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THE ROLE OF NUTRITION IN DENTISTRY IN MICHIGAN

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ABSTRACT

THE ROLE OF NUTRITION IN DENTISTRY IN MICHIGAN

By

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One thousand practicing dentists in Michigan were surveyed by mailed questionnaire to determine how dentists perceive the role of nutrition in dental health, to what extent nutrition counseling is provided, what procedures are used, and the need for additional training in the dental schools and for continuing education for practicing dentists in Michigan. The majority of respondents indicated nutrition had been part of their dental training; most felt it had been inadequate and inappropriate for their needs. Few had received nutrition training since graduating. Approximately half of the dentists provided nutrition counseling; those who did not cited lack of knowledge as the main reason. Dentists believed nutrition played an important role in dental health; attitudes were affected slightly by previous training. The majority of dentists indicated a need for continuing education programs in nutrition. Further research in this area is needed.

In honor of my parents,

Raymond C. Renner

and

Elinor J. Renner

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INTRODUCTION

Dental medicine is the specialty of medicine that is concerned with the care of the teeth and soft tissues of the mouth, and the diagnosis of diseases that have oral manifestations. During the past several decades, it has become evident that nutrition plays an important role in the development and health of the oral tissues as it does in the development and health of other tissues in the body (Shaw and Sweeney, 1973). It, therefore, is important that the dental practitioner be able to recognize that carbohydrate restriction is but one component of nutrient interactions essential to the health of teeth and oral tissues.

Because of the incidence of sub-optimal oral health in the United States, preventive dentistry, rather than restorative dentistry, has become recognized as the key to alleviating this problem (McBean and Speckmann, 1974; Dairy Council Digest, 1973). One important component of preventive dentistry is nutritional counseling (De Paola and Alfano, 1976; Nizel, 1972a; Nizel, 1976). The dentist is in an enviable position to evaluate dietary habits, counsel, and teach nutrition to his patients (Shaw, 1972). Since

patients are recalled periodically, dentists see a broad cross-section of the population more frequently and more regularly than the physician does (Shaw, 1974; Garverick et al., 1978). In addition, in contrast to medical visits, few dental visits are of an emergency nature; and the patient may be more often in a disposition to discuss underlying needs. Because the dentist has more regular and frequent contact with his patients, he is better able to notice signs of nutrient deficiencies and counsel his patients. When dietary recommendations are made for the patient's oral health, general health of the patient is often improved also (Shaw, 1972).

However, knowledge of the complex processes of human nutrition presents a large and critical gap in the education of most dental health practitioners (De Paola et al., 1978), and most dental students have little opportunity to pursue adequate nutrition education, even on the elective basis (Shaw, 1974). Over a decade ago, dental educators met to discuss nutrition teaching in dental schools (Nizel, 1966). This group recommended that dentists should be skilled in clinical nutrition and that dental schools should provide the opportunity for students to learn both basic and applied nutrition (Report and recommendations on nutrition teachings in dental schools, 1966).

National nutrition surveys completed in the last decade indicate that malnutrition is a surprisingly serious problem

in the United States (Nizel, 1972b; White, 1976). One of the criteria used for diagnosing malnutrition was the deplorable dental health of the individuals included in these surveys (DHEW, 1972; Kelly and Harvey, 1974; Schaefer and Johnson, 1969). Degenerative diseases associated with chronic malnutrition such as obesity, atherosclerosis, and dental caries are as prevalent in affluent as well as economically deprived groups (Nizel, 1972b). Further, dental caries is considered to be probably the most prevalent chronic nutritional problem in the United States today, because it affects 98% of the people (Nizel, 1972b).

In 1969, the White House Conference on Food, Nutrition, and Health made the following recommendations pertaining to dental health and diet:

1. All dental schools should offer an identifiable course in the science and practice of nutrition. The purpose will be to provide the dentist with one more preventive dentistry procedure. Personalized diet counseling for caries control should be an essential component of a complete program of oral health.

2. Training programs for dietitians should include experience in dental clinics. They should act as consultants for dentists as they do for physicians.

3. Proper status and financial reimbursement should be given for providing a diet counseling service in dentistry. Third party payment services should include this service in their approved fee schedule.

Although nutrition education in the dental curriculum has been strongly recommended, and nutritional counseling is advocated (De Paola and Alfano, 1976, 1977; Nizel, 1972a,

1976; Shaw, 1972), a study at the University of Washington Dental School (Swoope and Hartsook, 1977) showed that it is difficult to implement nutrition counseling as part of dental practice if training in nutrition had not been provided for the dentist in dental school. Smith (1970) states that to offer complete dental care, the dentist should be trained adequately in the science of nutrition, and the study of nutrition is "admittedly weak" in most dental colleges. Hence, the practicing dentist receiving little or no nutritional knowledge, is at a disadvantage, since nutrition is an important component in preventive dentistry. Knowledge of carbohydrate ingestion and caries is but one area which should be in the dental school curriculum concerning nutrition, and nutrition during development and for maintenance of the oral tissues in the dental curriculum is neglected (De Paola and Alfano, 1976). De Paola and Alfano (1977) have suggested a method for reorientation of the dental education system regarding nutrition knowledge. Both dental curriculum revisions, as well as recommendations for continuing education format changes have been made to incorporate nutrition objectives and training (De Paola and Alfano, 1977).

The objectives of the present research were to determine how practicing dentists in Michigan perceive the role of nutrition in relation to dental health and to determine their need for nutrition education. It was designed to

identify components of nutrition education in the dentist's background, and if this, in turn, affected the extent of preventive dentistry, in the form of nutrition counseling, that was practiced by the individual dentist. By identifying the dentist's nutrition education in and since dental school, and his attitude towards the role of nutrition in dentistry, a more realistic understanding of the dentist's nutrition knowledge and extent of nutrition counseling could be attained. Moreover, knowledge of some of the factors that influence dentists' decisions concerning nutrition and nutrition counseling will be useful in designing effective continuing education programs in nutrition and dental health.

Four hypotheses were tested:

1. Practicing dentists have limited knowledge of nutrition and its relationship to dental health.

2. The extent of nutritional counseling within the dental office is dependent upon the dentist's knowledge of nutrition and oral health.

3. There is a need to include nutrition education to a greater extent than is present in the dental school curriculum.

4. There is a need for adequate continuing nutrition education for the practicing dentist.

It is possible that a combination of factors, rather than a single factor, is responsible for the dentist's

perception of nutrition and dental health. Consequently, these may affect his decision to provide nutrition counseling for his patients.

REVIEW OF LITERATURE

Nutrients may affect the teeth through three routes: 1. by reacting with the tooth surface as food travels through the mouth (local action), 2. by reacting with the tooth surface after being absorbed from the intestine and returning via the saliva (systemic-local action), and 3. after being absorbed from the intestine and entering the tooth in the circulating blood (systemic action). Research concerning the latter two routes is very limited, therefore, the local action of nutrients remains the prime focus when investigating nutrition and dental health. Opinions are divided on some aspects of etiology and treatment of dental diseases, but the importance of nutrition in dental health is seen with the increasing emphasis on the importance that nutrition education should have in dental schools (Dairy Council Digest, 1978).

Dental Caries

Dental caries affects 98% of the United States' population, and is the principal means of tooth loss before age 35 (Bigaouette *et al.*, 1977). Repair of damage to decayed teeth has raised the national dental bill to over

four billion dollars a year (Nizel, 1977). Dental caries occurs as a result of acid decalcification of the inorganic component of the enamel, caused by the presence of carbohydrate in the diet.

Antecedent to the onset of dental caries is the formation of dental plaque. Plaque consists of a gelatinous substance, a protein-polysaccharide complex, in association with bacteria. Excess sucrose which is ingested is broken down to dextrose and levulose, which are polymerized to dextran and levulan. These combine with the protein which is broken down by neurimidase from the salivary mucins (Nizel, 1972a). Bacterial enzymes within the dental plaque ferment dietary carbohydrate, resulting in the formation of organic acids. The acids diffuse out of the plaque and initiate decalcification of both the enamel and the dentin. With access to the organic matrix, the bacteria are able to cause proteolytic degradation of the tooth (Dreizen, 1968).

Bibby (1975) cites studies which show that sucrose has been determined to be the most cariogenic of the carbohydrates. Sucrose releases more energy upon hydrolysis than the other carbohydrates, and the plaque organisms survive best in a high-energy environment (Nizel and Shulman, 1969). Both epidemiologic and experimental evidence have demonstrated sucrose to be most cariogenic, and starch is among the least cariogenic carbohydrates consumed by man. Sucrose is implicated in the etiology of dental caries in studies

involving individuals with an inborn enzyme defect with respect to metabolizing fructose. Since sucrose is hydrolyzed to fructose and glucose before it is absorbed, these patients must abstain from using sugar. These patients are practically caries-free (Marthaler, 1967).

As shown in the Vipeholm Study (Gustafsson et al., 1952), both the form and the frequency of sucrose ingestion are more important than the total amount of sucrose consumed, in relation to causing dental caries. Highest caries incidence occurred with between meal eating of sugars. Navia (1973) points out that the daily average consumption of sugar in the United States is one third of a pound, and that the United States' meal pattern is no longer one of three meals per day; instead, we are consuming more snacks, and usually in the form of "sweets". This has contributed to a great increase in caries incidence and severity.

Lipid in the diet in amounts greater than normal may decrease caries incidence in humans (Morhart and Fitzgerald, 1976). The mechanism for this is unclear, although it is thought that the fat may coat the tooth and food no longer is able to adhere to the plaque. Fat coatings on carbohydrates may make them less soluble, and therefore, unavailable for incorporation into plaque.

High protein diets may also decrease dental caries incidence in humans (Nikiforuk, 1970). High protein diets increase salivary urea, which forms ammonia. High

concentrations inhibit bacterial glycolysis, thereby inhibiting caries.

Two factors will determine if initiation of the caries process will occur: the duration of the microbial challenge and the resistance of the tooth surface. Dental caries is a multifaceted disease, its course being altered by three factors: host (tooth), agent (oral microflora), and environment (carbohydrate foodstuff) (Morhart and Fitzgerald, 1976). Therefore, the simplistic approach towards nutrition will not work, as caries susceptibility is influenced in addition, by pre-eruptive nutrient supplies and post-eruptive factors. It is the overall quality of the diet, before and after birth, and not the effect of a specific nutrient that is critical for proper development and maintenance of the oral tissues (De Paola and Alfano, 1977).

Pre-eruptive Effects of Nutrition on Tooth Development

Pre-eruptive nutrition can affect caries susceptibility of the tooth (Dairy Council Digest, 1978; Shaw, 1970). For each organ of the body, there are critical periods in development, where irreversible changes take place, due to rapid synthesis and accretion of protein. Oral tissues have "critical periods" in their development also. Nutrient imbalances during this period may affect resistant capabilities to later challenges, and thus, may be more susceptible to caries (De Paola and Kuftinec, 1976).

Shaw (1970) reports that deficiencies in calcium, vitamin A, and ascorbic acid during tooth development may lead to structural abnormalities and decreased resistance to decay. Vitamin A deficiency in rodents causes atrophic changes in the ameloblasts and odontoblasts on the lingual side, resulting in irregular formation of the dentin and imcomplete development of the enamel. In man, vitamin A deficiency converts enamel-forming cells into non-specific epithelial cells, resulting in defective enamel formation, hypoplasia, and irregular mineralization (Dreizen, 1973; Winter, 1976).

Ascorbic acid deficiency results in atrophy of the odontoblastic layer; consequently, dentin is laid down irregularly, at a reduced rate, or not at all (Shaw, 1970). Defective enamel formation and accumulation of blood and fluids in pulp tissue also occur.

Calcium deficiency during pre-eruptive tooth development causes imperfectly mineralized enamel and dentin, leading to an increased susceptibility to caries attack (Constant et al., 1954). Carbonate levels of the tooth rise in a calcium deficient state, rendering the tooth relatively acid soluble, and more susceptible to decay (Sobel et al., 1960).

Other studies (Dreizen, 1973) have shown vitamin D deficiency to cause similar problems with improper formation of structural components of the tooth. Both dentin and enamel are hypoplastic. Enamel calcifies poorly and

formation of interglobular spaces, as well as uncalcified dentin, results. The abnormal structure does not render the tooth more caries-susceptible; however, the rough surface which results may attract bacterial plaque more easily.

Studies by Navia et al. (1970), and Navia and Menaker (1973a) have shown the effects of marginal protein malnutrition on tooth development using pregnant and lactating rats. Changes in the dentition included decreased tooth size, delayed eruption, and subsequent increased caries susceptibility. The effects of protein undernutrition were shown to operate mainly during suckling, the period of maximal tooth development in the rat (Di Orio et al., 1973). Navia and Menaker (1973b) also found that protein deprivation during this period will affect the size (number of cells) of salivary glands, and consequently, the protein composition of saliva. The relationship between decreased salivary function and increased susceptibility to caries is being investigated.

