KNOWLEDGE AND OPINIONS OF HEALTH CLUB MEMBERS

CONCERNING VITAMIN SUPPLEMENTATION

A thesis submitted in partial satisfaction of the requirements for the degree of Master of Science in

Home Economics

by

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January, 1986
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This thesis is dedicated to my husband, Michael, with thanks for his support.
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ABSTRACT

KNOWLEDGE AND OPINIONS OF HEALTH CLUB MEMBERS
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Patrice Mincieli Carroll
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An increasing use of vitamin supplements in America recently may be a result of persuasive sales techniques or a desire to attain a more healthy diet. This study investigated, using a questionnaire, the reasons health club members used vitamins, and their supplementation habits. Their knowledge concerning vitamins was measured with a quiz. Also, they were asked to distinguish myths from facts.

Frequency data were obtained for sources of vitamin information, types and amounts of vitamins used, reasons for taking or not taking vitamins, and opinions on popular myths about vitamins.

Quiz scores were analysed for differences due to age
and educational level (significant) and length of membership (not significant), using analysis of variance. Pearson's r revealed a positive correlation between education and score and a negative correlation between age and score. Differences in scores due to sex, and use or non-use of vitamins, were not significant ("t" test). Types of vitamins used by men and women were not significantly different (chi-square).

The majority of respondents used vitamins, multivitamins being the most popular, and a substantial number of respondents took doses of some vitamins in excess of the RDA. The typical vitamin user was female; twenty-one to thirty years old; had some college education; and had belonged to a health club for over three years.

Knowledge of food sources of vitamins and vitamin function was fairly good, with a 75.3 mean score out of 105. Recognition of myths concerning vitamins was good, with a mean score of 22.9 out of thirty.
A remarkable diversity of opinion about nutrition and health exists among Americans. What constitutes a healthy diet? Many researchers, dietitians, and doctors recommend a variety of food in the diet to safeguard health. Food manufacturing companies and drug companies, as well as some health professionals, stress vitamins and other types of supplementation. Because these groups employ persuasive sales techniques, they have convinced a large number of people that the food they eat is simply not enough. Although researchers studying vitamin function are constantly discovering new facts, there is much that is unknown about how vitamins work in the body. Popular writers use this lack of knowledge to their advantage. They claim vitamins can cure or prevent illnesses and improve athletic performance and overall health. They utilize the inconsistencies found in the research literature to support their claims. Although questionable, this method often convinces the public. Selling vitamins is a lucrative business. The taking of vitamins is usually
harmless, but can be a waste of money. Also, reported cases of vitamin toxicity are not uncommon in the scientific literature.

How much does the public know? Dr. Pauling has recommended 1000 mg./day of vitamin C, but do his readers know that this is far above the Recommended Daily Allowance? There are a lot of myths circulating about vitamins; this study has investigated some of them.

Health club members are curious about methods of improving their fitness and health. Many members may believe that the best diet possible should contain vitamin supplements. This study has investigated the actual knowledge of health club members as well as the kinds and amounts of vitamins used and some of the reasons why. Employees of health clubs often recommend vitamin supplementation to balance the diet. They believe that people exercising regularly need more nutrients than others. They are also distrustful of the nutritive value of processed foods. This study has described the opinions of health club members toward vitamin supplementation, their use of vitamins, and their knowledge.

Justification

The use of vitamin supplements in our society is rather controversial. Many researchers have investigated the effects of specific vitamins in the body, and the reports of their results are often contradictory. The
general public tends to believe whichever study has the most publicity and promises the best results. The present study attempted to document the reasons why health club members use vitamins. This study was needed since little is known about the kinds and amounts of supplements people use. Even less is known about health club members, a rapidly growing group in our culture. Many people using health clubs consider vitamin supplementation to be crucial to a healthy diet and necessary for a healthy body. The study was needed to determine why these people believe supplementation is important.

Vitamin use is not a widely studied phenomenon.

Vitamin function is becoming more and more well known, but the habits of the American public with regard to vitamin supplementation are not. Since a sizeable portion of the population seems to be supplementing their diet, dietitians should be involved in educating them about the facts concerning vitamin functions and sources. To do this, dietitians must know what the public knows and believes. An educated public can safeguard itself against bad advice. Since the use of supplements is spreading, studies are needed to be able to provide sufficient education to combat poor practices.

Objectives

This study was designed to investigate the use of vitamin supplements by health club members. The primary objective
was to describe the use of vitamins, what kinds were used and at what dosages. Also, level of knowledge about vitamin functions and sources was investigated. Opinions members have toward popular notions about vitamins were solicited. Finally, the study investigated reasons for supplementation and sources of information about vitamins.

The alternate hypothesis investigated was: there will be a significant difference in the knowledge level of health club members concerning vitamin facts according to a) age, b) sex, c) whether or not they use vitamins and d) education level.

The null hypothesis being investigated was: there will be no significant difference in the knowledge level of health club members concerning vitamin facts according to a) age, b) sex, c) whether or not they use vitamins, and d) education level.

Limitations

The following limitations were recognized: the sample was not random, and was limited to three health clubs in the Los Angeles area. Also, the sample size was limited to one hundred and sixty-six health club members.

Assumptions

The following assumptions were made: the questionnaire was a valid tool for collecting data on health club members, and the responses were representative of health
club members in the Los Angeles area.

Definitions

Health Club:

A business which provides facilities to its members for the purposes of maintaining or attaining fitness. Weightlifting machines, exercise classes, exercise machines, a swimming pool, sauna, whirlpool, etc., as well as instructors, are provided for a fee.

Megadose:

A vitamin dosage that is ten or more times the Recommended Daily Allowance (except for vitamin D, where a megadose is five or more times the RDA (Wooliscroft, 1983).

Vitamin:

An organic substance required in very small amounts to promote one or more specific and essential biochemical reactions within the living cell. Lack of the substance for a prolonged period of time must cause a specific deficiency disease which is quickly cured when the substance is resupplied (Wooliscroft, 1983).

TPP

Thiamine pyrophosphate, a small molecule called a coenzyme that is an essential participant in some enzymatic reactions. Thiamine is a structural part of TPP.
(Reed, 1980).

**FAD:**

*Flavin adenine dinucleotide, a coenzyme containing riboflavin* (Reed, 1980).

**NAD:**

*Nicotinamide adenine dinucleotide, a coenzyme containing niacin* (Reed, 1980).

**DNA:**

*Deoxyribonucleic acid, the basic material in the chromosome of the cell nucleus— it makes up the genetic code and transmits the hereditary pattern* (Reed, 1980).

**RNA:**

*Ribonucleic acid, important in the synthesis of proteins in the cell* (Reed, 1980).

**CoA:** *A coenzyme containing pantothenic acid* (Reed, 1980).
CHAPTER 2

Review of Literature

The research conducted in this study depended on current knowledge of vitamin function. Although little research has been conducted on health club members, the knowledge, opinions, and behavior of other groups have been studied, and are valuable for comparison.

Vitamin Function

Vitamins are small organic molecules with major functions involving metabolism of proteins, carbohydrates, and fats (Whitney and Cataldo, 1983). Water soluble vitamins are absorbed into the blood while fat soluble vitamins are absorbed into the lymph system with fat. Fat soluble vitamins have long term storage in the body while water soluble vitamins do not. However, humans have up to a twenty year storage of vitamin B12 (Whitney and Cataldo, 1983).

As a class, vitamins are compounds that are not synthesized in the body, at least not in the amounts needed. Their presence is essential to life, and a
deficiency will produce a specific disease which can be cured by ingestion of the necessary vitamin (Machlin, 1983).

The B vitamins as a class function as coenzymes. Thiamin (in FAD) is utilized in the glucose to energy pathway. Niacin forms a part of the coenzyme NAD. Folacin accomplishes transfers of single carbon groups and functions in pathways that lead to cell reproduction (DNA and RNA). B12 contributes to the conversion of glucose to energy, and methylation reactions. B6 takes part in amino acid reactions in protein metabolism (Whitney and Cataldo, 1983).

Pantothenic acid is part of Coenzyme A, and biotin contributes to lipid synthesis, acid group transfers, and one carbon group transfers. Vitamin C is a catalyst for many hydroxylation reactions, and is an antioxidant. It is involved in maintenance and repair of connective tissue, especially collagen, and synthesis of hydrocortisone type steroid hormones. It aids in synthesis of serotonin and norepinephrine, and wound healing and capillary maintenance. It helps maintain cholesterol balance and efficiency of white blood cells. It aids in calcium absorption (Whitney and Cataldo, 1983).

Vitamin A is essential for vision as part of the pigment rhodopsin. As retinoic acid, it is involved in glycoprotein and mucous formation. It aids in resorption of old bone, and has roles in reproduction, maintenance of
cell membranes and nerve sheaths. It assists in making corticosterone in the adrenals, red blood cells, and thyroxin, and maintains healthy immune reactions (Marshall, 1983).

