kidney stone disease, also related to the insufficient magnesium. Magnesium deficiency also plays a significant role in the development of heart disease and irregularities, and high blood pressure, and many

cases are successfully treated by appropriate supplementation.

The preferred forms are magnesium orotate or aspartate, because they are readily absorbed. Sufficient vitamin B₆ and thyroid hormone also promote magnesium absorption. Supplemental magnesium should not be given to those who are in kidney failure, or suffering from the rare Addison's disease or myasthenia gravis.

Zinc

Zinc is necessary for brain amine formation. It is also involved in multiple physiological functions, and deficiency can be associated with many physical and some psychiatric disorders.

The average American diet contains about 10 mg daily, while the RDA is 15 mg. Zinc is reported to be deficient in the soils of thirty-two of our states. In addition, a high-fiber diet impairs the absorption of zinc if taken at the same time, so do not take minerals with bran or a fiber supplement. Estrogen pills and high copper levels in the body will contribute to zinc deficiency. On the other hand, excess zinc over 100 mg daily on a long-term basis can cause your body to lose copper and iron and to actually develop an iron or copper deficiency anemia.

Vitamins E and B₆ are synergistic with zinc, so it may not be possible to correct a zinc deficiency without also insuring adequate amounts of vitamins E and B₆.

Iron

Iron is a coenzyme needed to form the brain amines. It is also needed for proper metabolism of the B vitamins. An iron-related depression would likely be associated with poor attention span, listlessness and fatigue. There may also be irritability, head-

aches, feelings of numbness and tingling, and a burning sensation on the tongue.

Iron deficiency is the most common chronic disease in the world. Government surveys show that American women, children and teenagers have been in a dietary decline since 1950 in terms of meeting the RDA for iron (whereas the average American man has enough, if not too much, iron).

Most women have had iron deficiency anemia at some time in their lives. This condition is especially common during pregnancy. At least twenty million people in the U.S. are deficient in iron, including young women, children, those who are socio-economically oppressed and the elderly infirm.

Vitamin C will enhance iron absorption, while caffeine, antacids, high-fiber cereals and tetracycline will inhibit absorption. It's easy to get a blood test measuring the iron level and total iron storage (ferritin) in the blood. This can be a guide for whether supplementation is indicated. It is possible to store and accumulate too much iron, which can be toxic. Because of this potential, I recommend iron-free vitamins for men and post menopausal women. Children and menstruating or pregnant women often need some additional iron. If you do take iron, avoid the ferrous sulfate form, as it is less tolerable to the digestive system. Also use an amino acid chelated iron product, 50 to 100 mg, three times daily, or buy a multivitamin mineral which contains iron.

Manganese

Manganese is needed for brain amine formation, so a deficiency can be associated with depression. Manganese also activates a number of enzyme systems necessary for the utilization of vitamins C and B complex. It is essential for proper pituitary functioning and therefore indirectly helps regulate hormones.

Those with insufficient manganese levels also tend toward allergies and mood-changing low blood sugar problems.

Dietary manganese deficiencies are not uncommon because our soils are depleted of this mineral, which affects our vegetables and fruits. Because large amounts of calcium and iron inhibit manganese absorption, people who eat a lot of dairy foods, or who supplement too much calcium or iron, need to take a multivitamin mineral containing manganese. Excess phosphorus, such as is found in soft drinks and junk food diets, can also inhibit manganese absorption.

ARE NUTRIENT TOXICITIES POSSIBLE?

"Balanced" supplements are essential. If you are going to supplement at all, this approach will decrease the likelihood of problems with doses of single substances. Sometimes a person reads about the merits of a particular nutrient, starts taking it, and goes overboard on the dosage thinking "these same positive effects can be increased in the proportion that I increase the dose." Wrong! *Optimum dosages should be followed and not exceeded unless prescribed by a nutritionally aware doctor as treatment for specific medical conditions or symptoms.*

Toxic reactions are possible with some nutrients at extremely high doses. It is very important not to overdo vitamins A and D, because they are stored in the body.

In general, though, vitamins are essential to your health and are relatively harmless. In some instances you have to take amounts thousands of times the RDA before toxicity can occur. By comparison, many standard prescription drugs have no such leeway;

**DEPRESSION-RELATED VITAMINS AND MINERALS
DAILY DOSAGE AND TOXICITY LEVELS FOR ADULTS**

	RDA	OPTIMUM	TREATMENT	SIDE EFFECTS	TOXICITY
Vitamin B ₁ (Thiamine) (mg)	1.5	10-25	10-500	Over 1000	8000-24,000
Vitamin B ₂ (Riboflavin) (mg)	1.8	10-15	10-500	Over 1000	No Known Toxicity
Vitamin B ₃ (Niacin) (mg)	15-20	50-150	100-3000	Over 3000	70,000-280,000
Vitamin B ₅ (Pantothenic acid) (mg)	5-10	50-200	10-1000	Over 10,000	No Known Toxicity
Vitamin B ₆ (Pyridoxine) (mg)	2.0	10-25	10-500	Over 2000	Over 210,000
Vitamin B ₁₂ (mcg)	3.0	20-100	10-2000	None Known	No Known Toxicity
Folic Acid (mcg)	400	400-1000	400-10,000	Over 3000	No Known Toxicity
Biotin (mcg)	100-200	300-600	300-1200	Over 50,000	No Known Toxicity
Vitamin C (mg)	45	250-4000	100-10,000	Over 10,000	50,000-100,000
Magnesium (mg)	300	400-800	400-1200	None Known	Over 15,000
Copper (mg)	2-3	2-5	2-5	Over 7	Over 250
Iron (mg)	18	10-25	10-300	Over 50	Over 100
Manganese (mg)	2.5-5	3-20	10-100	Over 200	Over 1000
Zinc (mg)	15	15-30	25-200	Over 200	Over 1000

sometimes just doubling the dose can prove poisonous, or even fatal.

If you are uncertain about safety, the accompanying chart will tell you the minimum RDA and the optimum amounts for improving and maximizing health, the treatment dosages used by orthomolecular physicians to treat various conditions, the dosages which can create symptom side effects, and the amounts which can be toxic if indeed a substance has a toxic potential.

The dose ranges of the treatment program recommended in this book are far below any of the side effect amounts and on the low side of the treatment dosages.

Remember, balance is vital. You do not need to take more unless there is an indication of the necessity. "If some is good, then more is better" does not apply.

Certain individuals may be allergic to some vitamins because they are manufactured with starches, fillers, dyes, yeasts, corn, sugars and so on. This reaction is different from a reaction to excessive dosage. If you know you have allergies, use special hypoallergenic products. Only rarely are individuals allergic to the actual vitamin itself.

If you have any serious medical illness, then when supplementing any more than the lowest level of the treatment doses listed in this table consult a nutritionally-oriented physician of any specialty whose subspecialty is "orthomolecular or nutritionally-oriented medicine."