Publication 45
Revised June 1970

TENSION DIVISION
Virginia Polytechnic Institute

VITAMINS

Prepared by

Jo Anne Barton and Marjorie Porter,
Extension Specialists, Foods and Nutrition

What does the word vitamin mean to you? Many people automatically associate the word with a pill. Vitamins do come in pills but there are many natural sources as well. Casimer Funk coined the word "vitamine" to describe a substance which was essential for life. The "amine" portion of the word described what he believed was the chemical structure of the substance in rice polishings which prevented beriberi.

We now know that there are many of these substances which are essential for life. The "e" was dropped from the word when it was learned that not all the substances were amines.

The first vitamin, vitamin A, was not isolated until 1914 but the British were on the trail of vitamin C in the early 1700's. British seamen were plagued with scurvy. They learned that by eating lemons and oranges (rich sources of vitamin C) they could ward off or cure scurvy. In the late 1800's, beriberi was a problem for Japanese seamen whose diet consisted mainly of white rice. When vegetables, meat, and fish were added to the diet, the incidence of beriberi decreased.

Vitamins account for a minute portion of body weight. Nevertheless, they are indispensable for normal functioning of the body. Vitamins are organic compounds, necessary for growth and maintenance of life, which must be provided in the diet. The body is not able to make them, at least in amounts sufficient to meet its needs. An exception is vitamin D; exposure to ultraviolet rays develops this vitamin from its precursor present in the skin. Vitamins are regulatory substances, each performing a specific function. They are carried in the blood stream to all parts of the body.

In addition to the vitamins listed on the chart, there are others needed for good health.

In the B complex in addition to thiamine, riboflavin and niacin, are pyridoxine (B_6), folic acid, B_{12}, pantothenic acid, biotin, choline, and inositol. All have similar functions in the body. Each is needed in very small amounts and is found in commonly eaten foods of both plant and animal origin. It is not likely that human beings will ever have a deficiency of these vitamins.

Folic acid in amounts greater than 0.1 mg. per day may mask some of the symptoms of pernicious anemia and thus delay diagnosis and treatment of that disease. It cannot be sold without prescription in amounts recommending doses greater than 0.1 mg. per day.

Vitamin B_{12} is the most recently discovered vitamin, having been isolated in 1948. It is important because of its role in treatment of pernicious anemia.

Vitamins are needed in small amounts. The Recommended Daily Allowances are measured in milligrams or in International Units. A milligram is 1/1000 of a gram. There are about 30 grams or 30,000 milligrams in an ounce. An international Unit (IU) is used universally to measure potency of vitamins A and D. In the United States, pharmaceutical companies use the U. S. Pharmacopeia (USP) unit to express potency. It is exactly the same as the International Unit.

Nutrient	Why Needed	Some Important Sources
Vitamin A	1. Helps eyes adjust to dim light. 2. Helps keep skin smooth. 3. Helps keep lining of mouth, nose, throat, and digestive tract healthy and resistant to infection. 4. Promotes growth.	Liver; dark-green and deep-yellow vegetables such as broccoli, turnip and other leafy greens, carrots, pumpkin, sweet potatoes, winter squash, apricots, cantaloupe; butter, fortified margarine.
Thiamine (B_1)	1. Helps body cells obtain energy from food. 2. Helps keep nerves in healthy condition. 3. Promotes good appetite and digestion.	Lean pork, heart, kidney, liver, dry beans and peas, whole grain and enriched cereals and breads, and some nuts.
Riboflavin (B_2)	1. Helps cells use oxygen to release energy from food. 2. Helps keep eyes healthy. 3. Helps keep skin around mouth and nose smooth.	Milk, liver, kidney, heart, lean meat, eggs, and dark leafy greens.
Niacin (B_3)	1. Helps the cells of the body use oxygen to produce energy. 2. Helps to maintain health of skin, tongue, digestive tract, and nervous system.	Liver, yeast, lean meat, poultry, fish, leafy greens, peanuts and peanut butter, beans and peas, and whole grain and enriched breads and cereals.
Ascorbic Acid (Vitamin C)	1. Helps hold body cells together and strengthen walls of blood vessels. 2. Helps in healing wounds. 3. Helps resist infection.	Cantaloupe, grapefruit, oranges, strawberries, broccoli, Brussels sprouts, raw cabbage, collards and other greens, green and sweet red peppers, turnip greens, potatoes, and tomatoes.
Vitamin D	1. Helps body use calcium and phosphorus to build strong bones and teeth, important in growing children and during pregnancy and lactation.	Fish liver oils; foods fortified with vitamin D, such as milk. Direct sunlight produces vitamin D from precursor in the skin.

Publication 45
Cooperative Extension Service
Revised June 1970

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. W. E. Skelton, Dean, Extension Division, Cooperative Extension Service, Virginia Polytechnic Institute, Blacksburg, Virginia 24061.