Vitamin D aids in intestinal absorption of calcium and mobilizes calcium from bones to raise the blood concentration. It is involved in calcium retention in the kidneys, and regulates phosphorus metabolism. It promotes normal bone calcification and activates alkaline phosphatase to provide inorganic phosphate (Wooliscroft, 1983).

Vitamin E is an antioxidant which protects cell membranes, cell walls, and unsaturated fatty acids.

Vitamin K acts in the blood clotting mechanism to make prothrombin, and several other clotting factors (Converts glutamic acid residues to calcium chelators) (Whitney and Cataldo, 1983).

Food Processing

Many people supplement their food because they believe that food processing causes a loss of nutrients from the food. They often advocate the use of meals made from "natural, organically grown" foods. They believe health foods are more nutritious and may be looking for a simpler and healthier diet. According to Barker (1982), processing can improve flavor and destroy microorganisms and enzymes that would reduce the shelf life of the product or spoil
it. Most technological changes in recent years have been beneficial. However, some health food users believe, in addition to self protection, that technology should be used to preserve staples to feed the world, rather than producing convenience foods we do not need (Woolf, 1973). Furthermore, they correctly believe that processing done during home storage, preparation, and cooking also changes the nutrient composition of the food to an unknown degree. Some health conscious people are aware of these changes during processing, and this may be a reason for their use of supplements.

As an example of both the destructive and beneficial effects of processing, the vitamin C loss in tomatoes that are picked green is 30% over those allowed to ripen on the vine (Bender, 1978). On the other hand, vitamin C is used as an antioxidant and stabilizer in products such as wine and olives, making these foods richer in vitamin C than they originally were.

Cooking foods in water will lead to losses of water soluble vitamins in varying amounts. Vitamin A, riboflavin, folacin and vitamin D are susceptible to temperature, oxidation and/or light destruction. Vitamin E is also unstable during frozen storage (Bunnell, 1965).

The public is probably not aware, however, that processing is also associated with beneficial changes. In cooking, substances that destroy thiamine are inactivated. A form of niacin largely unavailable to humans in cereals
is liberated during heating, and biotin is preserved by heating avidin in eggs. Also, legumes contain a trypsin inhibitor that is destroyed by heating (Bender, 1978).

Different kinds of processing vary in their destructive effects on vitamins, although most people do not have sufficient specialized education to know the difference. An interesting theory by Bender (1978) reports that fruits and vegetables are picked at their peak of nutrient content to be frozen. Fresh fruits and vegetables are almost always "past their peak" at the time of purchase. Consequently, frozen foods may have a higher vitamin content at cooking time than fresh.

Fresh foods vary in vitamin content depending on where and when they were grown, and harvesting, transportation, and storage methods. Current information about vitamin stability comes from controlled investigation of vitamins in pure form, or in specific foods. However, the wide variability in methods of storage and preparation at home gives us little information on how much of the vitamin is actually consumed (Bender, 1978). This is one of the concerns of supplement users. They believe nutrient value is difficult to measure in food, and people may not be getting the amounts of nutrients they are told are present.

Vitamin Deficiency

A common fear of the American public may be having a deficiency of one or more vitamins which will rob them of
the ability to keep fit and grow stronger. Supplement promoters may use this situation to fit their needs. For example, in recent vitamin A studies, both high and low intake are shown to cause problems. Vitamin manufacturers claim that vitamin A supplementation is needed in varying amounts. Linus Pauling (1976) states many people need 25,000 I.U. of vitamin A daily. With large doses, cases of vitamin toxicity have been documented, with abnormal liver function, bone pain, and anemia occurring. As for deficiency studies, many have been done including the following recent ones. A study by Wiss and Wiss (1980) showed that early vitamin A deficiency in rats caused slight growth retardation. Rosebrough (1980) studied vitamin A deficient rabbits in utero to determine if there were behavior and learning changes and found increased anxiety and abnormal behavior in stressful situations and low potassium levels in the brain.

In examining the relationship between vitamin A and cancer, Morre and Kerksey (1980) injected high doses into male rats. Some were injected with tumor cells at the same time they were given the vitamin. In others, carcinomas were induced two weeks after the dietary regimen started. In the latter group, the tumors were fewer in number and appeared later than the non-supplemented ones. When the rats were injected with a metastatic type of cell two weeks after the initiation of the vitamin doses, no metastases appeared. Because of promising results like these, human
megadoses of the fat soluble vitamins may be promoted to prevent cancer. Some application to cancer may be possible in the future; however, the vitamin cannot be targeted to specific sites, and high doses can cause liver injury (Dubick and Rucker, 1983).

Wald, Idle, and Boreham (1980) reported an investigation on 16,000 men who had complete health screening in London between 1978 and 1979. Eighty-six men developed cancer and these men were found to have lower serum vitamin A levels than the controls. Low serum retinal levels were associated with an increased risk independent of age, smoking habits, and serum cholesterol levels. This is certainly an important study, and suggests that vitamin A prevents cancer.

A study by Halloran and Deluca (1980) investigated reproductive capabilities of vitamin D deficient rats. Deficiency resulted in reduced litter size, reduced fertility, and impaired neonatal growth.

Muscle function was studied by Pleasure (1979). Deficient chicks had muscles stimulated repeatedly, and the development of muscle weakness was significantly greater than in control chicks. Results showed no abnormality in structure, but calcium transport was reduced.

An experiment done on Leghorn chickens (Freidrichsen, Arscott and Willis, 1980) investigated vitamin E deficiency over almost a year's time. Decreased fertility, which rapidly returned to normal with supplementation, was found.
Hope, Machlin, and Filipski (1975) investigated vitamin E deficiency in rat platelets and found it to be associated with decreased synthesis of prostaglandins.

Jenkins (1980) studied the effects of different doses of vitamin C on deficient pregnant rats. Lower (2 microgram) doses produced higher cholesterol and less bile acids than higher (2 mg.) doses. The animals getting the low dose were more predisposed towards cholelithiasis and had lower serum and brain ascorbate levels. The lower dose was sufficient to prevent symptoms such as low fetal weight and small litter size. In humans a marginal deficiency may cause a higher incidence of gallstones in pregnant women. Lower serum levels are often noted by writers who believe tissue saturation is necessary for complete health. According to Breskin (1985) amounts necessary to maintain body stores are not always considered in the RDA. "Whether maximum stores should be equated with optimum stores is unknown" (Breskin, 1985, page 49).

A study by Lonsdale and Shamberger (1980) investigated patients consuming a "junk food" diet. These patients showed neurotic symptoms, fatigue, depression, and chest pains. These were alleviated in some by high doses of thiamine (150-300 mg./day). These results were doubted by Brin (1980) and Levy (1980) who thought the symptoms indicated general vitamin deficiency. Promoters of vitamin B megadoses agree that they will relieve stress and depression and give the user more energy and "pep".
Riboflavin status of adolescents was studied by Lopez, Schwartz, and Cooperman (1980) in New York City. Those deficient comprised twenty-seven percent of the sample. There was a significant positive correlation between milk consumption and riboflavin status.

It is common to find interesting studies like these used to promote vitamin use in humans. However, most people are not sufficiently educated now to differentiate between suggestive findings and unequivocal research findings.

**Megadose Usage**

The use of megadoses by many people has interested the scientific community. The practice is advocated by the popular literature, as well as by some doctors and researchers. For example, many people take large doses of vitamin C even though studies have shown that this may cause formation of renal or urinary oxalate stones and may reverse the effects of anticoagulants (Barness, 1977). Also noted were tendencies to produce false results in glucose testing and to cause rebound scurvy (Schrauzer, 1973). Although vitamin C seems to be harmless in most people even when ingested in very large doses, a number of potentially serious effects have been seen, as discussed. Vitamin C megadoses may also cause diarrhea, abdominal cramps, and incorrect results in hemoccult tests of stools (Rhead and Schrauzer, 1971, and Komindr and Kitabchi,
The best known promoter of vitamin C, Dr. Linus Pauling, believed that 1000 mg./day of vitamin C will reduce the incidence of colds by forty-five percent for most people (Pauling, 1976). He also believed many people need more than this amount (Pauling, 1970). Some studies have concluded that vitamin C has an antihistamine effect and may reduce the symptoms of a cold (Zuskin, 1973). This effect is the most well-documented, and is accepted by many researchers (McLean and Wilson, 1979).

Thiamine megadoses (10-100 mg./day) given parenterally have been reported to cause nausea, hypersensitivity reactions, tachycardia and dyspnea (Connor, 1981). The popular literature has promoted thiamine to prevent mental disease and senility, and claimed that it has antidepressant and antianxiety effects.