Phosphates and Dental Caries

Dietary phosphates have been shown to be cariostatic in laboratory animals (Nizel and Harris, 1960, 1964). Sobel et al. (1952) found that by feeding a very low phosphorus diet to rats, they could increase the carbonate content of the rats' bones and teeth, which made these structures very acid soluble. Low phosphate diets were shown to be more

cariogenic than low calcium diets (Wynn et al., 1956). The optimal amount of phosphorus in the rodent diet which produces significant cariostatic effect is approximately twice the amount needed for normal mineralization of bones and teeth (Nizel et al., 1961). These results have not been successfully duplicated with humans (Ship and Mickelson, 1964).

Micronutrients

The incidence of dental caries has been significantly reduced by the addition of 1 ppm sodium fluoride in the drinking water, especially if fluoridated water is consumed during the period of tooth development (Ast, 1943). Fluoride is incorporated into the tooth structure as fluoroapatite. Fluoride is found in highest concentrations in the outer surface of the enamel and the pulpal section of the dentin. Increased resistance to decay is due to less water present in the enamel, shorter and tighter bonding, enhanced interionic forces, and decreased surface area due to the larger fluoroapatite crystals. Because the crystals are larger and more stable, they are less soluble in acid. Concentration of fluoride in the tooth is dependent upon the amount consumed and the contact time (Navia, 1972). Studies by Ludwig (1969) and Moller (1967) support findings of increased crystal size and larger well-formed teeth upon fluoride ingestion. The use of fluorides and phosphates

together has resulted in an increased resistance to decay (Nizel, 1972a).

Experiments with rats, investigating the effects of other trace elements on the incidence of dental caries, have given conflicting results. Boron and molybdenum have been the only two elements shown conclusively to also have a cariostatic effect (Ludwig, 1969; Moller, 1967). Molybdenum has been shown to enhance the retention of fluoride in calcified and soft tissues. Hartles and Leach (1975) reported that excess selenium increased dental caries incidence, and research by Hadjimarkos (1965, 1969) has supported this. The literature regarding trace elements and dental health is conflicting and confusing, and Hadjimarkos (1968) makes a valid point that more research is needed in this area.

Periodontal Disease

Periodontal disease, the second major oral disease, affects 75% of the people of the world (De Paola and Alfano, 1977), and is the major cause of tooth loss after age 35 (Stahl, 1976). Many clinicians are doubtful that nutrition plays a role in periodontal disease; however, the factors involved in its etiology are complex and the slow rate of the disease makes study difficult (Alfano, 1976). Although nutritional deficiencies do not cause periodontal disease, they may modify the extent or severity of its progression,

by altering host resistance (Enwonwu, 1974; Stahl, 1976). However, the role of nutrition in periodontal disease still remains controversial.

A primary reason for this is the difficulty encountered in the design and analysis of studies involving this area of dental health. According to Alfano (1976), there are six basic problems encountered: periodontal disease is multifactorial, selection of appropriate diet, inadequate parameters to assess severity and progress of the disease, selection of a good animal model system, duration of the study, and statistical interpretation of the data. Nutrient deficiencies in man are usually relative or marginal, and require long periods of time for deleterious effects to become noticeable. Because the majority of studies on nutrition in periodontal disease have used short-term acute deficiencies, the importance of nutrition is often underestimated.

Recent studies (Krook, Lutwak and Whalen, 1972; Krook, Whalen, Lesser, and Lutwak, 1972) have suggested that periodontal disease may result from excess phosphorus and/or deficient calcium in the diet. To maintain serum calcium levels, a nutritional secondary hyperparathyroidism occurs, resulting in a marked loss of alveolar bone. Bone mineral is thought to be removed by "osteocytic osteolysis", or internal bone resorption. This has been observed in humans suffering from periodontal disease and has been reported to

respond well to calcium therapy (Krook, Lutwak and Whalen, 1972; Krook, Whalen, Lesser, and Lutwak, 1972).

The primary factor in the periodontal disease process is subgingival bacterial plaque. The disease is primarily a reaction to local irritants: dental plaque and impacted food debris. Gingivitis results from the combination of local chemical irritations from the toxins and enzymes of plaque bacteria and the mechanical irritations of food impaction (Thornard, 1968). Certain nutritional deficiencies, including protein, ascorbic acid, vitamin D, vitamin A, and calcium, can compromise the epithelial barrier function, resulting in increased epithelial permeability (Alfano et al., 1975). Hence, the tissue becomes more permeable to bacterial endotoxin. If not treated, this results in an increased toxic load to the connective tissue, and periodontal disease results, destroying the periodontal ligament and bone (Alfano, 1976).

Malnutrition may also compromise crevicular defense. The crevicular tissues have one of the fastest turnover rates in the body (Enwonwu, 1974), and are in a continuous state of rapid DNA, RNA, and protein synthesis. The tissues are particularly sensitive to deficiencies of protein, calories, and ascorbic acid (Alfano et al., 1975). These tissues are in a "continuous critical period" (De Paola and Kuftinec, 1976) and nutritional stress will impair renewal of the sulcular epithelium and possibly compromise its protective qualities (Alfano, 1976).

Studies on the effect of ascorbic acid on periodontal health have given rise to two conflicting schools of thought. Hanke et al. (1933) found that gingivitis could be ameliorated in children with daily intake of orange or lemon juice. Cheraskin et al. (1964) studied the effects of vitamin C supplements on gingival score, sulcus depth, and tooth mobility. They concluded that vitamin C is beneficial. Opponents to this theory are even more numerous. Linghorne and McIntosh (1946) examining Air Force personnel found that vitamin C had no clinical effect on gingival inflammation. More recent studies by Shannon and Gibson (1965) indicated no correlation with ascorbic acid levels in the blood and inflammatory changes in the gingival tissues. Experiments with guinea pigs (Cheraskin et al., 1968; Glickman, 1948a, 1948b) produced no evidence that vitamin C deficiency initiates periodontal disease.

Stahl (1976) reports that protein deficiency in animals results in osteoporosis and thinning of the periodontal fibers, but does not induce local inflammation. Children with kwashiorkor have a 50% higher periodontal index, but protein deficiency in its most severe form does not produce specific periodontal entities (Parfitt and Speirs, 1970). Protein malnutrition can result in decreased resistance, due to altered tissue integrity and decreased phagocytic activity and antibody formation. Altered repair potential results in persistent inflammation of the periodontal tissues (Enwonwu,

1974).

Physical Form of the Diet

Alfano (1976) states that a firm, fibrous diet is a stimulus to salivary secretions and increases the protein content of the saliva, resulting in potential benefits to oral health. Screebny (1972) believes there is not enough evidence to support this belief. Many of the studies in this area suffer from a number of limitations. In many, physical properties of food are not defined. In others, control and experimental diets are often not the same. The number of subjects or animals used may be inadequate and the experiments are usually of short duration. No objective and quantitative criteria are used to measure various functions studied (Screebny, 1972). Despite these limitations, sufficient evidence has accumulated to warrant certain conclusions concerning the effects of the physical form of the diet on dental health.

In 1931, Ivy et al. showed that dogs maintained on soft diets developed dental calculus, and a number of these animals showed early signs of periodontal disease. Soft diets tended to produce pathological changes in the crevicular complex, including impaction of food particles, gingival inflammation, and proliferation of the epithelium. In contrast, animals fed a hard diet did not show these changes.

Studies with rats and hamsters also demonstrate evidence of early periodontal disease, when fed a soft diet. In contrast to the dog studies, more extensive damage was seen when animals were provided with a coarse diet. Stahl and Dreizen (1964) showed food impaction, damage to the crevicular epithelium, gingival inflammation and gingival recession in their animals fed hard food. Cohen (1960) noted considerable destruction of the interdental papilla with an accompanying inflammatory reaction in the underlying connective tissue in rats fed a hard diet. Stahl and Dreizen (1964), when examining the periodontium, noted that food kernels had pierced the epithelial lining, indicating that such a coarse diet may be too hard for the rodents' periodontal tissues. For all animals studied, soft diets increased dental plaque formation, the amount of crevicular fluid produced, and inflammation of the crevicular tissues. Data for hard diets are inconclusive.

For humans, the importance of mastication of firm, fibrous foods in maintaining periodontal health has been cited by Greene (1977). Firm foods are believed to have a positive effect on periodontal health: by stimulating gingival tissue circulation, which increases the exchange of nutrients, by promoting keratinization of the epithelium, which protects against local irritants, and by promoting a balance between bone resorption and bone formation. Evidence to support the theory that a firm, fibrous diet is

beneficial to the periodontium is not convincing. In 1963, Arnim showed that a variety of fibrous foods (apple, celery, lettuce, carrots) failed in removing dental plaque. Studies in which apples were tested in removing dental plaque produced similar findings (Wade, 1971).

The physical consistency of food has recently shown to effect the secretory activity of the salivary glands. Hall and Schneyer (1964) demonstrated that liquid diets caused disuse atrophy of the salivary glands, resulting in a decreased synthesis of secretory proteins, and a decrease in the volume of saliva secreted. All changes were reversed by re-instating a hard diet. Whereas changes in the crevicular complex and those in the salivary glands both occurred following changes in the consistency of the diet, there was no proven cause and effect relationship.

Oral Surgery

Special guidance is needed from the dentist following oral surgery. Special problems of these patients include increased nutrient requirements, impaired masticatory function, and threat of infection, resulting from the abundant flora normally present in the oral tissues (Navia and Menaker, 1976). When physiologic or emotional stresses are imposed on an individual, hormonal reactions take place which increase nutrient mobilization and excretion (Randall, 1973). Physical trauma, as in oral surgery, may lead to

nutritional problems, as a consequence of failure to consume an adequate diet, increased needs, and increased tissue loss (Navia and Menaker, 1976).

For optimal nutritional status, the oral surgery patient should be placed on a high carbohydrate diet, prior to surgery, to build up glycogen stores (Jones, 1970). High protein intakes of 3-5 gm/kg body weight, following surgery are advocated to reverse the negative nitrogen balance incurred from blood, plasma, and tissue loss (Smith, 1970). Patients with fever may have increased basal metabolic rates and an increased need for calories (Nizel, 1972a; Randall, 1973). If the increase in calories is derived from carbohydrate, an increase in B vitamins is also recommended, as loss of the B vitamins probably occurs with excess fluid loss (Nizel, 1972a). Nizel (1960) advocates increased intake of iron-containing foods, due to iron lost concomitant with blood loss. Patients should start oral feedings as soon as possible after oral surgery (Jones, 1970; Navia and Menaker, 1976), in the form of liquid diets. These are usually based on milk, milk products, or eggs. As soon as the patient is able to swallow, a soft diet is advocated (Smith, 1970; Navia and Menaker, 1976).

Nutritional Counseling

Several methods of nutritional counseling for dental patients have been reported (Nizel, 1972a, 1972c, 1973;

De Paola and Alfano, 1976, 1977). When diet histories are taken, use of computers for analysis have been reported (Goodson, 1975; Young, 1975). According to Nizel (1972c), dental caries must be dealt with as a social as well as a pathological disease. The dentist needs to know why, as well as what, the patient eats, for counseling to be effective. Personalized counseling is an absolute requirement (Nizel, 1973), since it has the capability to instill individualized positive attitudes and meet the individual's particular needs. Witteman (1976) discusses the importance of non-directive counseling, a process in which the counselor's role is to aid the patient in clarifying and understanding his own situation, and then to guide him into making his own decisions. The necessity that the dentist is able to convey the importance of nutritional therapy, and believe in its value, is also emphasized.

Nutrition Education in the Dental School Curriculum

Despite numerous studies which appear in the literature linking nutrition and dental health, few studies documenting the dental students' nutritional knowledge have been reported. Leske and Jong (1968) reported a comparison of nutrition education in dental schools for 1947 and 1966. They found, in 1947, 63% of the schools taught a separate nutrition course, averaging sixteen hours. In 1968, 38% of the schools offered a separate nutrition course with the

same time allottment. This shows that neither the number of schools offering nutrition courses nor the clock hours for these courses had increased in the last twenty years.

Nizel (1972b) reports since the White House Conference on Nutrition, over 60 schools of dentistry and dental hygiene have sent their nutrition teachers to participate in the Continuing Education Program of Tufts University School of Dental Medicine. As a result, 41 schools now teach diet counseling, and 37 schools show a more positive attitude towards nutrition. However, this study failed to mention whether nutrition courses were added to dental school curricula, and if so, to what extent nutrition was now taught in dental school.