Recommended Daily Allowances

The Food and Nutrition Board of the National Research Council reviews research studies and, based on the results of these studies, establishes Recommended Daily Allowances for certain nutrients. These recommendations are designed to maintain good nutrition of healthy persons in the United States. They are not to be considered as minimum requirements, maximum requirements, or even optimum requirements.

Needs for certain nutrients change with age and body size.

As part of the nationwide household food consumption survey made by the USDA in spring 1965, information was obtained on the food intake for one day of individual members of the households interviewed. Approximately 14,500 reports of food intake of men, women, and children were collected.

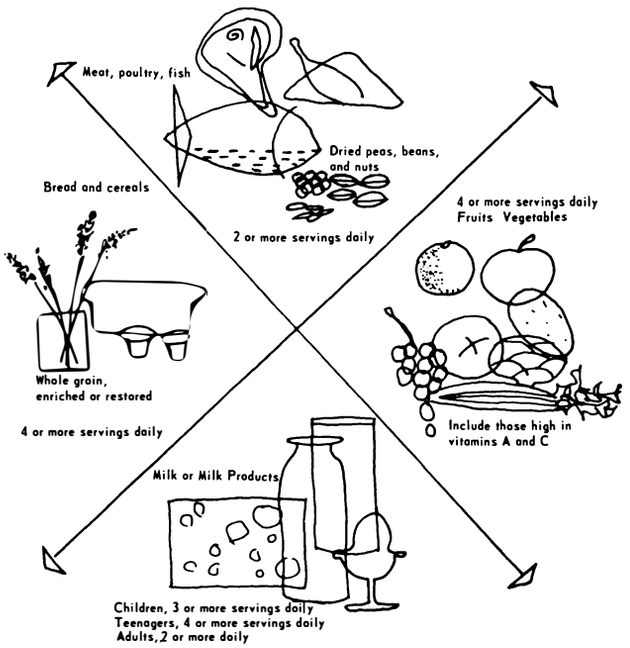
Average intakes were calculated for 22 groups of persons, classified by age and sex, for calories, protein, vitamin A value, thiamine, riboflavin, ascorbic acid, calcium, and iron. The average nutrient content for each group was compared with the 1968 Recommended Dietary Allowances.

For most of the sex-age groups, average diets approached or were above the recommended allowances for calories, protein, vitamin A value, thiamine, riboflavin, and ascorbic acid. Calcium and iron were below the RDA for many of the sex-age groups.

Thiamine intake was below recommended allowances for girls and women, ages 9 through 64. Older women, 65 and over, were short thiamine, riboflavin, vitamin A value, iron, and calcium. Men of the upper age group, 75 and over, had diets that were below the allowances for riboflavin, vitamin A value, ascorbic acid, and calcium.

No information was obtained on the nutritional status of individuals. Failure to meet the allowances does not necessarily mean malnutrition. Nor is it justification for indiscriminate use of vitamin supplements.

The usual, and most reasonable and enjoyable source of vitamins, is food. A diet selected from the variety of foods available does supply all of the vitamins a person needs. The Daily



Food Guide — Four Food Groups — is a handy guide for planning family meals which will supply the vitamin needs of all family members.

Vitamin Supplements

The Council on Foods and Nutrition of the American Medical Association has said that an adequate intake of vitamins is assured when one consumes a variety of foods in sufficient amounts. Americans have available to them a wide variety of attractive, wholesome foods throughout all seasons of the year. Even so, they spend $500 million a year on falsely promoted vitamin pills and so-called health foods. Their popularity is undoubtedly aided by catchy TV, radio, newspaper, and magazine advertisements.

Vitamin supplements may be useful in some cases. A physician should decide when they are necessary. He is also the one who should decide which vitamin or vitamins the supplement should contain. Supplementation may be necessary when a person is unable or unwilling to eat an adequate diet such as during an illness, emotional upsets, or because of an allergy. In such cases vitamin supplements are not meant to replace food but to supplement it. Supplementation should be eliminated when normal eating habits are resumed.

There are many reasons why the indiscriminate taking of vitamin supplements is not advisable.