Toxic effects of high doses of nicotinic acid include a flushed face, neck, and chest. Cardiac arrhythmias may occur, and megadoses (100-300 mg.) may produce headache, cramps, nausea, vomiting, diarrhea, hypotension, tachycardia, and hypoglycemia. Doses of more than 2 grams per day can produce dry skin, aggravation of peptic ulcer disease, and toxic effects on the liver (Rosenhamer and Carlson, 1980; Richards and Breghouse, 1982). However, niacin is taken by many people as a treatment for arthritis, migraine headaches, mental illness, and atherosclerosis (Wooliscroft, 1983).
In very high doses, (150mg./kg./day) in animals, pyridoxine has been shown to cause neurologic disease. In humans, some signs of rebound deficiency have been noted when moderate doses are suddenly withdrawn. A specific effect has to do with Parkinson's disease patients on levodopa, where B6 supplementation may cause a decrease in therapeutic effect (McKiernan, Mellor and Court, 1981). B6 is believed by many users to alleviate nausea, prevent seizures, skin disease, nerve diseases, and prevent premenstrual symptoms (Wooliscroft, 1983).

A well-known but rare side effect of folacin supplementation is a masking of B12 deficiency. This can cause correction of the anemia, but neurologic problems continue unrecognized. Popular writers advise use of folic acid to cure many skin diseases, and prevent food poisoning, graying of hair and mental disorders (Wooliscroft, 1983).

As a fat soluble vitamin, A is stored rather than excreted when taken in excess, and can produce many toxic symptoms. Acute toxicity is rare. It manifests as increased intracranial pressure with headache, anorexia, vomiting, nausea, hair loss, fatigue, hemorrhages, edema, long bone tenderness, hepatomegaly and splenomegaly (Stults, 1981, and Korner and Vollm, 1975). Long term vitamin A effects include liver damage and possible cirrhosis. Congenital deformities in almost all organ systems develop when pregnant women ingest megadoses.
Other effects include peeling skin, sleep disturbances and hemorrhages (Smith and Goodman, 1976, and Geelen, 1979). In a vitamin promotion, weight loss might be touted as an effect of vitamin A megadoses. Also, supporters believe that vision can be improved in non-deficient people, disease resistance can be improved, skin diseases can be prevented, and cancer can be stopped. Studies exist that support some of these claims in vitamin A deficient people, but extrapolation to the healthy population has little scientific support (Wooliscroft, 1983).

Toxic and acute symptoms result from deranged calcium metabolism when megadoses of vitamin D are taken. Symptoms include anorexia, nausea, headache, abdominal pain, polyuria and polydipsia. Renal failure may occur in severe cases (Wooliscroft, 1983). Chronic toxicity causes weight loss, vomiting, constipation, mental confusion, hypercalcemia, and hyperphosphatemia. Calcification of soft tissue and bone pain also occur (Wooliscroft, 1983).

Vitamin D is stressed less than the other vitamins in popular literature, since it is recognized to be toxic in large amounts. However, it is sometimes recommended to prevent colds, rheumatoid arthritis, and osteoporosis. These diseases were once treated with vitamin D by doctors, who have since recognized that it has no benefit (Wooliscroft, 1983).

Despite the large numbers of people self-medicating with vitamin E, a clear picture of toxicity hasn’t

Vitamin E is a very popular supplement. It is said to prevent skin problems, ischemic heart disease, peripheral vascular disease, muscular dystrophy, pollution induced diseases, baldness, sexual dysfunction, and cancer. It also is claimed to ensure a normal pregnancy and increase athletic prowess. It appears there is scientific support for vitamin E megadoses in the treatment of peripheral vascular disease, but the other uses have no scientific support at this time (Wooliscroft, 1983).

Little evidence of toxic effects have been shown with vitamin K, riboflavin, pantothenic acid, and biotin. B12 is promoted to increase energy, improve concentration and memory, and relieve irritability. Pantothenic acid is taken to prevent fatigue, reduce arthritis pain, and improve hair and skin. Finally, biotin is purported to prevent baldness, graying of hair and eczema (Wooliscroft, 1983).

Most of the research on megadose usage has indicated many side effects. However, this has not prevented promoters from making recommendations for vitamin use as a means of preventive medicine.
Use of Vitamin Supplements

Many people seem to believe that vitamins are safe in any amount. For example, in a study of registered nurses, a potential for toxicity was found (Willit, 1981). Sixty percent of the sample took one gram or more of vitamin C per day, and used substantially in excess of the RDA of A and E. Use increased with age.

Forty percent of those living in a university community (Bremer, 1975) reported eating a typical sensible American diet, and also taking vitamins. Fifty percent of those using health foods also took supplements. Although 75 percent of those questioned believed the best source of nutrients was a normal diet, 20 percent took vitamin C when they got a cold and 3 percent used vitamins "of great potency".

A study in Australia (Worsley, 1984) showed that 37 percent of men and 53 percent of women sampled used supplements. Most popular were multivitamins, B complex, and C. Women used a broader range of supplements than men. Many added C, E, and B in megadoses to their diets. It seemed that vitamin C was used mostly by high socioeconomic groups while vitamin E was used by low income groups.
A large sample of people in seven western states was studied for patterns of vitamin usage (Read, 1981). Many subjects used over 1000 percent of the RDA of C and E, and a small percentage of the subjects were at risk of toxicity from vitamin A. Large numbers used vitamin E. The author concluded that there was some degree of potential harm in these practices, since there was no evidence of benefits of megadoses. The National Research Council has recommended that no supplement should be taken in a dosage greater than ten times the RDA.

Shapiro (1983) studied adults in California and found intakes of C in the zero to seven thousand mg. range. Women used vitamins more frequently than men. Those not likely to use them were males from sixteen to forty-four years of age. She also found that eating breakfast had a positive association with taking vitamin C supplements.

In a study by Schutz (1982), the typical supplement user was young and female, with some college education. These women believed that vitamins were effective in preventing disease.

High school athletes were studied by Douglas (1984). Nineteen percent used vitamins regularly and 41 percent never used them. All scored low on nutrition knowledge tests, but even the women athletes, who had scored higher,
didn't seem to use their knowledge in making food choices. Some used vitamins only when training and competing.

Health food consumers in Hawaii (Anderson, 1975) were shown to be concerned about health, and were influenced by writings on pollution, safety of food, and distrust of the FDA. One hundred and five of the 136 assessed used vitamins. They seemed eager to use their nutrition knowledge, but misconceptions were common among this population.

In a study of female adolescents in the southeastern United States, (McCoy, 1984) it was found that higher income people used more supplements, and more urban than rural dwellers took vitamins. High intake (2500 percent of the RDA) was found in a small percentage of subjects.

According to Dubick and Rucker, (1983) Americans spent 1.5 billion dollars on supplements in 1983, and 50 percent used them regularly. Advocates claim these products are safer and more nutritious than the food we buy in a supermarket. On the other hand, researchers say the main difference is cost of food vs. cost of supplements. In a study of health food consumers in Texas, (Rhee, 1976) it was shown that half of the users believed health food would help them stay healthy. Also, 59 percent believed that pesticides affected nutritional value of food. They believed vitamin supplements were important to health. Reasons for taking vitamins were to "stay healthy", to "cure specific illness", and "they are nutritious". Rhee
(1976) notes that these are coincidentally, the claims of supplement producers.

Some of these above quoted reasons were also noted by English in her study (1981). Family practice patients took vitamins for energy, vitality or strength, as well as for nutrition insurance, and to prevent illness or stress. Most thought supplements would benefit healthy people as well as sick. The researcher commented that there are benefits possible from a placebo effect that cannot be discounted.

Half of the sample in a university study (Bootman, 1980), used vitamins regularly or for acute disorders. According to the researcher, self-medication for illnesses is a serious hazard that stops people from consulting a doctor when ill. The majority of people in this study took vitamins for colds, pep, and energy.

Few data exist on the long term impact of megadose use. Wooliscroft (1983) stated the following reasons promoters use to sell vitamins: "Individual biologic variability makes insurance necessary, vitamins are "natural" nutrients and can't do any harm, and extraplation from research makes vitamin supplements popular". He believes many individuals consider vitamins to be safe in any amount, do not consider them to be drugs, and are rarely aware of their toxic side effects. Megavitamin doses are a daily habit for many, who use them to stay healthy or to treat a specific disease.
Health food consumers in two Texas cities (Rhee, 1976) believed that supplemental vitamin intake was important to health. Sixty-six percent of the entire study population and 93 percent of the confirmed health food consumers in the study used supplements. The general public represented in the study used mostly multivitamins, while the health food consumers took mostly specific vitamins, often in large amounts.

Even dietitians seem prone to vitamin supplementation. Washington state dietitians were surveyed (Worthington-Roberts, 1984) and 60 percent were found to use supplements, most commonly multivitamins with minerals and vitamin C, on a daily basis. Use of vitamin C was theorized to help iron absorption, or to shorten a cold. The dietitians suspected C was needed for stress and body defenses.