A study conducted at the University of Kentucky Dental School (Bozdeck et al., 1978), to determine the source and quality of nutrition education and the nutritional knowledge gained by dental students, revealed a limited nutrition component widely scattered among a number of departments and offered at varying times in the four year curriculum. A dental-related nutritional knowledge test, completed by 178 students, resulted in a mean score of 58.7%. This was below the mean for undergraduates who had received a "C" in the basic level nutrition course. These results indicate that the nutrition program at the University of Kentucky Dental School, which is recognized as having an outstanding dental program, is lacking in depth and cohesiveness, and

nutritional knowledge of the dental students is variable and limited.

De Paola et al. (1978) describe a program developed at the Medical College of Virginia Dental School designed to integrate nutrition education into an existing dental school curriculum. It was designed to enable the dental student to understand the role of nutrition in oral health and to provide experience in general nutrition counseling. To meet these requirements, the program was designed with both didactic and clinical components. Significant increase in knowledge by pre and post-testing has been shown, and Witteman et al. (1978) report that observation and rating forms indicate that interactive skills were utilized and incorporated into the clinical counseling situation.

Garverick et al. (1978) describe a study concerning second year dental students' interest in nutrition. Results show that interests in nutrition topics tend to be stable among dental students, and do not vary. Practical implications for instructional design have resulted. This study also points out that despite professional recommendations for nutrition education for dental students, nutrition courses are still not available.

Attitudes Toward Continuing Education for Practicing Dentists

Since nutrition education for the practicing dentist would involve some aspect of continuing education, the

literature was reviewed to determine how receptive the practitioner would be. Snyder and Schmalgemeier (1973) report a study of Michigan dentists. A questionnaire to determine how the dentist perceives the continuing education programs that are available to him, obtained a 76% response rate. Fifty-six percent of the dentists evaluated available programs as outstanding or excellent, and 31% evaluated them as good. Those above age 45 were most positive in their rating. Sixty percent of those surveyed believed dental journals were the best source of information.

In 1974, the American Dental Association ruled (Cafferata et al., 1975) that participation in continuing education is an obligation of all dentists, and that curricula should be developed based on the needs of dentists in each region. Cafferata et al. (1975) surveyed 600 New York dentists regarding continuing education needs. They determined from this study that the quality of care was a more universal concern than the skillful management of the practice. The greatest interests in updating dental skills were in the areas of Crown and Bridgework, Dentures, and Preventive Dentistry, of which nutrition is a component.

In 1978, Bauer and Bush conducted a survey of 2200 Mid-West dentists concerning their attitudes toward continuing dental education. Of the 66% responding, the majority thought a minimum number of hours should be necessary. The most important attribute of the program is the topic, and

not the reputation of the instructor.

Because of the shifting emphasis from therapeutic to preventive dentistry, the need for quality control in continuing education is increasingly evident, especially when discussing nutrition. Jarvis (1977) warns against "nutritional quackery" and gives examples of the types of claims and promises that may be presented as nutrition information to the dentist. He also cites criteria for judging if nutrition information presented is valid, and reiterates the dentist's responsibility to the public welfare when acquiring nutrition information through continuing education.

Nutrition Education in the Medical School Curriculum

Since incorporation of nutrition education in other health professions has also been recommended, the literature was reviewed to determine to what extent nutrition education is present in the medical school curricula.

In 1962, the Food and Nutrition Council of the American Medical Association stated that the recognition, support, and attention given to nutrition teaching in medical schools is inadequate and mostly centered around deficiency diseases (Dutra de Oliveira, 1976). Stare, in 1949 (Stare, 1959) stressed the importance of teaching nutrition in medical schools, since nutrition is a broad and important aspect of health. He suggested specific nutrition courses, divided into basic and applied components. A survey of the teaching of nutrition in medical schools (High, 1958) showed that

in the sixty medical schools responding, nutrition was taught in an "integrated way". Twenty percent offered a special course in nutrition, averaging 21 class hours. Despite the apparent evidence of nutrition education in medical school, it was found that teaching was not well coordinated, and nutrition, as a subject, had little impact on the medical school curriculum.

Robinson (1963) at the American Medical Association Conference on teaching nutrition in medical schools stated that nutrition is currently scattered throughout most departments without any coordination. Basic concepts are not being taught and nutrition has tended to lose its identity as a clinical discipline. Four years later, Mueller (1967) noted that a revision was occurring in medical education, and with major innovations in the curriculum, a proper place for nutrition would be found. He defined some of the problems with teaching nutrition in the medical school curriculum as the lack of a definition for nutrition, problems with defining a nutrition coordinator, difficulties in organizing the curriculum, and lack of a specialty in regards to student motivation and interest. The importance of separate nutrition courses was doubtful.

In 1969, the White House Conference on Food, Nutrition, and Health concluded "the teaching of nutrition in schools of medicine is most inadequate at the present time; in some schools, it is almost non-existent" (Frankle et al., 1972).

In 1972, the Williamsburg Conference on Nutrition in Medical Education stated that slow and inadequate progress had been made in United States medical schools concerning the teaching of nutrition (Coursin, 1974).

Wen et al. (1973) surveyed current nutrition instruction in United States medical schools. They found 20% included nutrition education in their core curriculum; 4% offered it as an independent course. These authors conclude that no major changes have been made since the time of High's survey (High, 1958), and no major effort has been made to include nutrition in the medical school curriculum.

Recent studies (Murray, 1977; Sandson, 1977; Krause and Fox, 1977; National Nutrition Consortium Commentary, 1974) still indicate that training is limited and poorly organized, and that nutrition is not given high priority and still receives insufficient attention in the medical school curriculum.

Nutrition Knowledge of Medical Students

Although many articles have emphasized the importance of nutrition education in medical school, little has been reported on the nutrition knowledge of the medical student. Phillips (1971) reports findings of a study in 1967 with 254 New England medical students. On a 100 item nutrition knowledge test, covering normal nutrition and diet therapy, the average score was 46. She concluded that the majority

of medical students were not familiar with many of the basic concepts and knowledge of nutrition that a panel of experts felt they should know. This study emphasizes that nutrition does not make an impact or that it is not included in medical school.

Podell et al. (1975) report on a study conducted with third and fourth year New York medical students, to determine their strengths and weaknesses in nutrition knowledge. They found large variations within each area of knowledge. Only 9% taking the exam scored 70% correct; only 1% scored 80% correct. Their study supports findings that clinical nutrition knowledge is low among medical students.

Recent Advances in Nutrition Education in Medical School Curricula

Christakis et al. (1972) report that it is unfortunate and intolerable that the nation's physicians are unable to diagnose primary nutrient deficiency diseases and are unable to relate laboratory results to needed nutritional therapy. They describe the program at Mt. Sinai Medical School, which opened in 1968, emphasizing that nutrition is an integral component of every aspect of man and his environment. Lectures demonstrate the significance and relevancy of nutrition to clinical and community medicine. Other factors important to the success of the program are also cited. Frankle et al. (1972) describe the content

and success of one aspect of this program. Many of the problems encountered in teaching nutrition in medical schools (Dutra de Oliveira, 1974) have been alleviated in this program.

Hodges (1977) reports the University of California Medical School's program of teaching nutrition during the clinical years. Emphasis is placed on nutrition clerkships and elective courses. At the University of Texas Medical School at Houston, technical and practical aspects are presented at bedside (Long and Dudrick, 1977). Primarily, dramatic cases are presented to generate interest and enthusiasm, and are later discussed in conference settings. Sandson (1977) discusses the Boston University School of Medicine's Nutrition program. Reasons for its success include a senior faculty member responsible for the nutrition education program, and adequate allotment of curriculum time for nutrition education. Although these programs show promise, the problems cited by Dutra de Oliveira (1974) and Murray (1977) are still major obstacles to nutrition education in the medical school curriculum.

Conclusion

There is substantial evidence to show that nutrition makes a significant contribution to the development of oral tissues and the maintenance of dental health. Because of this, and the role the dentist has as a health professional,

it has been advocated that the dentist should be knowledgeable in the science of nutrition. It has been strongly recommended that nutrition education be included in both the dental school and medical school curriculum. However, little evidence is available that progress has been made to include nutrition in either curriculum.

METHODS AND PROCEDURES

The data were collected with an instrument, specifically designed for the purpose of this research (Appendix A).

Development of the Instrument

No prototype questionnaires evaluating dentists' perceived role of nutrition and dental health and their need for continuing education in nutrition could be found in the literature. A 22 item questionnaire, developed by the researcher, was mailed to Michigan dentists to obtain background information such as size of the area in which they practice, district of Michigan Dental Association affiliation, dental school graduated from, year of graduation, specialty, and other personnel working in the office.

Another section of the instrument was concerned with the dentist's nutrition training in dental school, and his attitudes concerning the effectiveness of that training. Further questions were included to assess his nutrition training since dental school. Scales were created for all items presented in this question, since a range of response format was used. Values ranged from 1-4, corresponding to never received nutrition information, received nutrition information once, received information 2-4 times, and

received information more than 4 times. Finally, the dentist's attitude towards nutrition being included in the dental school curriculum was assessed.

A third section of the instrument dealt with nutrition education in the dental practice. Questions were designed to obtain information on whether nutrition counseling was provided in the dental office by the dentist and/or his auxiliary personnel and what types of procedures were used. Other questions asked the dentists to give an opinion on the importance of nutrition in areas of dental health and disease. Scales were created for all items presented in a range of response format. Nutrition was rated as most important, equally important, small importance, unsure of importance, or no importance, corresponding to a scale of values from 1 to 5. Questions were also included to determine what type of continuing education the dentist felt would be most beneficial to him. In addition, space was provided for comments.

The instrument and cover letter (Appendix B) were approved by the Michigan State University Committee for Research Involving Human Subjects.

Informed Consent

Informed consent was implied if participants completed and returned the questionnaire. Participants were not identified in any way: there were no identifying marks on either the instrument or the return envelope.

Pre-testing

The instrument was pre-tested for item clarity by a local dentist and was also subject to evaluation by the researcher's Graduate Committee. Dr. Lewis Menaker, D.D.S., an Assistant Dean in the School of Dentistry at the University of Alabama and Dr. James Shaw, Ph.D., a nutritionist in the School of Dental Medicine at Harvard University reviewed the instrument, and their suggestions for revision were incorporated. Other changes made in the instrument following the pre-test were rewording of certain questions for increased clarity.

Sample Selection

The Michigan Dental Association has a mailing list of 4668 dentists who are currently members of the M.D.A. The list was purchased by the researcher and a sample of 1000 dentists was randomly selected using the Michigan State University CDC 6500 computer.

Michigan Dental Association Approval

John Nolen, D.D.S., Executive Director of the Michigan Dental Association, met with the researcher and her major professor, Dr. Jenny Bond. He approved the proposed study. The proposal was sent to Dr. Joseph Chasteen, Chairman of the M.D.A. Education Committee, who reviewed the proposal and gave his approval also.

Data Collection

Data were collected from April 27 to June 12, 1979.

Procedure

The instrument and cover letter were mailed to the selected dentists. A postage paid envelope for return of the completed form to the Department of Food Science and Human Nutrition was enclosed with the questionnaire. All completed forms were returned to the researcher's major professor. Upon receipt of at least 50% of the forms, data were coded and analyzed.

Data Analysis

The data were analyzed on the Michigan State University CDC 6500 computer, utilizing Statistical Package for the Social Sciences (Nie et al., 1975) programs. Frequencies were calculated for all variables.

No single procedure for statistical analysis was possible since some parts of the questionnaires involved facts and other attitudes, judgements, and opinions. All data were tabulated and analyzed in a form appropriate to the particular item. Sub-programs used were Crosstabs, Pearson Correlation, and Breakdowns. A Chi square test was performed between selected variables where appropriate. The level of significance used for statistical analysis was at the $p \leq .05$ level.

Follow-Up

All dentists in the sample will receive a summary of the findings via mail.

Results of this survey will be shared with persons within the Food Science and Human Nutrition Department at M.S.U., with Dr. George Owen at the University of Michigan Human Nutrition Program, The Michigan Department of Public Health, The Michigan Dental Association and the American Dental Association.

RESULTS

Of the 1000 questionnaires mailed, 539 or 53.9% were returned. Data from 505 of these were usable. Reasons for omitting the others returned included the following: retired, 11; dead, 3; teaching and/or research, 4. Throughout, respondents will refer to those dentists in practice returning the survey questionnaire.

Background Information

Distribution of the respondents relative to size of the area in which they practice is shown in Table 1. The largest number of dentists (44.2%) practiced in an area with a population exceeding 100,000, while approximately 7% of the respondents had practices in areas with less than 2500 people.