RECOMMENDED DAILY DIETAR

Designed for the Maintenance of Good Nutrition
(Allowances are intended for persons n

	Age Years from-to	Weight		Height		Calories	Protein gm.
		kg.	lbs.	cm.	in.		
Infants	0-1/6	4	9	55	22	kg x 120	kg x 2.2
	1/6-1/2	7	15	63	25	kg x 110	kg x 2.0
	1/2-1	9	20	72	28	kg x 100	kg x 1.8
Children	1-2	12	26	81	32	1,100	25
	2-3	14	31	91	36	1,250	25
	3-4	16	35	100	39	1,400	30
	4-6	19	42	110	43	1,600	30
	6-8	23	51	121	48	2,000	35
	8-10	28	62	131	52	2,200	40
Males	10-12	35	77	140	55	2,500	45
	12-14	43	95	151	59	2,700	50
	14-18	59	130	170	67	3,000	60
	18-22	67	147	175	69	2,800	60
	22-35	70	154	175	69	2,800	65
	35-55	70	154	173	68	2,600	65
	55-75+	70	154	171	67	2,400	65
Females	10-12	35	77	142	56	2,250	50
	12-14	44	97	154	61	2,300	50
	14-16	52	114	157	62	2,400	55
	16-18	54	119	160	63	2,300	55
	18-22	58	128	163	64	2,000	55
	22-35	58	128	163	64	2,000	55
	35-55	58	128	160	63	1,850	55
	55-75+	58	128	157	62	1,700	55
Pregnancy						+200	65
Lactation						+1,000	75

[1]Food and Nutrition Board, National Academy of
mended Dietary Allowances, seventh revised editi

[2]Entries on lines for age range 22-35 years repres
other entries represent allowances for the midpo
dren 1-2 is for age 1½ years (18 months); 2-3 is

[3]Niacin equivalents include dietary sources of the
60 mg. tryptophan represents 1 mg. niacin.

[4]Assumes protein equivalent to human milk. For
creased proportionately.

ALLOWANCES, REVISED 1968

of Practically all Healthy Persons in the U.S.A.
rmally active in a temperate climate)

Vitamin A Value, I.U.	Vitamin D I.U.	Ascorbic Acid, mg.	Niacin Equiv.[a] mg.	Riboflavin mg.	Thiamine mg.	Calcium g	Iron mg.
1,500	400	35	5	0.4	0.2	0.4	6
1,500	400	35	7	0.5	0.4	0.5	10
1,500	400	35	8	0.6	0.5	0.6	15
2,000	400	40	8	0.6	0.6	0.7	15
2,000	400	40	8	0.7	0.6	0.8	15
2,500	400	40	9	0.8	0.7	0.8	10
2,500	400	40	11	0.9	0.8	0.8	10
3,500	400	40	13	1.1	1.0	0.9	10
3,500	400	40	15	1.2	1.1	1.0	10
4,500	400	40	17	1.3	1.3	1.2	10
5,000	400	45	18	1.4	1.4	1.4	18
5,000	400	55	20	1.5	1.5	1.4	18
5,000	400	60	18	1.6	1.4	0.8	10
5,000	—	60	18	1.7	1.4	0.8	10
5,000	---	60	17	1.7	1.3	0.8	10
5,000	---	60	14	1.7	1.2	0.8	10
4,500	400	40	15	1.3	1.1	1.2	18
5,000	400	45	15	1.4	1.2	1.3	18
5,000	400	50	16	1.4	1.2	1.3	18
5,000	400	50	15	1.5	1.2	1.3	18
5,000	400	55	13	1.5	1.0	0.8	18
5,000	---	55	13	1.5	1.0	0.8	18
5,000	---	55	13	1.5	1.0	0.8	18
5,000	---	55	13	1.5	1.0	0.8	10
6,000	400	60	15	1.8	+0.1	+0.4	18
8,000	400	60	20	2.0	+0.5	+0.5	18

Sciences — National Research Council: Recom-
n, 1968, Publication 1694.

nt the reference man and woman at age 22. All
t of the specified age periods, i.e., line for chil-
for age 2¼ years (30 months), etc.

reformed vitamin and the precursor, tryptophan.

proteins not 100% utilized factors should be in-

Some of the vitamins contained in vitamin preparations are known to be essential but disease resulting from a deficiency of them in the diet is uncommon. Therefore, why spend money for them? The inclusion of pyridoxine, pantothenic acid, vitamin E, and vitamin B_{12} can be questioned for this reason.

There's a hazard of a false sense of security connected with taking vitamin pills. "If I take a vitamin pill, it won't matter what I eat." We have to remember that no pill provides the carbohydrates, fat, protein, and minerals that we need daily.

In giving vitamin supplements to children rather than concentrating on supplying them with nutritious, well-planned meals, poor food habits may develop.

Without the direction of a physician there's the hazard of not knowing which vitamin or vitamins are needed because the food eaten lacks them. In one study of adolescents in Idaho, 28 out of 100 students were taking vitamin pills, principally B complex pills. It was shown that only 2 of the 28 had poor diets and their diets were lacking in calcium and ascorbic acid.

Many of the vitamin preparations available to the public contain large quantities of each vitamin. Sometimes people feel that since a little bit is good, more must be better and take more than one pill. Either way, they may get a daily intake of each vitamin in excess of the Recommended Daily Allowance. Such intakes are unwarranted and potentially dangerous.