According to research by Wooliscroft, (1983) vitamin ingestion is a daily practice for many. The FDA reported that 55 percent of the population used supplements, and concluded that there were some potentially toxic practices, especially regarding vitamins A, C, and E. Twenty-five percent of the population used over 125 percent of the RDA of C, and 11 percent used two to eight grams daily.

A forty-eight-state survey by the USDA in 1977-78 found that 35 percent of the sample used vitamins, and that infants, children from one to five years old and women over seventy-four years old were the most regular users. Also,
the use of supplements has changed from 1965 to 1977. The use of A, thiamine, niacin, and C increased, while that of riboflavin decreased.

From a review of the research it can be seen that the American public frequently use vitamin supplementation. Although the reasons were varied, it seemed that many people believe vitamin supplementation would make them healthier.

Reasons for Supplement Use

According to Anderson (1975), the use of health foods, including vitamins, in America, has increased because of concern about health. In her study of Hawaiian health food users, she found that users were influenced by religious, sociological, psychological, and emotional motives more than scientific knowledge. Most had different ideas than their parents about processed foods, for example, and about 85 percent used vitamins. They distrusted the protective role of the FDA with regard to the quality of their food, and relied on books by popular writers. They were concerned with the environment, and purity of foods. Food had value for nutrition, pleasure, sharing, and security, among others.

Herbert (1980) reported that many people don't realize that sufficient vitamins can be gotten from a normal diet.

The elderly were studied by Grotkowski (1978). Purchases of supplements were positively related to
socioeconomic level. Vitamin users took them to get more 
pep and energy, to make themselves healthier, to prevent 
colds, to treat arthritis, and to be safe. The adequacy of 
the subjects' diets was inversely related to the belief 
that supplements were necessary.

According to some researchers (Breskin, 1975, Herbert, 
1980) the use of megadoses is primarily due to marketing in 
the popular press. In Schutz' study (1982) the typical 
user was shown to be a young female with some college 
education. The typical vitamin user believed the quality 
of food had decreased over the years and that supplements 
were useful in preventing various diseases. One of the 
most common reasons found for supplementation in her study 
was to make up for what was not present in food.

There are certainly valid reasons for taking vitamins. 
According to Herbert, (1980) vitamin dependent genetic 
diseases, defective transport, and toxicity of antivitamins 
are the only real reasons for using supplements, other than 
for true dietary deficiency.

In Dubick's (1983) evaluation of supplements, the 
subjects took vitamins for more energy, no matter how 
adequate their diets were. Also, they were used to try to 
cure diseases. Dubick states:

The reasons behind why the general public uses 
megavitamin supplementation are many, but they basically 
reflect insecurity concerning the nutrient content of the 
food supply and beliefs that vitamins are useful for 
fatigue, that people can protect their health by taking 
larger doses of vitamins than they normally need, and that 
a lack of vitamins partly causes many degenerative diseases
Nutrition Knowledge of Groups

In 1976, the results of the FDA's consumer nutrition knowledge survey were published. The survey showed that food shoppers rated their nutrition knowledge as: high—33 percent, moderate—38 percent, and low—26 percent. Young people in higher socioeconomic groups scored better on the quiz than all others. Men had lower scores than women, and the southern region of the United States had the lowest scores of all regions. It was a widely held belief that vitamins added to food are not as beneficial as natural vitamins (62 percent). Forty-seven percent of shoppers said that someone in their home regularly used vitamins. The quiz asked questions about which vitamins were hard or easy to get in the diet. They also tested knowledge of which foods provided certain nutrients. For example, 70 percent of the sample knew milk was a good source of vitamin D, but only 28 percent knew it provided riboflavin. It was the belief of 70 percent of the sample that canned or frozen vegetables aren't as nutritious as fresh vegetables. Younger shoppers were more likely to say they didn't get a balanced diet, and they also took the most vitamins. Overall, the study reported poor knowledge

(Dubick, 1983, page 50).
on food sources of vitamins, but slightly better knowledge about foods that can be substituted for one another. Increased education correlated with increased knowledge, and increased age correlated with decreased knowledge.

A variety of studies have recently attempted to measure nutrition knowledge and to relate it to attitudes and behavior. Most research shows that people poorly understand the functions of nutrients in the body (FDA survey, 1976, Grotkowski, 1978, Douglas, 1984). The more knowledgeable people are younger, better educated, and sometimes in higher socioeconomic groups (Fusillo, 1977, Anderson, 1975).

High school athletes were studied by Douglas (1984) and found to have poor food practices. Female athletes scored better on knowledge tests, but had poorer food choices than men. On the whole the study concluded that young athletes have little knowledge about nutrition.

As in other studies, (Schwartz, 1975, Fusillo, 1976) the women athletes didn't utilize their nutrition knowledge in planning a diet.

Alexander (1977) studied college students, and found no significant relationship between knowledge and adequacy of diets. Although nutrition students scored significantly better on a knowledge quiz, they didn't make significantly better food choices.

Collegiate physical education majors (Cho, 1974)
scored lower on a nutrition quiz than nutrition students, and they had many misconceptions. On the other hand, high school graduates (Schwartz, 1975) had relatively high levels of knowledge. In most studies of school age subjects, parents were considered to be the most reliable source of nutrition information (Douglas, 1984, Cho, 1974, Schwartz, 1975).

A significant difference in scores on a nutrition quiz was found in a study of vegetarians and non-vegetarians (Freeland-Graves, 1982). Although both groups had low scores compared to those of nutrition students, vegetarians knew more than non-vegetarians.

In Poplin's study (1980) of the knowledge of health profession students, he surveyed the general public, members of health science classes, and health club members. There were no significant differences in the scores of the groups even though the health science students had taken nutrition classes.

A group that seems to get consistently low scores on nutrition quizzes is doctors. A study by Krause (1977) showed that about 62 percent needed better nutrition education.

In studying registered nurses, Vickstrom (1976) found that average knowledge about basic nutrition declined with age and experience. Knowledge was significantly related to attitude about nurses' roles in nutrition education.

Overall low nutrition knowledge was found in the
scores of the elderly (Grotkowski, 1978). In this study, belief that supplements can be used as medicine correlated with purchase of multivitamins.

Overall the research indicates that well educated young people have the greatest nutrition knowledge. Most studies have revealed that many people have little understanding of nutrient functions in the body. Also, people don’t often use their nutrition knowledge in meal planning.

Opinions, Beliefs, and Practices

Often, individuals base food choices on something other than knowledge of nutrition. Health food consumers in Hawaii were influenced by much more than knowledge (Anderson, 1975). They incorporated religious, emotional, and other motives in choosing their diet. Nutrition courses in school were seen as dull while books by popular writers were interesting and informative. In studying the elderly (Grotkowski, 1978), the researcher found that attitudes may have greater effect on diet than knowledge.

In a study of lactating women, Sims (1978) reported that teaching nutrition concepts does not seem to result in improved intake. She postulated that attitudes and beliefs influence behavior. As a group, nursing mothers had high knowledge levels, possibly because of their favorable attitudes toward nutrition for their children. In this study it was found that attitudes influenced knowledge,
which influenced behavior. She suggested that education be geared toward changing attitudes.

In a study of high school graduates, (Schwartz, 1975) a different model was accepted. Attitudes influenced knowledge and practices, but knowledge and practices did not correlate (K→A→P). The women graduates who had high knowledge scores didn’t apply their knowledge to food choices.

In studying young spouses, Yetley (1990) found that the knowledge-practice link was conflicting. She found that the evaluation and acceptance of nutrition information was affected by education, income, social class, health goals, and the spouse. She concluded that knowledge is an insufficient basis for one spouse to convince another that sound dietary practices are important.

In his study, Wolff (1973) says of health food users, "They believe and behave not because of what they read, they read because of the beliefs they have." He believes dietary attitudes are formed through association with peers.

None of the above reported studies utilized health club members as subjects. However, the research on other groups has indicated that factors such as age, sex, and education may be salient factors for health club members as well. Research on health club members may help to clarify their use of vitamins, their reasoning for use of vitamins, their sources of information, and their knowledge of
vitamin functions. As with other groups, health club members possibly supplement to ward off vitamin deficiency, to cure specific diseases, or just to be safe.
CHAPTER 3
Methodology

A questionnaire was developed to measure the nutrition knowledge of health club members, to describe their opinions about supplements, and their use of supplements. It was pilot tested using twenty-five members of a health club in Simi Valley. After testing, the questionnaire was revised to make some questions clearer, and shortened to four pages.

The final questionnaire included six demographic questions, five about supplementation habits and sources of information, ten opinion questions, and thirty-five knowledge questions about functions and food sources of vitamins.