The Michigan Dental Association has members in 24 districts (Figure 1). Respondents represented 22 of the districts (Table 2). No responses were received from M.D.A. members in districts 1 and 2, the two most western districts of the Upper Peninsula. The greatest number of respondents were affiliated with the Detroit (19.6%) and Oakland (11.7%) districts. Seven percent of the respondents did not answer this question. Sample responses received from dentists in each district were representative of the total membership of

Table 1. Location of practice relative to area population[a]

Population	n[b]	% of total respondents
Less than 100	33	6.6
2500-10,000	70	14.0
10,000-50,000	99	19.8
50,000-100,000	77	15.4
Over 100,000	221	44.2

[a]500 total responses

[b]Number of responses for each population group

Figure 1. Component societies of the Michigan Dental Association

1 Gogebic Range District
2 Copper Country District
3 Cloverland District
4 Superior District
5 Sault Ste. Marie District
6 Northeastern District
7 Resort District
8 Manistee-Mason District
9 Ninth District
10 Muskegon District
11 West Michigan District
12 Central District
13 Genesee District
14 Saginaw Valley District
15 Thumb District
16 Oakland District
17 Macomb District
18 Detroit District
19 Washtenaw District
20 Jackson District
21 Southwestern District
22 Kalamazoo Valley District
23 Lakeland Valley District
24 Vacationland District

Table 2. District of M.D.A. affiliation[a]

District	% of total sample respondents	% of total M.D.A. membership[b]
1. Gogebic Range	0.0	0.2
2. Copper Country	0.0	0.4
3. Cloverland	0.4	1.1
4. Superior	1.2	0.9
5. Sault Ste. Marie	0.2	0.5
6. N.E.	0.6	0.6
7. Resort	2.2	1.7
8. Manistee-Mason	1.0	0.9
9. Ninth	0.6	0.8
10. Muskegon	2.8	1.6
11. West Michigan	8.3	8.9
12. Central	7.1	5.4
13. Genessee	4.8	4.7
14. Saginaw Valley	4.0	5.1
15. Thumb	3.2	1.7
16. Oakland	11.7	13.6
17. Macomb	7.7	6.5
18. Detroit	19.6	27.8
19. Washtenaw	4.4	6.7
20. Jackson	3.2	2.6
21. S.W.	3.6	1.9
22. Kalamazoo Valley	4.0	3.6
23. Lakeland Valley	1.8	2.0
24. Vacationland	0.8	0.9

[a]505 total sample respondents

[b]4652 members

the Michigan Dental Association (Table 2).

The majority (85.4%) of dentists responding indicated they were in general practice (Table 3). Other specialties represented were: oral surgery, periodontics, pedodontics, orthodontics, endodontics, and prosthodontics.

Table 3. Type of specialty[a]

Specialty	% of respondents
General	85.4
Oral surgery	2.4
Periodontics	2.2
Pedodontics	2.8
Orthodontics	4.8
Endodontics	1.0
Prosthodontics	1.0
Other	0.4

[a]n=500

Seventeen dental schools were represented by the respondents; however, only schools which graduated ≥1% of the respondents are listed separately (Table 4). The remaining schools are listed as "Other". The majority of graduates (86.7%) were from dental schools within the state; 49.7% graduated from the University of Michigan; 36.9% graduated from the University of Detroit.

Table 4. Dental school graduated from[a]

School	% of respondents
University of Michigan	49.7
University of Detroit	36.9
Northwestern	2.3
Loyola	1.9
Indiana	1.0
Marquette	1.9
St. Louis	1.0
Other[b]	5.2

[a] n=485

[b] University of Minnesota, Case Western Reserve, Temple, Ohio State University, University of Pittsburgh, Loma Linda University, Howard, Emory, Baylor, Meharry

Most (41.4%) of the responding dentists graduated within the last fifteen years; 25.6% had graduated between 1956 and 1965, 20.1% between 1946 and 1955, and 12.9% prior to 1946 (Table 5).

Table 5. Year of graduation[a]

Year	% of respondents
Prior to 1925	0.4
1925-1935	3.6
1936-1945	8.9
1946-1955	20.1
1956-1965	25.6
1966-1978	41.4

[a] n=497

Approximately one third of the dentists (34.5%) are in a joint practice, working with another dentist (Table 6). A small percentage (2.8%) are in group practice, working with two, three, or four other dentists. Most dentists employed at least one dental assistant and one dental hygienist. Approximately 2% of the respondents employed a nutritionist/dietitian.

Dentists' Nutrition Training in Dental School

The majority (75.4%) of those responding indicated that nutrition had been presented in their dental school curriculum (Table 7).

The following data are presented in two ways: Figure 2 depicts percentages of the total number of responses received to how nutrition was presented in the dental school curriculum. In most cases, (54.3% of the responses), nutrition was incorporated into other coursework (Figure 2). Approximately 38% of the responses received indicated that nutrition was presented in a separate course (Figure 2).

Of the 377 dentists responding that nutrition had been presented in dental school, 45.2% indicated it had been presented as a separate course, 6.3% obtained nutrition instruction through practical experience, and 63.3% of the dentists had nutrition incorporated into other coursework (Table 8). Note that percentages total to greater than 100% since multiple responses were possible.

Most (48.1%) of the respondents indicated that the amount of nutrition information presented in their dental

Table 6. Other personnel in the dental office[a]

Number of personnel	% of respondents				
	1	2	3	4	≥5
Another dentist	34.5	2.0	0.4	0.4	0.0
Dental Assistant	76.4	8.0	3.2	1.0	1.8
Dental Hygienist	61.2	5.7	1.2	0.6	0.2
Receptionist	69.6	3.4	0.6	0.0	0.0
Laboratory Technician	2.4	0.0	0.0	0.0	0.0
Nutritionist/Dietitian	2.2	0.0	0.0	0.0	0.0
Nurse	0.6	0.2	0.0	0.0	0.0
Office Manager	1.2	0.0	0.0	0.0	0.0
Other	5.8	0.0	0.0	0.0	0.0

[a]n=505

Table 7. Nutrition as part of the dental school curriculum[a]

Response	% of respondents
Yes	75.4
No	24.6

[a]n=501

Figure 2. Percentages of responses to how nutrition was presented in the dental school curriculum. Percentages are based on the total number of responses received from the sample. As multiple responses were possible, a total of 455 responses were received.

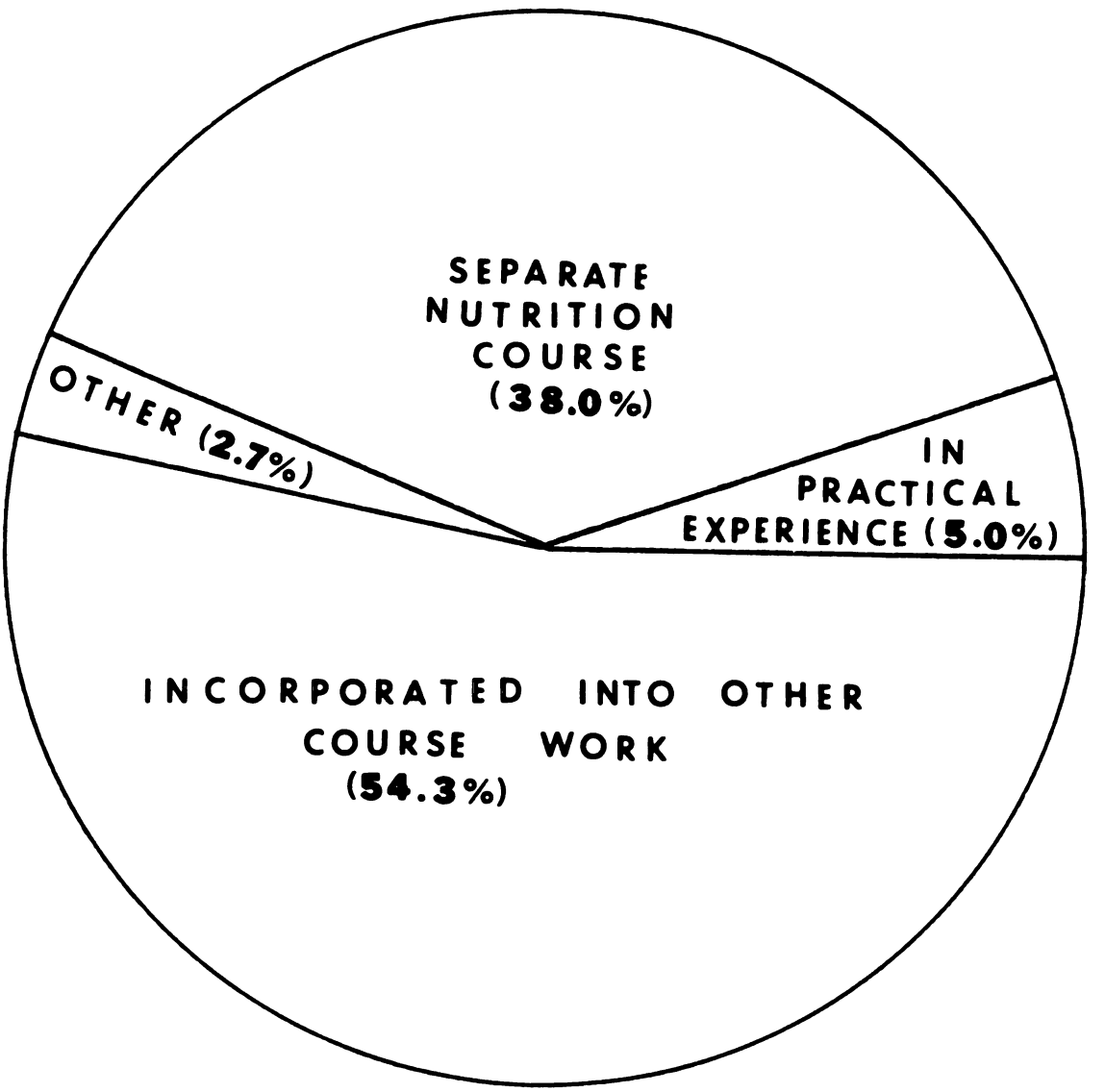

SEPARATE NUTRITION COURSE (38.0%)
IN PRACTICAL EXPERIENCE (5.0%)
INCORPORATED INTO OTHER COURSE WORK (54.3%)
OTHER (2.7%)

Table 8. How nutrition was presented in the dental school curriculum[a]

Form of presentation	% of respondents[b]
Separate course	45.2
In practical experience	6.3
In other coursework	63.3
Other	3.2

[a] n=377

[b] Total is greater than 100% since respondents may have chosen more than one answer.

education was less than what was needed in their practice (Figure 3). Only 27.5% indicated that it had been adequate for their needs (Figure 3).

More than 90% of the respondents were of the opinion that the content of the nutrition presentations was inappropriate for their needs (Figure 4). Dentists cited a number of reasons for the inappropriateness, particularly that the information was too general, practical applications were not presented, and that no information was presented (Table 9).

Nutrition education since graduation from dental school was investigated (Figure 5). Since graduating, less than 50% of the respondents had received nutrition education in workshops (46.7%), post-graduate courses (42.5%), national meetings (40.7%), or in other professionional meetings (40.5%). The majority of those responding had received

Table 9. Dentists' reasons given for content of nutrition information in the dental school curriculum being inappropriate for needs[a]

Reason cited	% of responses
Information too general	22.2
Information more detailed than needed	9.9
Practical applications not presented	28.5
Information too specific	2.9
Information became outdated	16.7
No information presented	19.8

[a]n=414 responses for 369 respondents

Figure 3. Dentists' evaluation of the amount of nutrition information in the dental school curriculum. Percentages are based on a total of 422 respondents.