Excess amounts of water soluble vitamins cannot be stored in the body so they are excreted in the urine. It's a waste of money to buy these vitamins which the body cannot and will not use.

The 2 fat-soluble vitamins, A and D, cannot be excreted. Excessive consumption of these vitamins over a period of time may result in toxic symptoms.

Hypervitaminosis A is being reported increasingly in children and adults who have taken excessive dosages for varying lengths of time. Symptoms are skin lesions, an itching rash, a coarsening of the skin, thinning of the hair and pain in the joints.

The Council on Foods and Nutrition of the American Medical Association states that there is definite possibility of harm from the prolonged ingestion of vitamin A in excess of 50,000 USP units daily. Multiple vitamin capsules usually have 5,000 to 30,000 USP units per capsule.

There is great variation in individual tolerance to large amounts of vitamin D. Age, exposure to ultraviolet light (which changes the percursor in the skin to vitamin D), the amount of calcium in the diet, and hormone secretion influence the response to excessive quantities of this vitamin. Early symptoms of toxicity are nausea, diarrhea, and frequent urination. Later symptoms include weakness, the deposition of calcium in soft tissues, and depression.

From all of this it can be seen that vitamin supplements are usually taken needlessly and may in some instances be harmful. The content of vitamin capsules should be checked to make sure they don't contain toxic amounts of the fat-soluble vitamins. It is best to take vitamin supplements only when the need for them has been well established.

Conserving the Vitamins

Vitamin C is the least stable of the vitamins. Preparation techniques which conserve vitamin C afford good protection for the other vitamins. These techniques include preparation near the time of serving, cooking in a small amount of liquid in a covered container for a short time, and storage in a cold, dark place.

The B vitamins are water soluble so may be transferred to meat drippings, broth or stock. Some thiamine is lost in cooking whether it be toasting bread or roasting meat. Riboflavin is sensitive to light. Some riboflavin was lost from milk when it was allowed to stand on the step in a glass bottle. Present methods of merchandising milk have remedied this situation.

Expensive equipment is not needed for cooking vegetables or other foods to conserve their nutrients. A utensil that has a lid that fits tightly and is heavy enough to prevent the escape of vapor and steam is suitable for cooking with a minimum amount of added water.

The kind of material (aluminum, enamel, glass, stainless steel) is not important in con-

serving nutritive values of the food cooked in them.

Holding and/or reheating prepared fruits and vegetables causes additional losses of nutrients, particularly of vitamin C. High acid foods retain most of their vitamin C. Thus orange juice loses little of its vitamin C.

Interpreting Labels

The Food and Drug Administration has established Minimum Daily Requirements (MDR) for some of the vitamins to be used as a basis for label claims. The MDR for vitamins are generally lower than the Recommended Daily Allowance.

The Minimum Daily Requirement for vitamin C is 30 mg.; the Recommended Daily Allowance for an adult male is 60 mg. A product which claims to furnish 100% of the MDR of vitamin C for an adult need contain only 30 mg. A product containing 200% of the MDR has 60 mg. of vitamin C, equal to the Recommended Daily Allowance.

MINIMUM DAILY REQUIREMENTS

	ADULT
Vitamin A	4000 I.U.
Thiamine	1.0 mg.
Riboflavin	1.2 mg.
Vitamin C	30 mg.
Vitamin D	400 I.U.

It has been proposed that the Recommended Daily Allowances be used as the basis for labeling. This would certainly simplify the consumer's job of evaluating claims.

Buy bread and cereal products which are labeled "whole grain" or "enriched". Whole grain forms retain the germ and outer layers of the grain where the B vitamins and minerals are concentrated.

Enriched products have the B vitamins—thiamine, riboflavin, and niacin—and iron added within limits specified by the federal standard of enrichment.

Enriched flour has about 7 times as much thiamine, nearly 6 times as much riboflavin, and about 4 times as much niacin and iron as unenriched all-purpose flour.

Many manufacturers of breakfast cereals add nutrients to their products. The amount and kinds of nutrients added or restored are determined by the manufacturer. No federal standard is set for restoring cereals.

Summary

Vitamins are needed for normal functioning of the body. Recommended Daily Allowances have been established for some of the vitamins. All needed vitamins are supplied in foods commonly eaten and enjoyed. Daily meals which include the recommended number of servings from each of the Four Food Groups will supply the needed vitamins.

REFERENCES

"Conserving the Nutritive Values in Foods." 1963. USDA.

"Food Intake and Nutritive Value of Diets of Men, Women, and Children in the United States, Spring 1965." March, 1969. Agricultural Research Service, USDA.

"Vitamin Supplements and Their Correct Use." 1964. American Medical Association.

Wilson, E. D., K. H. Fisher and M. E. Fuqua. 1965. PRINCIPLES OF NUTRITION. John Wiley and Sons, Incorporated, New York, New York.