Data Collection Procedures

The population of this study consisted of members of three health clubs in the San Fernando Valley and Simi Valley areas. The sample included 166 members who were willing to fill out and return the questionnaire. At two
of the clubs, questionnaires were given out by the researcher and a spa representative at different times of the day and night to get a representative sample. At the third club, the questionnaires were mailed, along with a return envelope, to the members' homes with their monthly bill. Participants were informed that the study was an investigation of nutrition habits being done at California State University, Northridge. Answers were provided to anyone requesting them after the questionnaire was filled out.

Instrument

The data collection instrument used was a four page questionnaire, with demographic, opinion, and knowledge questions.

Demographic data solicited included age, sex, marital status, education level, membership status, and length of membership.

The questionnaire asked whether vitamins were used, and provided a chart to describe which vitamins were taken, how often, and the size of the dosage. One question asked, for example, "Where does most of your information about vitamins come from?" Then nine choices were listed. Ten opinion questions were presented. For example, subjects were asked to agree, disagree, or indicate they were unsure whether "extra vitamins make up for skipped meals".

Thirty five multiple choice knowledge questions were
included. For example, regarding food processing damage to vitamin C, subjects were asked to choose methods of minimizing destruction.

Analysis of Data

One hundred and sixty-six questionnaires were completed. Each was given a number for purposes of computer analysis. Each subject was given a nutrition score according to the number of correct answers on the quiz portion of the questionnaire. Scores from thirty-five to one hundred and five were possible. The mean score was calculated for the group.

Frequency data were obtained for descriptive data, including sources of vitamin information, types and amounts of vitamins used, reasons for taking or not taking vitamins, and opinions about popular myths about vitamins.

Quiz scores were analysed by age, sex, education level, length of membership, and whether or not vitamins were used.

Scores were analysed for differences between men and women and use or non-use of vitamins using the student's "t" test.

Certain opinion and knowledge questions were analysed using pearson's r, to investigate consistency of knowledge and opinions.

Analysis of variance was used to test differences in types of vitamins used by members of different ages, levels
of education, and lengths of membership.

Also, scores were compared for differences due to age, length of membership and educational level using analysis of variance. Furthermore, Pearson's r was used to clarify the relationships between these variables.

Finally, vitamin usage was analysed for differences between men and women using the chi square test. The lowest level of significance accepted for all tests was .05.
CHAPTER 4
Results and Discussion

The objective of this study was to investigate health club members' knowledge of vitamin functions, their opinions concerning popular myths, and their habits of using supplemental vitamins.

Subjects

Of the 166 people who completed the questionnaire, eighty-five were male and eighty-one were female (see Table 1). Thirty-four percent were between twenty-one and thirty years old, and 35 percent were between thirty-one and forty years old.

Over half of the sample was married. Thirty-nine percent had received some college education, while 26 percent were college graduates. Fourteen percent of the sample held an advanced degree.

Thirty-three percent of the sample had been health club members for over three years, while 23 percent had been members for one to two years. Twenty-nine percent
Table 1
Selected Demographic Characteristics of Respondents

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>81</td>
<td>49</td>
</tr>
<tr>
<td>Male</td>
<td>85</td>
<td>51</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>under 21</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>21-30</td>
<td>58</td>
<td>35</td>
</tr>
<tr>
<td>31-40</td>
<td>59</td>
<td>35</td>
</tr>
<tr>
<td>41-50</td>
<td>31</td>
<td>19</td>
</tr>
<tr>
<td>51-60</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>61-70</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>over 70</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Educational Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>some high school</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>high school graduate</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>some college</td>
<td>65</td>
<td>39</td>
</tr>
<tr>
<td>college graduate</td>
<td>43</td>
<td>26</td>
</tr>
<tr>
<td>some graduate school</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>advanced degree</td>
<td>23</td>
<td>14</td>
</tr>
<tr>
<td><strong>Length of Membership</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; six months</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>6 months- 1 year</td>
<td>34</td>
<td>21</td>
</tr>
<tr>
<td>1-2 years</td>
<td>39</td>
<td>24</td>
</tr>
<tr>
<td>2-3 years</td>
<td>23</td>
<td>14</td>
</tr>
<tr>
<td>&gt; three years</td>
<td>55</td>
<td>33</td>
</tr>
</tbody>
</table>
Supplemental Vitamin Utilization

Of the 166, 121 used vitamins and forty-five did not. When asked why they didn't use vitamins, non-users responded that their diet was adequate (20 percent), vitamins are unnecessary (8 percent), subjects are healthy (6 percent), and "other" (5 percent). (Percentages don't add to one hundred because these are the reasons most often used, but others were possible). In contrast, Worsley's study (1984) indicated these reasons given for non-use: "My diet is adequate without them (43 percent), they are unnecessary (23 percent), and "I feel well" (13 percent). More subjects in the thirty-one to seventy age group in this study thought their diet was adequate without supplements.

Vitamin users were polled to find the most important reasons why they used vitamins (see Table 2). The modal reason was "to make up for what is not in food". Twenty-six percent cited this as the most important reason, 18 percent as the second most important, and 10 percent as the third most important reason.

"I feel my diet is inadequate" was listed as the most important reason for taking vitamins by 15 percent of the sample. "To give me energy" was listed as most important by 11 percent. Other reasons noted by a substantial number of people were "to prevent colds or other illnesses", and
Table 2

Reasons for Supplement Use
Ranked by Importance

<table>
<thead>
<tr>
<th>Reason</th>
<th>#1</th>
<th></th>
<th>#2</th>
<th></th>
<th>#3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>To give me energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>11</td>
<td>17</td>
<td>10</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Makes up for what is not in food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>26</td>
<td>30</td>
<td>18</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>Prevents colds or other illnesses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>10</td>
<td>16</td>
<td>10</td>
<td>21</td>
<td>13</td>
</tr>
<tr>
<td>I feel my diet is inadequate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>15</td>
<td>24</td>
<td>15</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>As a precaution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>--</td>
<td>--</td>
<td>18</td>
<td>11</td>
<td>19</td>
<td>11</td>
</tr>
</tbody>
</table>

Percentages don't add to one hundred since all reasons given are not listed.
"as a precaution".

In other studies, diverse reasons were noted for vitamin use. Young (1981) and Shapiro (1983) noted possible use for preventing cancer (vitamins A, C, and E). Bremer's subjects (1975) took vitamins for colds and to stay healthy. In Worsley's study (1984) users reported more energy, and used vitamins for stress, tiredness, and colds.

In Schutz's study (1982) in seven western states reasons for supplement use included disease prevention. Dietitians in Washington state (Worthington-Roberts, 1984) used vitamins to play it safe, and possibly to help iron absorption, or decrease the duration of a cold.

Certainly, in looking at the reasons for vitamin use given in the present study, it was shown that health club members either do not trust the available food supply to provide the necessary vitamins or feel their diet does not include adequate amounts of certain nutrients.

Sources of Information

All those questioned were asked where they get their information about vitamins (see Table 3). Most people got their information from magazines and newspapers. Many read nutrition books, while some said they read scientific research. Only 15 percent mentioned nutrition classes as their source, and health club instructors were noted by only 6 percent. In Douglas's 1984 study of high school
Table 3

Sources of Information About Vitamins

<table>
<thead>
<tr>
<th>Source</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition Classes</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td>Friend</td>
<td>42</td>
<td>25</td>
</tr>
<tr>
<td>Health Food Stores</td>
<td>26</td>
<td>16</td>
</tr>
<tr>
<td>Nutrition Books</td>
<td>62</td>
<td>37</td>
</tr>
<tr>
<td>Scientific Research</td>
<td>29</td>
<td>17</td>
</tr>
<tr>
<td>Health Club Instructor</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Magazines/Newspapers</td>
<td>68</td>
<td>41</td>
</tr>
<tr>
<td>TV/Radio</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>Other (Mostly Relatives)</td>
<td>36</td>
<td>21</td>
</tr>
</tbody>
</table>
athletes, the most reliable source of information was considered to be parents. In contrast, nursing students (Ross, 1984) turned to printed materials and other professionals. Anderson (1975) polled Hawaiian health food users and found their information came from health food store owners and popular writers. Nutrition courses in school were seen as "dull" and "old-hat". The present sample of health club members follow a pattern similar to the health food consumers.

Family practice patients (English, 1981) got advice from friends (70 percent) and newspapers (24 percent).

It was promising that in this study 17 percent of the sample used scientific literature as their source. Also, nutrition books were noted quite often, although specific titles were not solicited.