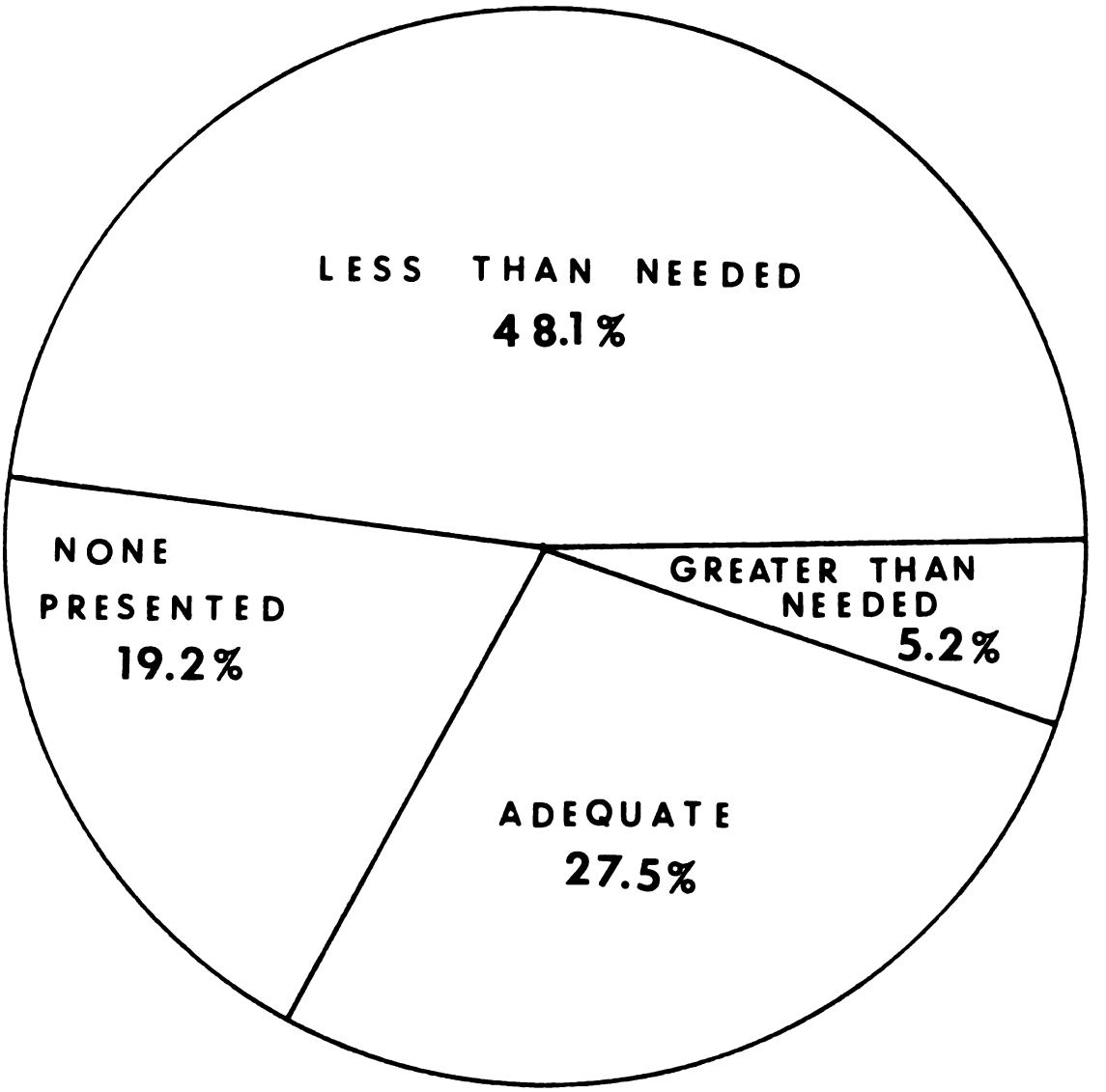

LESS THAN NEEDED
48.1%
NONE PRESENTED
19.2%
GREATER THAN NEEDED
5.2%
ADEQUATE
27.5%

Figure 4. Dentist's evaluation of the content of nutrition information in the dental school curriculum. Percentages are based on a total of 400 respondents.

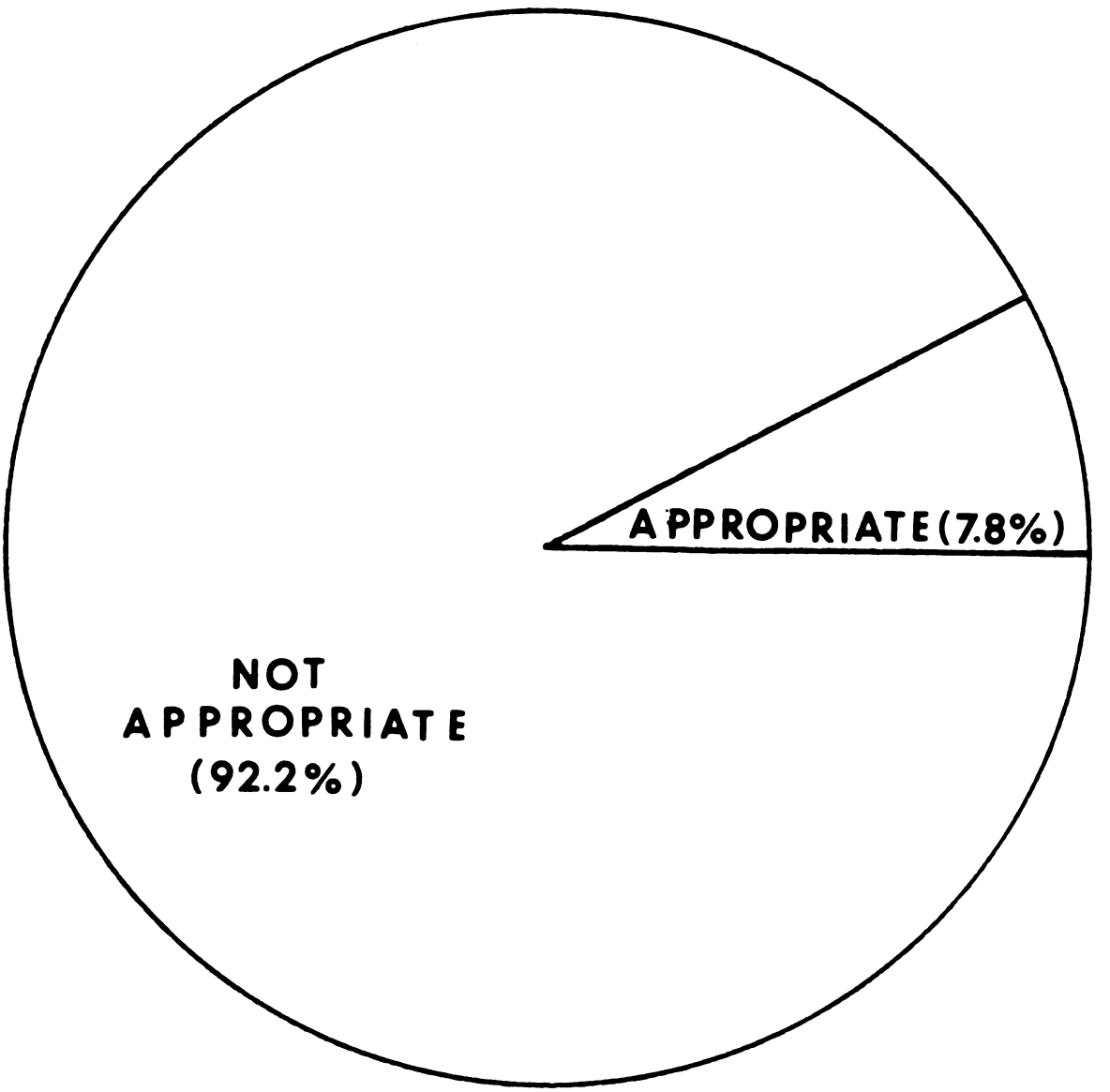
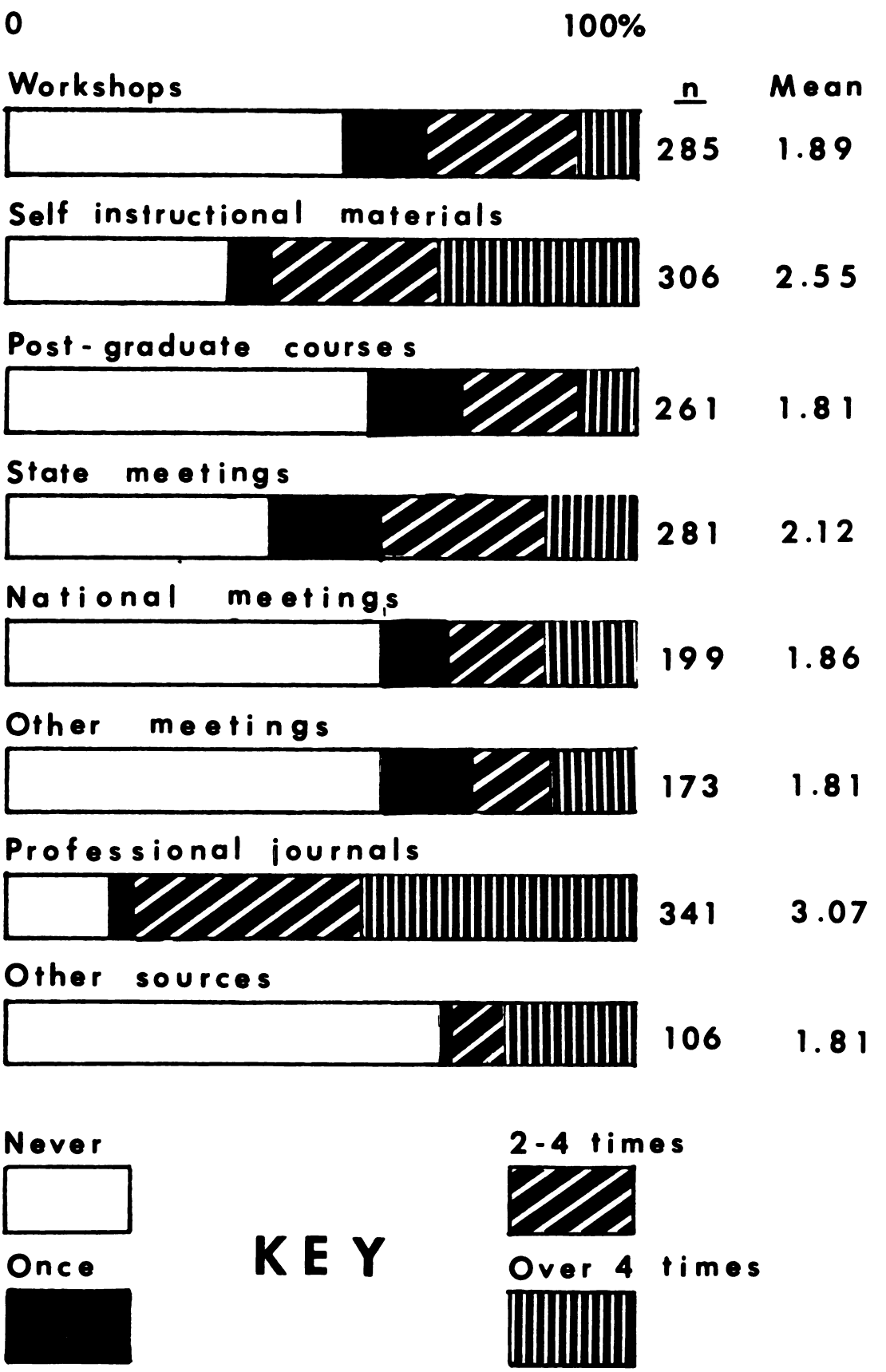

APPROPRIATE (7.8%)
NOT
APPROPRIATE
(92.2%)

Figure 5. Nutrition training received since graduating from dental school. n represents the number of respondents for each method of obtaining information. Each section in a bar represents the percentage of those respondents who indicated receiving nutrition information in the particular method evaluated. Note that a value of 1.0 signifies never having used this source since graduating, a value of 2.0 signifies having used this source once since graduating, a value of 3.0 signifies having used this source between two and four times, and a value of 4.0 indicates having used this source >four times since graduating.


0
100%
Workshops
n
Mean
285
1.89
Self instructional materials
306
2.55
Post-graduate courses
261
1.81
State meetings
281
2.12
National meetings
199
1.86
Other meetings
173
1.81
Professional journals
341
3.07
Other sources
106
1.81
Never
Once
KEY
2-4 times
Over 4 times

their post-graduate nutrition information via professional journals; 43.7% have used this source of nutrition information more than four times and 36.1% have used it between two and four times. Self-instructional materials ranked second as the method used most often to obtain nutrition information since graduation from dental school; 31.4% indicated they had used this method more than four times, and 27.5% indicated that they had used this method between two and four times (Figure 5). When comparing the means for these different methods of post-graduate nutrition education, professional journals ranked as the source used most often since graduating to obtain nutrition information (mean=3.07) (Figure 5) (Appendix E). Means were determined using a scale of 1 to 4; lower values indicate the method had been used less often and higher values indicate the method had been used a greater number of times. Self-instructional materials was the next method used most often by the dentist since graduating (mean= 2.55). The remaining methods all had means of approximately 1.8, indicating the method had been used approximately once since graduation.

The majority of respondents (78.7%) felt it was essential for the dentist to receive basic nutritional knowledge in dental school (Table 10). Approximately 20% felt it was helpful, but not necessary.