Nutrition Mythology

Ten statements relating to popular nutrition myths were included in the questionnaire. On four of these statements, most people agreed with currently accepted research. For example, 83 percent of those questioned agreed that vitamins don't make up for skipped meals. Eighty percent disagreed with the statement that it is wise to take megadoses each day. Seventy-seven percent of the subjects also agreed that some vitamins can build up in the body and cause harmful effects. Seventy-one percent disagreed that megadoses are necessary for improved
athletic performance. Although it has been shown that knowledge is not always followed by consistent practices, seventy to eighty percent of the sample agreed that megadoses are unnecessary and too many vitamins can be harmful.

On other statements, respondents scored lower in terms of correct answers. For example, one statement claimed that the amounts of vitamins needed varies greatly from person to person. Only 15 percent disagreed. Only 30 percent disagreed with the statement that vitamins can give you extra energy. One statement claimed that modern farming methods using chemical fertilizers produced food with a lower nutrient content. Only 38 percent disagreed with this statement. A reaction similar to this was noted by Anderson (1975) in the Hawaiian study. Many health food users distrusted the FDA while relying on popular writers, and were concerned that modern methods of processing and growing may be harming the food and the environment.

A total score was given on this section of the questionnaire. Three points were given for a response that agreed with currently accepted scientific thought, two points were given for an "unsure", and one point was given for a response that disagreed with a currently accepted statement. Thirty points were possible, indicating agreement with accepted research on all statements. Scores ranged from sixteen to thirty, with a mean of 22.9. The
modal score was twenty-four. This indicates rather good recognition of false beliefs concerning vitamins (see Table 4). The average on this section was better than that on the knowledge section, showing that while most people scored lower on function and source questions, they at least did better in picking out falsehoods. However, according to other studies (Douglas, 1984, Alexander, 1977, Sims, 1978, Schwartz, 1975) possessing adequate knowledge does not always lead to behavior congruent with this knowledge. People in this sample who believed vitamins can cause harm and are not necessary for athletes, are still undoubtedly taking them for some reason, as shown by their reported habits.

Knowledge of Vitamin Function

The quiz portion of the questionnaire focused on food sources of vitamins and vitamin functions. The scores on this ranged from forty-three to ninety-three (the possible range was thirty-five to 105). The mean score was 75.5. The modal score was seventy-six. On this portion the respondent was given three points for a correct answer, two points for an "unsure", and one point for an incorrect answer. The student's "t" test was used to test for differences in scores due to sex, and whether or not vitamins were used. Both results were not significant (see Table 5). The null hypothesis was accepted, since there was no difference in knowledge level due to sex or to
Table 4
Responses to Selected Opinion Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A balanced diet provides all necessary nutrients.</td>
<td>Disagree: 21, Unsure: 13, Agree: 67</td>
</tr>
<tr>
<td>Synthetic vitamins differ from natural vitamins.</td>
<td>Disagree: 36, Unsure: 35, Agree: 29</td>
</tr>
<tr>
<td>Megadoses are necessary for athletes.</td>
<td>Disagree: 71, Unsure: 21, Agree: 8</td>
</tr>
<tr>
<td>It is wise to take megadoses to make sure you get enough.</td>
<td>Disagree: 8, Unsure: 13, Agree: 7</td>
</tr>
<tr>
<td>Peoples' needs for vitamins vary greatly.</td>
<td>Disagree: 15, Unsure: 13, Agree: 72</td>
</tr>
<tr>
<td>Chemical fertilizer produces less nutritious food.</td>
<td>Disagree: 36, Unsure: 36, Agree: 29</td>
</tr>
<tr>
<td>Vitamins can build up and cause harmful effects.</td>
<td>Disagree: 3, Unsure: 21, Agree: 77</td>
</tr>
<tr>
<td>Fortification of foods with vitamins is a good way to ensure an adequate intake.</td>
<td>Disagree: 24, Unsure: 25, Agree: 51</td>
</tr>
</tbody>
</table>

Wording of questions has been shortened to save space.
Table 5
Comparison of Scores with Selected Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>p = 0.0001</td>
</tr>
<tr>
<td>Age</td>
<td>p = 0.0159</td>
</tr>
<tr>
<td>Length of Membership</td>
<td>p = 0.5793</td>
</tr>
<tr>
<td>Sex</td>
<td>p = 0.9530</td>
</tr>
<tr>
<td>Use of Vitamins</td>
<td>p = 0.3340</td>
</tr>
</tbody>
</table>
vitamin use.

Analysis of variance was used to test for significant differences in score due to age, length of membership, and educational level. Results showed a significant difference in score due to age \((p<.02)\). In this case the alternate hypothesis was accepted. There is a difference in knowledge level due to age. This difference was further tested using Pearson's product moment correlation coefficient (Pearson’s \(r\)). This result was also significant \((p<.03)\), and illustrated a decreasing score with age (see Table 6).

Analysis of variance for comparing scores to length of membership resulted in no significant difference in knowledge level due to length of membership in the spa.

Analysis of variance was also used to test differences in scores due to education level. Results showed a significant difference \((p<.001)\). In this case the alternate hypothesis was accepted; there was a difference in knowledge level of health club members due to their level of education; logically, more education led to greater knowledge.

Certain questions were answered correctly by a substantial percentage of the sample. For example, they were asked whether megadoses of vitamins could cause a healthy person's vision to improve. Eighty-seven percent said this was false, while 13 percent checked true.

To the statement "vitamin D can cure arthritis,
Table 6
Correlation Coefficients of Quiz Scores
With Demographic Data

<table>
<thead>
<tr>
<th>Factor</th>
<th>Pearson &quot;r&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X₁</td>
</tr>
<tr>
<td>Score (X₁)</td>
<td>1.00</td>
</tr>
<tr>
<td>Education (X₂)</td>
<td>.314*</td>
</tr>
<tr>
<td>Age (X₃)</td>
<td>-.170*</td>
</tr>
<tr>
<td>Length of Membership (X₄)</td>
<td>.081</td>
</tr>
</tbody>
</table>

* p < .05
** p < .01
according to most research", 90 percent answered false. Most people agreed with the statement that vitamin A is poisonous in large amounts (64 percent). A good deal more people (83 percent) disagreed with a similar statement that vitamin A is harmless in large doses. While not consistent, at least the trend is toward the correct information. The statement about vitamin D being more effective in large doses was also disagreed with by most people (92 percent). A statement giving false sources of vitamin C was recognized by a large percentage (90 percent). However, true sources of vitamin C were recognized by fewer people (70 percent). This is again an inconsistency, but still, a high percentage of correct answers was given on these statements.

To the food processing question, chopping (92 percent) and boiling (87 percent) were recognized as false solutions to vitamin C destruction. Almost 76 percent of the sample correctly answered the statement that cooking foods for a short period of time will minimize destruction of vitamin C. With regard to vitamin E, 75 percent of the sample correctly identified two false statements, that it will prevent heart disease and that it will increase fertility.

Finally, 70 percent of the sample knew that B vitamins cannot supply energy (even though 36 percent of the sample reported taking vitamins for energy, and 12 percent took them for tiredness). Many studies (Worsley, 1984, Herbert, 1980, Dubick, 1983) noted that people took vitamins for
pep, to relieve stress, and to combat tiredness. But at the same time, almost 70 percent of the sample in this study knew these reasons were invalid! It seems that knowledge isn't the only prerequisite to good nutrition practices. According to Sims (1978) and Schwartz (1975) attitudes have far more influence on behavior than objective knowledge. Results of this study seemed to bear out this theory.

The questions most frequently answered correctly stated "vitamin D should be taken in large doses to be effective (92 percent said no) and "damage to vitamin C can be minimized by chopping foods (again, 92 percent said no)."

On the other hand, a large percentage of the sample did not know the answers to certain questions. The two most often missed were: "vitamin E is present in considerable amounts in margarine" and "damage to vitamin C can be minimized by storing foods in a dark place" (see Table 7). These results show that a large number of people don't know the food sources of some vitamins. The same results were found in the FDA's study (1976) of consumer nutrition knowledge. Also, basic concepts of nutrient preservation are misunderstood. The fact that vitamin C can be destroyed by light was a concept that went unrecognized by 80 percent of the sample. Poor understanding of the basic concepts was also demonstrated in the FDA survey by asking people which nutrients are hard
Table 7
Responses to Selected Questions Most Frequently Answered Incorrectly

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th>Correct (%)</th>
<th>Incorrect (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin D is found in tuna and egg yolks.</td>
<td></td>
<td>31</td>
<td>69</td>
</tr>
<tr>
<td>The body rids itself of B vitamins it doesn’t need.</td>
<td></td>
<td>32</td>
<td>68</td>
</tr>
<tr>
<td>Milk is an important source of riboflavin.</td>
<td></td>
<td>36</td>
<td>64</td>
</tr>
<tr>
<td>Vitamin C helps the body absorb iron.</td>
<td></td>
<td>34</td>
<td>66</td>
</tr>
<tr>
<td>Vitamin E is present in considerable amounts in margarine.</td>
<td></td>
<td>13</td>
<td>87</td>
</tr>
<tr>
<td>Storing foods in a dark place can help preserve vitamin C.</td>
<td></td>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>
or easy to get in the regular diet. It seems likely that people such as health club members would be very interested in getting the most nutrients out of their food as possible if teaching these concepts could be made to sound modern and exciting; possibly, "Turn Your Everyday Foods Into Health Foods!".