Most dentists (51.7%) felt that the best method for incorporating nutrition into the dental curriculum was a combination of a separate general nutrition course with integration of nutrition information dealing with specific oral problems (Table 11). Approximately 30% of the

Table 10. Dentists' perceptions of the importance of nutrition in the dental school curriculum

Importance in the curriculum	% of respondents
Essential	78.7
Helpful, but not necessary	20.1
Not required	0.7
Not pertinent	0.2
Totally unimportant	0.2

[a]n=418

Table 11. Best method for incorporating nutrition into the curriculum[a]

Method	% of respondents[b]
Separate general nutrition course	31.2
Integration of information with other courses	26.8
Combination of two above	51.7
Specific applications in clinic	28.0

[a]n=577 responses for 418 respondents

[b]Total is greater than 100% since respondents may have chosen more than one answer

dentists suggested that nutrition should be presented in each of the following ways: separate course, integration of nutrition information with other coursework, and specific applications in the clinic (Table 11).

Nutrition Education in Practice

Approximately half of the respondents provided their patients with some nutrition education (Table 12). Dentists used a variety of methods (Table 13) to present this information, particularly counseling (78.2%) and brochures (42.3%). The nutrition counseling is most often provided by dentists (90.2%) and dental hygienists (58.6%) (Table 14).

The percentage of patients who received counseling in the individual dental office is given in Table 15. A large number of dentists (48.8%) counsel 20% or fewer of their patients (Table 15). Thirteen percent of the dentists reported that they counsel approximately 100% of their patients.

The patients who most often received nutrition counseling were those with rampant caries (Table 16).

This counseling was provided using a number of procedures (Table 17). Evaluation of eating habits and foods which cause dental disease was the procedure used by most of the dentists (87.6%). The majority of dentists evaluated general dietary intake (70.1%). A large number (57.9%) evaluated eating habits and counseled on systemic disease (Table 17).

Most dentists who evaluated general dietary intake were recent (1966-1978) graduates of the University of Michigan or the University of Detroit and had received

Table 12. Nutrition education provided for patients[a]

Response	% of respondents
Yes	51.4
No	48.6

[a]n=498

Table 13. Methods of presenting nutrition education[a]

Method	% of respondents[b]
Brochures	42.3
Counseling	78.2
Referral	13.7
Video Cassettes	12.4
Other[c]	11.1[c]

[a]n=369 responses for 234 respondents

[b]Total is greater than 100% since respondents may have chosen more than one answer

[c]Chairside discussion with patient, bulletin board, slides

Table 14. Person responsible for counseling[a]

Person responsible	% of respondents[b]
Dentist	90.2
Dental assistant	23.8
Dental hygienist	58.6
Outside professional	3.9
Other	3.1

[a]n=462 responses for 256 respondents

[b]Total is greater than 100% since respondents may have chosen more than one answer

Table 15. Percentage of patients receiving counseling[a]

Percentage	% of respondents
0-5%	20.2
6-10%	14.3
11-20%	14.3
21-30%	11.5
31-40%	4.4
41-50%	7.9
51-60%	4.4
61-70%	1.2
71-80%	3.6
81-90%	5.6
91-100%	13.1

[a]n=252 respondents

Table 16. Patients receiving counseling[a]

Patients	% of respondents[b]
All	27.7
Elderly	11.3
All with rampant caries	62.5
All with periodontal disease	36.7
Other[c]	29.7

[a]n=530 responses from 256 respondents

[b]Total is greater than 100% since respondents may have chosen more than one answer

[c]Any patients with prosthondontic problems, young patients, any patient in whom a need is indicated

Table 17. Procedures used in counseling

Procedure	n[a]	% of respondents
Evaluation of general intake	231	70.1
Evaluation of eating habits/foods causing dental disease	251	87.6
Evaluation of eating habits/counsel on systemic disease	221	57.9
Evaluation of nutrient intake/ compare with the Basic 4	177	49.7
Evaluation of intake of all nutrients	179	54.2
Computer analysis of nutrient intake	148	10.1

[a]Total number of respondents for each procedure investigated

nutrition training in a separate course and/or in other courses (Table 18).

The dentists who evaluated their patients' eating habits and noted foods being consumed that cause dental disease (Table 19) and those dentists who evaluated eating habits and counseled on systemic disease (Table 20) had similar characteristics as those who evaluated general dietary intake. Most had received some nutrition training at the University of Michigan or the University of Detroit since 1966, in a separate nutrition course and/or through nutrition incorporated into their coursework.

Procedures used by the dentists to modify the diet are presented in Table 21. Most dentists (83.4%) explain the necessities of an adequate diet when modifying the patient's diet. Giving the patient a list of foods to supplement his diet was used by 38.7% of the dentists; vitamin supplements were prescribed by 38.3% of the respondents.

Reasons stated for not providing nutrition counseling were that dentists and staff lacked the necessary knowledge and time, and patients were not interested in the topic (Table 22).

Table 23 summarizes significant differences detected with a Chi-square test for those dentists who expressed a lack of nutrition knowledge and for those dentists who did not express a lack of nutrition knowledge. Of those expressing a lack of knowledge, 69.6% had nutrition in their curriculum; 30.4% did not. Of those who did not report they lacked knowledge,

Table 18. Characteristics of dentists evaluating general dietary intake

Characteristic	n[a]	% of respondents using this procedure
Had nutrition in dental school	161	73.9
As a separate course	119	54.6
In practical experience	119	10.9
In other courses	119	61.3
University of Michigan graduates	154	46.8
University of Detroit graduates	154	41.6
Graduates of other schools	154	11.7
Graduated prior to 1945	162	13.0
Graduated between 1946 and 1955	162	18.5
Graduated between 1956 and 1965	162	26.5
Graduated between 1966 and 1978	162	42.0

[a]Total number of respondents using this procedure for each characteristic investigated

Table 19. Characteristics of dentists evaluating habits and noting foods that cause dental problems

Characteristic	n[a]	% of respondents using this procedure
Had nutrition in dental school	219	75.8
As a separate course	166	50.0
In practical experience	166	8.4
In other courses	166	65.7
University of Michigan graduates	212	48.1
University of Detroit graduates	212	38.7
Graduates of other schools	212	13.2
Graduated prior to 1945	219	14.2
Graduated between 1946 and 1955	219	17.4
Graduated between 1956 and 1965	219	26.9
Graduated between 1966 and 1978	219	41.6

[a]Total number of respondents using this procedure for each characteristic investigated

Table 20. Characteristics of dentists evaluating eating habits and counseling on systemic disease

Characteristic	n[a]	% of respondents using this procedure
Had nutrition in dental school	127	73.2
As a separate course	93	54.8
In practical experience	93	10.8
In other courses	93	63.4
University of Michigan graduates	123	41.5
University of Detroit graduates	123	44.7
Graduates of other schools	123	13.8
Graduated prior to 1945	127	15.7
Graduated between 1946 and 1955	127	18.9
Graduated between 1956 and 1965	127	28.3
Graduated between 1966 and 1978	127	37.0

[a]Total number of respondents using this procedure for each characteristic investigated

Table 21. Procedures used to modify the diet[a]

Procedure	% of respondents[b]
Give the patient a list of foods to supplement the diet	38.7
Write a diet to promote good dental health	10.9
Have the patient write a diet to promote good dental health	3.6
Explain the necessities of an adequate diet	83.4
Prescribe vitamin supplements	38.3
Prescribe mineral supplements	19.2
Prescribe vitamin/mineral supplements	30.1
Other[c]	10.9

[a] n=454 responses for 193 respondents

[b] Total is greater than 100% since respondents may have chosen more than one answer

[c] Blood sample analysis for nutrient status, hair analysis, discuss restriction of sugar in the diet

Table 22. Dentists' reasons for not providing nutritional counseling[a,b]

Reason	% of respondents[c]
Lack time	39.7
Lack knowledge	51.0
Staff lacks knowledge	32.4
Patient disinterest	46.2
Don't believe it is important	7.4
Refer patients to professional in the community	5.8

[a] n=569 responses for 312 respondents

[b] 312 respondents is greater than 242 respondents who indicated they did not provide nutrition counseling. Some of the respondents who indicated they provided counseling also answered this question

[c] Total is greater than 100% since respondents may have chosen more than one answer

Table 23. Comparison of the characteristics of those dentists who expressed a lack of nutrition knowledge with those who did not[a]

	Characteristics							
	Had nutrition in dental school		Amount		Content		Provide nutrition counseling	
	Yes	No	Adequate	Not Adequate	Appro-priate	Not Appro-priate	Yes	No
% of respondents who expressed a lack of knowledge	69.6	30.4	13.9	86.1	3.7	82.4	18.5	81.5
% of respondents who did not express a lack of knowledge	78.1	21.9	41.8	58.2	7.2	68.8	66.6	33.4
	p=.05 (sig)		p=.00 (sig)		p=.01 (sig)		p=.00 (sig)	

[a]A Chi-square test was performed to detect significant differences

78.1% had nutrition in the dental school, and 21.9% had not. Of those dentists expressing a lack of knowledge, 18.5% provide nutrition counseling for their patients, 13.9% felt the amount of training they had received had been adequate, and 3.8% believed the content of nutrition information had been appropriate. Dentists who did not have nutrition in dental school were more likely to express a lack of knowledge. Dentists who rated the amount of nutrition education adequate were less likely to express a lack of knowledge; those who rated the amount not appropriate were more likely to express a lack of knowledge. Fewer dentists who expressed a lack of knowledge provide counseling than those who did not express a lack of knowledge.

Characteristics of dentists providing nutrition counseling are compared to those of dentists who do not provide this service in Table 24. No significant differences were detected between whether nutrition counseling was provided to patients and the following characteristics: whether nutrition had been presented in dental school, the content of that information, what school the dentist graduated from, and the year of graduation from dental school. Slightly more dentists who rated the amount of nutrition information adequate provide counseling. Of those dentists who provide counseling for their patients, 37.3% indicated the amount of nutrition information to be adequate for their needs; 62.7% indicated it was less than what was needed. Of those dentists who do not provide counseling, 72.4% indicated the amount was inadequate for their needs, 27.6% indicated it had been appropriate. Those dentists who provide nutrition counseling were

Table 24. Comparison of characteristics of dentists providing nutrition counseling to those of dentists who do not provide counseling[a]

	Characteristics							
	Had nutrition in dental school		Content		Amount		Feel you lack knowledge	
	Yes	No	Appropriate	Not Appropriate	Adequate	Not Adequate	Yes	No
% of respondents providing nutrition counseling	78.0	22.0	7.8	69.9	37.3	62.7	11.3	88.7
n=	199	56	20	179	79	133	29	227
% of respondents who do not provide nutrition counseling	72.5	27.5	4.1	76.9	27.6	72.4	52.9	47.1
n=	174	66	10	186	58	152	128	114
	p=.19 (not sig)		p=.12 (not sig)		p=.04 (sig)		p=.00 (sig)	

[a]A Chi-square test was performed to detect significant differences.

Table 24 (cont'd.).

	Characteristics						
	School			Prior to 1946	Year of graduation		
	U of M	U of D	Other		1946-1955	1956-1965	1966-1978
% of respondents providing nutrition counseling	47.3	40.0	12.7	14.1	20.7	24.2	40.2
n=	116	98	31	36	53	62	103
% of respondents who do not provide nutrition counseling	51.5	33.9	14.6	10.3	19.0	26.4	41.7
n=	120	79	34	25	46	64	101
		p=.38 (not sig)				p=.39 (not sig)	

less likely to feel they lacked knowledge.

No significant difference was found between the dental school graduated from and if nutrition had been included in the curriculum.

No significant difference was found between the method of presentation of nutrition in dental school and whether counseling was provided in the dental practice. Likewise, there was no significant difference found between method of presentation of nutrition in dental school and percentage of patients who received nutrition counseling.