Over half of the sample didn't know that the body rids itself of excess vitamin B or that milk is an important source of riboflavin. About half of the respondents didn't know vitamin A is found in spinach and tomatoes or that fruits and vegetable aren't good sources of the B vitamins.

Certain answers about vitamin myths were compared to the true-false quiz answers using Pearson's r. It was useful in comparing answers on similar subjects to measure consistency of opinion or knowledge. For example, one question asked whether vitamins can build up in the body and cause harmful effects. These answers were compared to three other questions (see Table 8). There was a significant positive correlation between this statement and that asking if vitamin A can be poisonous in large doses. There was a similar result to the statement "vitamin A is harmless in large doses". However, when that statement was compared to "vitamin D should be taken in large doses", no significant correlation was found. Whether this indicated more knowledge about vitamin A than D is unknown, but consistency of knowledge was not maintained.

Another comparison was made with the question asking
<table>
<thead>
<tr>
<th>Statement</th>
<th>Pearson &quot;r&quot; Value</th>
<th>Compared With</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A is usually harmless in large amounts.</td>
<td>.1429</td>
<td>Vitamin A is poisonous in large amts.</td>
</tr>
<tr>
<td>Vitamin A causes vision improvement in a healthy person taking megadoses.</td>
<td>.0678</td>
<td>One-half cup of carrots provides &gt; the RDA of vitamin A.</td>
</tr>
<tr>
<td>Vitamin A is found in spinach and tomatoes.</td>
<td>.2059**</td>
<td>&quot;</td>
</tr>
<tr>
<td>Vitamin A can be poisonous in large amounts.</td>
<td>.3439**</td>
<td>Vitamins can build up in the body and cause harmful effects.</td>
</tr>
<tr>
<td>Vitamin A is usually harmless in large amts.</td>
<td>.1567*</td>
<td>&quot;</td>
</tr>
<tr>
<td>Vitamin D should be taken in large doses to be effective.</td>
<td>.1398</td>
<td>&quot;</td>
</tr>
</tbody>
</table>
Table 8 (continued)

<table>
<thead>
<tr>
<th>Vitamins contain no</th>
<th>B vitamins can supply energy directly to the body.</th>
</tr>
</thead>
<tbody>
<tr>
<td>calories and supply no energy.</td>
<td>.3108**</td>
</tr>
</tbody>
</table>

Vitamins can give you extra energy. .2688**

Vitamin C destruction can be minimized by boiling foods .2315**

..cooking for short periods of time .1038

..chopping foods. .2593**

..storing in dark place .1732*

---

* p < .05

** p < .01
whether a half-cup of carrots provides more than the RDA of vitamin A. This was compared with "vitamin A causes vision improvement" (not significant) and "vitamin A is found in spinach and tomatoes" (p<.01). This suggests good knowledge of food sources of vitamin A, but less knowledge of the functions of the vitamin. On the whole, it seemed that answers to questions were fairly consistent. However, when it came to practices, this knowledge was not consistently utilized.

Description of Vitamin Users

Of the 121 people that took vitamins in the survey, 43 percent were male and 57 percent were female. Most were between twenty-one and thirty years of age (36 percent) while 34 percent were between thirty-one and forty years of age, and 20 percent were between forty-one and fifty years of age. Sixty-five percent of those using vitamins were married.

The majority of the vitamin users had some college education (42 percent). Twenty-six percent had a degree, while 10 percent were high school graduates. Thirteen percent had obtained advanced degrees. The largest percentage of vitamin users (31 percent) had belonged to a gym for over three years. Twenty-two percent had been members for between one and two years. Twenty percent had belonged for six months to a year, while 16 percent were members for two to three years.
Length of membership and types of vitamins used were compared using analysis of variance. Most of the vitamins used had no significant relationship with length of membership. However, the use of multivitamins with iron was significantly different with differing lengths of membership (p<.05). The use of more vitamins as membership length increased may be the result of the increased "push" to use supplements in gyms.

Specific Vitamins Utilized

Multivitamins were most popular with this sample of health club members (see Table 9). Fifty percent of the study population reported taking one tablet a day. Three percent took three per day. Multivitamins containing minerals were used by 18 percent once a day, and by 3 percent three times per day.

Multivitamins with iron were also commonly used. Fifteen percent of the group took one tablet per day; one person took two per day.

The B complex vitamins were used by 16 percent once a day and by 3 percent either twice a day, three times a day or in one dose of 100-199 mg.

Vitamin D was taken in varying amounts, up to three tablets per day, or eight hundred to nine hundred International Units daily. Five percent took one tablet per day, while 2 percent took 400-499 International Units daily. Ten percent of the sample took between one thousand
<table>
<thead>
<tr>
<th>Supplement</th>
<th>Number</th>
<th>% (of vitamin users only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multivitamin</td>
<td>85</td>
<td>69</td>
</tr>
<tr>
<td>Multi with minerals</td>
<td>37</td>
<td>29</td>
</tr>
<tr>
<td>Multi with iron</td>
<td>24</td>
<td>19</td>
</tr>
<tr>
<td>B Complex</td>
<td>37</td>
<td>29</td>
</tr>
<tr>
<td>D</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>C</td>
<td>59</td>
<td>47</td>
</tr>
<tr>
<td>A</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>K</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>37</td>
<td>29</td>
</tr>
</tbody>
</table>
and eleven hundred mg. of vitamin C per day. Eight percent took fifty-sixty mg. per day, and the same percentage used one tablet per day (approximately 125 mg.). A small percentage (2 percent) took over ten thousand International Units per day of vitamin A.

Vitamin E was used by 9 percent in the amount of one tablet per day. Seven percent took four hundred to five hundred International Units per day, and 2 percent took one thousand International Units four or five times a week.

The chi-square test was used to find any significant differences between whether the respondent used supplements or not depending on age or length of membership. The results of these two tests showed no significant difference in the age or length of membership between vitamin users and non-users. Female members seemed to use more vitamins, however, and this result approached significance (p= .0566). This result paralleled those in other studies (Worsley, 1984, Shapiro, 1983, Schutz, 1982).

Analysis of variance was used in testing types of vitamins used, according to age and education categories. All results of this testing were not significant.

In comparing vitamin intake to the RDA it was found that substantial numbers of people supplemented in amounts far in excess of the recommended limit. For example, while 50 percent of the group used multivitamins that provided 100 percent of the RDA, 2.4 percent took 300 percent of the
With regard to vitamin C, 10 percent took about sixteen times the RDA, and 8 percent took ten times the RDA. Also, vitamin E was taken in doses up to twenty times the RDA, although the reliability of reports by the subjects wasn't known. Vitamins A and D were taken by a small percentage in doses up to three times the RDA.

It seemed that indiscriminate use of vitamins was widespread, and some danger of toxicity could be present. In Worsley's study (1984) of nutrient intake vitamin C use averaged 279 mg. per day, about four times the RDA. Vitamin E intake was 136 mg. per day, about thirteen times the RDA. Vitamin B6 intake averaged forty-six mg. per day, which was about twenty-one times the RDA.

In Willett's study (1981), 60 percent of registered nurses took one gram or more of vitamin C and used substantially in excess of the RDA for A and E. In a study of young children, Breskin (1985) found vitamin C supplementation from forty-three to 625 mg. per day. Adults in seven western states (Read, 1981) took vitamins C and E, many in doses of over 1000 percent of the RDA. A small percentage of the Read study population was at risk for vitamin A toxicity. In a group of Texas health food users, Rhee (1976) found frequent use of megadose strength vitamin supplements. In the forty-eight state survey by the USDA (1984) it was found that there was a potentially harmful degree of supplementation of vitamins A, E, and C.
in the population. Therefore, the health club members in the present study are not unusual when compared with these groups.
CHAPTER 5

Summary, Conclusions, and Recommendations

Increased use of vitamin supplementation in recent years has led to concern by professionals about potentially harmful practices. While doctors, dietitians, and most researchers maintain the superfluous nature of megadose supplementation, others promote it as necessary to health and fitness.

This study was designed to investigate the knowledge, habits, and opinions of health club members toward vitamins.

A questionnaire was distributed which tested knowledge of vitamin functions and opinions about popular myths and asked questions about supplementation habits.

Of the 166 completed questionnaires, 121 people used vitamins, some substantially in excess of the RDA.