Significant differences were found between the method of presentation of nutrition information and the dental school graduated from (Table 25). The two relationships contribuging most to this difference were: 1) those dentists who had received training in a separate nutrition course were less likely to have graduated from University of Michigan and more likely to have graduated from University of Detroit; and 2) those dentists who had nutrition incorporated into other coursework were more likely to have graduated from University of Michigan and less likely to have graduated from University of Detroit (Table 25). Approximately one third (32.9%) who received training in a separate course had graduated from University of Michigan; this was lower than the expected value (Table 25) if no difference were to exist between the two schools for this method of presentation. Over half of the dentists (55.3%) who had a separate nutrition course were University of Detroit graduates, which was higher than the expected value. Conversely, of those dentists who

Table 25. Method of presentation of nutrition in dental school compared to dental school graduated from

Method of Presentation	Observed Values[a]			
	School			
	U of M	U of D	Other	Total
Separate nutrition course	56[c]	94[c]	20	170
In practical experience	14	7	1	22
In other coursework	136[c]	65[c]	31	232
Other	9	3	0	12
Method of Presentation	**Expected Values[b]**			
	School			
	U of M	U of D	Other	Total
Separate nutrition course	84	66	20	170
In practical experience	11	9	3	22
In other coursework	114	90	28	232
Other	6	5	1	12

[a]Values are numbers of graduates who had this method of presentation of nutrition

[b]Values are the expected numbers of graduates who had this method of presentation of nutrition information, if no significant difference exists

[c]Like superscripts in the same row indicates a significant difference exists at $p \leq .05$

received nutrition incorporated into other coursework, 58.6% were University of Michigan graduates and 28.0% graduated from University of Detroit. This was higher than expected for University of Michigan graduates and lower than expected for University of Detroit graduates.

Dentists' Attitudes Toward the Importance of Nutrition

Table 26 presents data on how dentists view nutrition in different aspects of dental health. The majority of dentists felt nutrition was at least as important as any other factor involved for each of the areas investigated. The next largest number of respondents, (18.2%, 15.9%, 15.4%) were unsure of what contribution nutrition makes in the areas of periodontal disease, to resist infection, and in treatment of the elderly patient, respectively. The next largest number of respondents in the areas of prevention of dental caries (22.8%) and aiding in wound healing (14.2%) thought that nutrition was the most important contributing factor in these areas of dental health.

Dentists' attitudes towards importance of nutrition in the areas represented in Table 26 were compared with other background characteristics and tested for significance with analysis of variance (Table 27). Means were determined using a scale of 1 to 5; lower values indicate nutrition was given greater importance in dental health. Higher values indicate nutrition was viewed as being less important in dental health. There is a significant difference between those dentists who had nutrition in their dental training and those who did not, in how they view the importance of nutrition in prevention of dental caries. The mean for those dentists

Table 26. Dentists' attitudes towards the importance of nutrition

Nutrition as a contributing factor	n[a]	% of respondents				
		Most important	Equal to other factors	Small	Unsure	No contribution
For prevention of dental caries	408	22.8	65.2	4.2	7.6	0.2
For prevention of periodontal disease	402	7.0	56.0	16.7	18.2	2.2
To aid in wound healing	394	14.2	58.4	14.2	11.7	1.5
To resist infection	397	14.6	56.2	11.8	15.9	1.5
In the treatment of the elderly dental patient	395	13.2	58.0	13.2	15.4	0.3
In the treatment of the oral surgery patient	385	8.3	56.9	17.9	16.4	0.5

[a]Total number of respondents for each area of dental health investigated

Table 27. Perception of the importance of nutrition in dental health related to selected characteristics of the dentists' nutrition training[a]

Area of dental health		Characteristics							
		Had nutrition in dental school		As a separate course		In practical experience		In other courses	
		Yes	No	Yes	No	Yes	No	Yes	No
Dental caries	mean=	1.91	2.16	1.93	2.00	1.78	1.98	1.88	2.07
	±std error=	.72	.87	.78	.77	.55	.78	.65	.87
	n=	310	96	140	268	18	390	203	205
		p=.01		p=.40		p=.27		p=.01	
Perio-dontal disease	mean=	2.51	2.57	2.58	2.50	2.61	2.52	2.47	2.58
	±std error=	.94	.95	.99	.92	.92	.94	.91	.97
	n=	305	96	137	265	18	384	199	203
		p=.56		p=.45		p=.70		p=.25	
Wound healing	mean=	2.22	2.46	2.34	2.30	2.11	2.28	2.20	2.36
	±std error=	.83	1.08	.87	.92	.76	.91	.83	.96
	n=	300	93	134	260	18	376	195	199
		p=.03		p=.52		p=.42		p=.08	
Infec-tion	mean=	2.28	2.49	2.35	2.33	2.06	2.35	2.20	2.47
	±std error=	.90	1.13	.90	.99	.80	.97	.88	1.02
	n=	301	95	134	263	18	379	197	200
		p=.06		p=.82		p=.21		p=.00	
In treat-ment of elderly patient	mean=	2.31	2.32	2.35	2.30	2.06	2.33	2.28	2.35
	±std error=	.88	.94	.94	.88	.73	.90	.84	.95
	n=	300	94	133	262	18	377	197	198
		p=.93		p=.64		p=.21		p=.41	
In oral surgery	mean=	2.40	2.54	2.42	2.45	2.28	2.45	2.36	2.52
	±std error=	.85	.97	.89	.88	.75	.89	.82	.93
	n=	292	92	129	256	18	367	190	195
		p=.17		p=.75		p=.43		p=.07	

[a]Analysis of variance ($p \leq .05$) was performed to detect significant differences.

Table 27 (cont'd.).

Area of dental health		Characteristics						
		School			Year of graduation			
		U of M	U of D	Other	Prior to 1946	1946-1955	1956-1965	1966-1978
Dental caries	mean=	1.94	2.01	1.95	1.98	2.01	1.90	1.99
	±std error=	.72	.86	.72	.95	.85	.68	.73
	n=	197	139	57	44	74	102	181
			p=.72			p=.75		
Perio-dontal disease	mean=	2.63	2.43	2.39	2.38	2.42	2.42	2.66
	±std error=	.97	.91	.89	1.01	.90	.92	.95
	n=	194	138	56	42	73	101	179
			p=.08			p=.08		
Wound healing	mean=	2.41	2.21	1.98	2.16	2.40	2.25	2.28
	±std error=	.95	.88	.69	1.08	1.03	.81	.87
	n=	190	135	54	38	72	102	176
			p=.00			p=.54		
Infec-tion	mean=	2.41	2.27	2.20	2.23	2.43	2.26	2.36
	±std error=	.97	.98	.82	1.14	1.06	.92	.91
	n=	191	135	56	40	72	101	178
			p=.23			p=.58		
Elderly patient	mean=	2.43	2.22	2.21	2.13	2.35	2.21	2.41
	±std error=	.89	.89	.90	.99	.87	.83	.92
	n=	191	132	57	40	72	101	175
			p=.07			p=.17		
Oral surgery	mean=	2.53	2.37	2.23	2.19	2.59	2.37	2.47
	±std error=	.90	.84	.82	.91	.93	.84	.87
	n=	188	129	53	37	71	99	172
			p=.05			p=.12		

who had nutrition training in dental school was 1.91, compared to a mean of 2.16 for those who did not have nutrition training in dental school. Dentists who did not have nutrition training in dental school perceived nutrition to be less important in the prevention of dental caries.

Of those dentists who had nutrition in dental school, a significant difference exists between those who had nutrition incorporated into other courses and those who did not, in how they view the importance of nutrition in the prevention of dental caries. Nutrition was believed to be more important in prevention of dental caries by those who had nutrition incorporated into other coursework, compared to those who had not. No significant relationships were evident between school graduated from or year of graduation and attitudes towards nutrition and dental caries (Table 27).

Dentists' attitudes towards the importance of nutrition in wound healing were significantly different between those who had nutrition training in their curriculum and those who did not. Nutrition in wound healing was given greater importance (mean=2.22) by those with nutrition training in dental school, compared to those who had not had nutrition (mean=2.46)(Table 27). A significant difference existed between the dental school graduated from and the dentists' attitudes toward the importance of nutrition in wound healing. Those graduates from other dental schools thought nutrition played a greater (mean=1.98) role in aiding in wound healing than graduates of the University of Michigan (mean=2.41) and the University of Detroit (mean=2.21) (Table 27).

When evaluating dentists' attitudes towards the importance of nutrition in resisting infection, a signicifant difference was found between those who had nutrition incorporated into other courses (mean=2.20) and those who had not (mean=2.47). Those who had nutrition incorporated into other courses perceived nutrition to be a more important factor in resisting infection than those who did not have nutrition training by this method (Table 27).

Dentists' attitudes towards the importance of nutrition and oral surgery were significantly different between those graduating from the University of Michigan, the University of Detroit, and other schools listed in Table 4. Greater importance was given to nutrition and oral surgery (mean=2.23) by graduates from other schools, compared to the University of Detroit graduates (mean=2.37) and the University of Michigan graduates (mean=2.53)(Table 27). No significant differences were noted in dentists' perceptions of the importance of nutrition in oral surgery based on the characteristics of nutrition training and/or the form of training in dental school.

No significant differences existed between dentists' attitudes toward nutrition in the prevention of periodontal disease and any of the characteristics evaluated in Table 27. Likewise, no significant differences were observed between dentists' attitudes toward the importance of nutrition in the treatment of the elderly patient and any of the characteristics evaluated (Table 27).

A Pearson Correlation was performed to determine if a relationship existed between how important dentists felt it was to receive nutrition information in dental school and

dentists' attitudes toward the importance of nutrition in certain aspects of dental health. Table 28 shows that a weak, but significant, positive relationship exists between the dentists' attitudes toward the importance of nutrition in the dental curriculum and the dentists' attitudes toward the importance of nutrition in all selected areas of dental health. The strongest correlation existed between the dentist's attitude towards the importance of nutrition in wound healing and how important he felt it was to have nutrition included in the dental school curriculum. The weakest relationship existed between the dentist's attitude towards the importance of nutrition in the treatment of the elderly patient and how important he felt it was to include nutrition in the curriculum (Table 28).

Continuing Education

Respondents thought that a nutrition newsletter would be the most useful form of continuing education for the practicing dentist (Table 29). Regional workshops and self-instructional units were also viewed as being particularly useful.

The majority of dentists had received nutrition information in the following areas: dental caries, periodontal disease, wound healing, nutrient requirements, diabetes, hypertension, aging, and tooth development (Table 30). The areas which had the highest percentage of positive

Table 28. Pearson Correlation Coefficients relating dentists' attitudes toward importance of nutrition in selected areas of dental health and dentists' attitudes toward importance of nutrition in the dental school curriculum

Importance of nutrition	To prevent dental caries	In periodontal disease	In wound healing	To resist infection	In treatment of elderly patient	In oral surgery
r=	.2277	.1863	.2518	.2289	.1136	.1960
n[a]=	377	371	364	367	364	356
p=	.001	.001	.001	.001	.015	.001

[a]Total number of respondents for which a relationship can be found

Table 29. Type of continuing nutrition education most useful for the practicing dentist[a]

Method of continuing education	% of respondents[b]
Regional workshops	39.8
Cassette tapes	18.0
Self-instructional units	39.1
Nutrition newsletter	51.3
Other[c]	6.6

[a] n=661 responses for 427 respondents

[b] Total is greater than 100% since respondents may have chosen more than one answer

[c] Well-written journal articles, post-graduate courses, district-sponsored programs

Table 30. Areas in which the dentist has received nutrition information

Area	n	%		Source of information %[a,b] of respondents			
		Yes	No	Dental School	Cont Ed	Readings	Other
Dental caries	478	97.9	2.1	89.3	50.4	65.7	7.4
Periodontal disease	457	94.1	5.9	81.4	51.2	60.9	6.5
Nutrient requirements	423	85.1	14.9	71.4	38.1	59.7	11.1
Hypertension	413	74.1	25.9	57.2	33.3	68.0	11.1
Diabetes	429	86.0	14.0	69.6	31.7	60.2	10.0
Aging	399	62.4	37.6	50.2	34.5	66.3	9.2
Wound healing	422	83.4	16.6	69.3	35.8	56.8	8.5
Tooth development	429	86.0	14.0	86.7	27.4	50.9	5.4

[a]Total across are greater than 100% since respondents may have chosen more than one answer

[b]Number of respondents for each area is equal to % of n responding yes

respondents were dental caries (97.9%) and periodontal disease (4.1%). Dental school was cited by the majority of dentists for all areas investigated as one source of information. Continuing education was cited by the majority of dentists as a source for dental caries information (50.4%) and periodontal disease (51.2%). Readings were cited by the majority of dentists for all subject areas as the source of nutrition information; for hypertension and aging, readings were the source of nutrition information that the greatest number of respondents cited as their source of information (Table 30).

Of those dentists who responded in the space left for comments at the end of the questionnaire (n=123), 30.1% indicated a need for more knowledge in the area of nutrition and dental health and a need for more continuing education programs in nutrition for practitioners.

Summary

A relationship was found between lack of nutrition knowledge and whether the dentist had received nutrition training in dental school or not. A relationship was also found between lack of knowledge and the amount of nutrition information the dentist had received, the content of the nutrition information the dentist had received, and whether the dentist provided nutrition counseling or not.

A relationship also existed between the amount of nutrition information the dentist had received and whether

the dentist provided counseling or not. A relationship was also found between the method of presentation of nutrition information in dental school and the dental school graduated from.