Quiz scores indicated a fair amount of knowledge, with a mean score of 75.5. Opinions about vitamin myths were reasonably close to current scientific thought. A mean
score of 22.9 out of thirty indicated a surprising amount of agreement with current research. Answers to myth and knowledge questions were compared to measure consistency using Pearson's r, with a high percentage of significant relationships between answers.

Analysis of variance was used to test scores depending on age (p<.02), length of membership (not significant), and education level (p<.01). Consequently, the alternate hypotheses stating that knowledge would differ significantly according to age and education level were accepted, while that stating knowledge would differ significantly due to length of membership was rejected, and the corresponding null hypothesis accepted.

Pearson's r was used to further test score differences due to education level (positive correlation, p<.001) and age (negative correlation, p<.03).

The t-test was used to test score differences due to sex (not significant) and whether or not vitamins were used (not significant).

Vitamin use was compared between men and women using chi-square (not significant, although vitamin C was used more by women).

When looking at vitamin habits, it was found that vitamins C, A, D, E, and multivitamins were supplemented in excess of the RDA by a fair proportion of the sample.

Although scores on the knowledge and attitude tests indicated fair knowledge, health club members had many
misconceptions. Until this can be corrected, there exists in this population a potential hazard of over-medication.

Further research is needed to delve deeper into exact dosages of specific vitamins taken by this group and others. Also, health club members are an excellent group to use in investigating the knowledge-practices-attitudes link touched on in this study.

Other interesting questions that developed out of the present study are: what is the level of perceived knowledge in members compared to their actual knowledge? Can an information booklet geared to this population be effective in disseminating the facts, and counteracting the misinformation they are receiving?
Bibliography


Appendix A

Your club is participating in a nutrition survey being done at California State University, Northridge. If you are interested in good nutrition, please take part by filling out this short questionnaire.

If you have any questions about nutrition or your diet, let your health club instructor know. We'd be happy to answer any questions.

Questionnaire

1. Age
   - Under 21: 10
   - 21-30: 58
   - 41-50: 31
   - 51-60: 6
   - over 70: 1

2. Sex
   - M: 85
   - F: 81

3. Marital Status
   - Mar: 102
   - Sin: 47
   - Div: 14
   - Wid: 0
   - Sep: 3

4. Education Level
   - Some high school: 2
   - College grad: 15
   - High school grad: 65
   - Some grad school: 18
   - Some college: 65
   - Advanced degree: 23

5. Are you a member of a health spa? Yes: 166
   No: 0
6. Length of Membership
   Under 6 mos.: 14   2-3 years: 24
   6 mos.-1 yr.: 34   >3 years: 55
   1-2 yrs.: 39   N/A: 0

7. Do you take vitamin supplements? Yes: 121 No: 45

8. If you don’t take any vitamins, please indicate your reason or reasons.
   They are unnecessary: 13 Other (please describe): 9
   I am not ill at this time: 3
   My diet is adequate: 33

9. If you take supplements, please fill out the following chart. Check the space next to the vitamins you take. Then write how often you take them (3 times a day, once a day, once a week, etc.). Finally, indicate how much you take at a time.

<table>
<thead>
<tr>
<th>Supplements</th>
<th>Check If Used</th>
<th>How Often</th>
<th>Amt. Each Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multivitamin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi/iron</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi/minerals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B complex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11. * If you take vitamins, please list the three most important reasons (Put "1" next to the most important, "2" next to the second most important reason, and "3" next to the third most important reason).

1  2  3

To give me energy: 18  17  25
Makes up for what isn’t in food: 43  30  17
Prevents colds or other illnesses: 16  16  21
For tiredness: 0  5  14
I feel my diet is inadequate: 25  24  15
As a precaution: 0  18  19
Dr. prescribed it: 3  3  6
For my skin: 1  3  1
Because of pregnancy: 6  3  0
To help me lose weight: 1  1  1
I am anemic: 2  1  1
Friend’s advice: 0  1  2
To help me gain weight: 0  1  1
Other (please explain): 13  3  4
12. Please indicate your feelings about the following statements.  

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
<th>Disagree</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Vitamins can give you extra energy:</td>
<td>78</td>
<td>50</td>
<td>38</td>
</tr>
<tr>
<td>b. A healthy person can get all the nutrients needed by eating a well-considered variety of foods:</td>
<td>111</td>
<td>34</td>
<td>21</td>
</tr>
<tr>
<td>c. Synthetic vitamins have different effects than vitamins found in food</td>
<td>60</td>
<td>48</td>
<td>58</td>
</tr>
<tr>
<td>d. Megadoses are necessary for healthy athletes to improve performance:</td>
<td>14</td>
<td>118</td>
<td>34</td>
</tr>
<tr>
<td>e. It is wise to take megadoses to make sure you get enough each day:</td>
<td>12</td>
<td>132</td>
<td>22</td>
</tr>
<tr>
<td>f. People vary greatly in their needs for vitamins. Some need more than others:</td>
<td>120</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>g. Modern farming methods using chemical fertilizers produce food with a lower nutrient content.</td>
<td>48</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td>h. Vitamins make up for skipped meals:</td>
<td>10</td>
<td>137</td>
<td>19</td>
</tr>
<tr>
<td>i. Some vitamins can build up in the body and cause harmful effects:</td>
<td>121</td>
<td>5</td>
<td>34</td>
</tr>
<tr>
<td>j. Commercial fortification of food (like milk) with vitamins is a good way to ensure an adequate intake:</td>
<td>85</td>
<td>40</td>
<td>41</td>
</tr>
</tbody>
</table>
13. Please check the appropriate answer:

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Vitamins are needed in the diet in tiny amounts:</td>
<td>62</td>
<td>65</td>
<td>39</td>
</tr>
<tr>
<td>b. Vitamins increase the speed of chemical reactions:</td>
<td>48</td>
<td>23</td>
<td>90</td>
</tr>
<tr>
<td>c. Synthetic vitamin A may be less beneficial than the vitamin found in food:</td>
<td>46</td>
<td>39</td>
<td>81</td>
</tr>
<tr>
<td>d. Vitamins contain no calories, so they don't supply energy directly:</td>
<td>60</td>
<td>45</td>
<td>61</td>
</tr>
<tr>
<td>e. Vitamin A can be toxic in large doses:</td>
<td>106</td>
<td>9</td>
<td>51</td>
</tr>
<tr>
<td>f. Vitamin C can alleviate some symptoms of a cold, like a stuffy nose:</td>
<td>51</td>
<td>82</td>
<td>33</td>
</tr>
<tr>
<td>g. Vitamin E is found in most foods:</td>
<td>22</td>
<td>68</td>
<td>76</td>
</tr>
<tr>
<td>h. Good sources of vitamin C are spinach, strawberries, and cabbage:</td>
<td>65</td>
<td>56</td>
<td>45</td>
</tr>
<tr>
<td>i. Fruits and vegetables are good sources of thiamine (a B vitamin):</td>
<td>73</td>
<td>31</td>
<td>62</td>
</tr>
<tr>
<td>j. Good sources of the B vitamins are poultry and fish:</td>
<td>62</td>
<td>31</td>
<td>73</td>
</tr>
<tr>
<td>k. A half-cup of serving of carrots provides more than the daily requirement of vitamin A:</td>
<td>78</td>
<td>9</td>
<td>73</td>
</tr>
</tbody>
</table>
Please circle the letters in front of ALL the statements that you believe to be true.

T   F

14. Vitamin A:
29 137 a. is usually harmless in large doses.
59 107 b. aids in resisting infection.
21 145 c. can cause vision to improve in a healthy person who takes megadoses.
81 82 d. is found in spinach and tomatoes.

15. Vitamin D:
100 66 a. keeps calcium in balance in the body.
52 114 b. is found in tuna and egg yolks.
17 149 c. can cure arthritis, according to most research.
14 152 d. should be taken in large doses to be effective.

16. Regarding the B vitamins:
51 115 a. They can supply energy directly to the body.
53 113 b. The body gets rid of any it doesn’t need.
38 128 c. Thiamine aids in removing lactic acid from muscles after they have been worked.
60 106 d. Milk is an important source of riboflavin.

17. Vitamin C:
51 115 a. Sweet peppers, broccoli, and brussels sprouts are poor sources of vitamin C.
72 94 b. Vitamin C should be supplemented since food
processing destroys most of it in our food.

51 109  c. Vitamin C helps the body absorb iron.

18 148  d. Vitamin C is found in whole grains and cereals in good amounts.

18. Vitamin E:

41 125  a. can prevent heart disease.

41 125  b. has been shown to increase fertility in men.

22 144  c. is present in considerable amounts in margarine.

58 108  d. increases stamina and endurance.

19. Food processing can destroy some vitamins in food. Damage to vitamin C can be minimized by:

126 40  a. cooking for short periods of time.

22 144  b. boiling foods.

152 14  c. chopping foods before cooking.

33 133  d. storing foods in a dark place.

Thanks again for your help!