Relationships were also found between the dentists' perceptions of the importance of nutrition in the prevention of dental caries and 1. whether the dentist had received nutrition training in dental school and 2. whether nutrition training had been incorporated into other coursework or not. A relationship existed between the dentists' perceptions of the importance of nutrition in both wound healing and oral surgery and the dental school graduated from. A relationship was also found between the dentists' perceptions of the importance of nutrition in wound healing and if nutrition training had been part of their dental curriculum. Lastly, a relationship was found between the dentists' perceptions of the importance of nutrition in resisting infection and whether nutrition had been incorporated into other coursework during dental school or not.

DISCUSSION

Nutrition education in the dental school curriculum has been strongly advocated, and nutrition counseling by the dentist has been recommended (Shaw, 1972; De Paola and Alfano, 1977; Nizel, 1972a). However, much evidence indicates that nutrition education is still lacking for both the dental student and the practitioner. Without nutrition information available in dental education, it places the dentist at a disadvantage for providing his patients with nutrition counseling. Because there have been no studies reported documenting the practitioner's training in nutrition, the present research was conducted. This study was an attempt to evaluate how practicing dentists in Michigan perceive the role of nutrition in dental health, to what extent nutrition counseling is provided, and what procedures are being used. An attempt was made to assess the need and method for continuing education in nutrition for dentists in Michigan.

The typical dentist who responded to this study comes from an area where population exceeds 100,000 (Table 1), graduated from either the University of Michigan or the University of Detroit (Table 4) within the past twelve years (Table 5), is in general practice (Table 3), and employs a

dental assistant, a dental hygienist, and a receptionist (Table 6). This suggests that the findings of this study will be pertinent for the dental schools in the state, since most of the respondents graduated from them (Table 4).

The majority of practicing dentists indicated that nutrition was part of their dental education (Table 7). Most of these respondents (63.3%) had nutrition incorporated into their other coursework, although nearly half (45.2%) of the dentists had a separate nutrition course in dental school (Table 8). Yet, 92.2% of the dentists felt that the content of nutrition information was not appropriate for their needs (Figure 4) and only 27.5% indicated the amount they had received was adequate (Figure 3). These results suggest that although an attempt has been made to include nutrition as part of dental education, the practitioner still perceives the quality and quantity to be inadequate for his needs. Comments indicate that nutrition information is still limited to the area of caries control and/or periodontal disease in dental school and that the need exists to incorporate more practical applications into their training.

Since the majority (86.9%) of these dentists were graduates of the two schools in the state, and there were no significant differences between the schools as to whether nutrition was presented in the dental program, it appears that inadequacy exists in nutrition education at both the University of Michigan and the University of Detroit dental

schools. Because a significant difference did exist between the dental school attended and the method in which nutrition was presented in the dental school curriculum, this relationship was further explored to detect which methods had been presented to a greater extent relative to the particular school graduated from. The differences found between the University of Michigan and the University of Detroit graduates in how they received their training may relate to a difference in the method that nutrition was presented in the dental curriculum, a difference in whether nutrition was required or was an elective, or a difference in when separate nutrition courses were established at the two schools. It may also indicate a difference in the philosophies of the two schools in how they view how nutrition should be incorporated as part of the dental program. Further work evaluating the status of nutrition in both the University of Detroit and the University of Michigan curricula is needed before conclusions can be drawn from this finding.

Since the majority of dentists surveyed (51.7%) felt that the best method of incorporating nutrition into the dental school curriculum was a separate nutrition course in combination with nutrition information when specific oral problems are presented in other courses (Table 11), the importance of a separate nutrition course for dental students is evident. Furthermore, the next largest group of respondents (31.2%) indicated that the best method of presenting nutrition to

dental students was a separate general nutrition course alone (Table 11). Dutra de Oliveira (1974) notes that, often, when nutrition is not presented as a separate course, but is incorporated into other coursework, it loses its importance in the medical and dental curriculum. After graduation, practitioners were unable to relate nutrition concepts to clinical applications. He stated that a separate nutrition course is preferred since it encompasses basic nutrition and its aspects of preventive dentistry, as well as nutrition-dental health relationships which may be overlooked when nutrition is incorporated into other coursework.

The small number of responses from those who had a separate nutrition course at the University of Michigan may be due to several factors: a separate nutrition course did not exist at the University of Michigan until recently, dental students were not interested in pursuing nutrition via a separate course since it was incorporated into their other courses, or dental students were not interested in pursuing nutrition in a separate course since they did not feel that nutrition played an important role in dental health. Although some differences do exist in attitudes dentists have concerning the role of nutrition in certain aspects of dental health depending on which dental school they attended (Table 27), there is no basis from this study to assume the latter as the reason for only 32.9% of those who had a separate nutrition course to be University of

Michigan graduates (Table 25). Further work is needed to determine why more of those respondents receiving nutrition education in other courses were University of Michigan graduates and why more of those having a separate nutrition course graduated from the University of Detroit.

The majority of dentists surveyed reported that they had never received any post-graduate training in nutrition through any method, except for self-instructional units and professional journals (Figure 5). The results (Figure 5) suggest either: 1. that dentists are not interested/do not have time for nutrition education after graduation, or 2. that the appropriate method and/or nutrition information is not available in continuing education in nutrition for dentists in practice. These results suggest the latter since those methods that must be presented for the dentist by someone else; i.e. workshops, courses, and meetings, were the methods used the fewest number of times by the practitioner. Those methods by which the dentist received post-graduate nutrition information most often were those he could seek out himself; i.e. self-instructional units and readings in nutrition. The lack of availability of programs in nutrition for the practicing dentist and the desire to become more knowledgeable in nutrition and dental health was cited often (63.4%) in the Comments section of the questionnaire. This suggests that a strong interest in nutrition exists, but the present programs available to the practicing dentist are

limited and inadequate to meet their needs.

Dentists in this state appear to recognize the important role nutrition has in dental health, and the need for dentists, as health professionals, to receive nutrition training in dental school, since the majority of those surveyed felt it was essential to have nutrition as part of the dental school curriculum (Table 10). A significant, but weak, positive relationship existed between their perceptions of the importance of nutrition in the dental school curriculum and their attitude towards the role of nutrition in selected areas of dental health (Table 28). This suggests that dentists who believe it is essential for nutrition to be in the dental school curriculum also believe nutrition plays an important role in certain selected areas of dental health.

Approximately half (51.4%) of the research sample provides nutrition education for their patients (Table 12). Of these dentists providing nutrition education for their patients, 78.2% provide nutrition counseling (Table 13). In practically all cases, the dentist provides the counseling (Table 14), and most dentists counsel approximately 20% or less of their patients (Table 15). Thirteen percent of the dentists indicated they counsel 91-100% of their patients (Table 15), yet in Table 16, 27.7% of the dentists indicated that all of their patients receive nutrition counseling. An explanation for this discrepancy may be that 27.7% of the dentists make counseling available to all their patients,

but, in actuality, may counsel fewer than 100%. A second reason for this discrepancy may be if the dentist interpreted "all patients" to mean "all patients that show and/or indicate a need for this service". In this case, this may only constitute a small percentage of patients; therefore, the dentist would be counseling fewer than 100% of his patients.

Table 17 lists procedures used in counseling. For those procedures used most often: evaluation of general dietary intake, habits that cause dental problems, and counseling on systemic disease, characteristics of the dentists using them were evaluated (Table 18)(Table 19)(Table 20). The dentists that use any one of these procedures had the same characteristics as those using either of the other procedures. Approximately 75% had nutrition in dental school; the majority graduated from either the University of Michigan or the University of Detroit since 1966, and most had nutrition either as a separate nutrition course or incorporated into other coursework. Apparently, there are no differences among dentists as far as background characteristics are concerned in regards to what procedure they choose to use in nutrition counseling. The two methods used most often, evaluating general dietary intake and evaluating habits and noting foods which may cause dental problems, are the two methods recommended most often for use in counseling (Nizel, 1972a, 1973; Shaw, 1972).

More in-depth counseling procedures of evaluating nutrient intake were only provided by half of the dentists who provided nutrition counseling to their patients (Table 17). This suggests dentists may either lack time, interest, or knowledge to provide these procedures to their patients. Although 83.7% explain the necessities of an adequate diet to their patients when modifying the diet, very few use any other procedures to modify the patient's diet (Table 21). Close to 40% of the dentists who provide counseling prescribe vitamin supplements for their patients (Table 21). Considering the perceived lack of nutrition training in dental school, it is questionable as to what the rationale for prescribing supplements is based on. It would be of interest to investigate why vitamin supplementation is used to such a great extent, if knowledge necessary to evaluate a patient's nutritional status is indeed lacking in dental training. Witteman (1976) and Nizel (1973) stress the importance of having the patient write a diet for himself and understand how the changes will be beneficial to his dental health. Again, further research is needed in this area to determine why certain procedures are/are not used.

Since relatively the same number of dentists who had training in school provide nutrition counseling for their patients as those who did not have training, and the same holds true for those who do not provide counseling, it appears the decision to provide nutrition counseling

(Table 24) is made on an individual basis. The dentists' training in nutrition and the form of presentation does not seem to play a role in his decision (Table 24), except whether the amount of information had been adequate for his needs. Since 92.2% indicated the content of the information they had received had not been appropriate (Figure 4), it can be assumed that counseling is being provided by dentists who are inadequately trained or that the dentists providing counseling have obtained nutrition training since graduating. However, this second reason seems unlikely since few programs exist at the present time for the practicing dentist to receive nutrition information, unless he has actively pursued his interest by reading. Although the question specifically defines nutrition counseling as counseling other than information related to caries control, some dentists may have still thought of nutrition counseling in this sense. In the subject area of sugar and caries control, the dentist usually receives adequate preparation, and the type of counseling provided for his patients would probably not be affected if he had nutrition in dental school or not. Because the majority of those providing counseling feel that the content of their nutrition education was lacking (Table 24), this may be one reason that some of the counseling procedures previously mentioned are not utilized to any great extent (Table 17).

For those dentists citing reasons for not providing nutrition counseling, 51% feel that they lack knowledge

(Table 22). Note that some of those dentists who provide nutrition counseling also chose to respond to this question (Table 22). This becomes apparent when evaluating for differences among those who feel they lack knowledge and whether nutrition counseling is provided (Table 23). As expected, the majority who provide counseling do not feel they lack knowledge; however, 11.3% who provide counseling feel they lack knowledge (Table 24). Approximately 19% of those who feel they lack knolwedge are providing nutrition counseling (Table 23). That these dentists feel they lack knowledge (Table 22)(Table 23) indicates that their previous training had been inadequate and that they realize their present level of knowledge is still inadequate.

Patient disinterest was also cited by many of the dentists as a reason for not providing counseling (Table 22). Of the written comments received, 16.3% dealt with this area alone. Many of those dentists felt patients are not interested in changing their dietary habits and many had negative experiences with counseling, citing lack of motivation on the patient's part as a contributing factor. However, not only are patients unreceptive to nutrition counseling, but "many refuse to pay much attention to <u>any</u> type of preventive counseling". Several dentists mentioned that patients are unwilling to pay a fee for a nutrition counseling service and third-party payment systems will not provide coverage for this service. Recommendations made ten years ago at the

White House Conference on Food, Nutrition, and Health (1969) advocated payment for this service by third-party carriers and incorporation of this service into the dentist's fee schedule. As evidenced by this study, acceptance of nutrition counseling procedures into the dental office as recommended have not progressed to any great extent. However, regardless of the negative comments concerning patient interest, very few dentists (7.4%) indicated that they didn't feel it was important to provide nutrition counseling for their patients (Table 22). It appears that the majority of dentists favor nutrition counseling as part of preventive dentistry procedures, but at the present time, feel they lack the competence in nutrition to effectively provide this service to their patients.

That dentists believe nutrition is an important factor in dental health and related areas is supported by findings cited in Table 26, where the majority of dentists believed that nutrition was either the most important contributing factor or equally as important as any other factor in each area investigated. The small percentage of dentists who were unsure of the importance of nutrition suggests that either they lack sufficient knowledge to evaluate the role of nutrition or are uncertain as to what to believe in this area. Several comments were made concerning the "great deal of contradictory presentation from one author to another" in an area "about what nobody will agree on".

Another dentist noted that "it is difficult to find factual nutritional information that is not slanted according to organization or author's personal or business gain".

Although the majority of dentists felt nutrition plays an important role in dental health, it can not be assumed from this that the dentists understand what that role is, or consequently, are knowledgeable in these aspects of nutrition. These findings are encouraging since they indicate the dentist believes in the importance of nutrition in dental health and acknowledges a role for nutrition in his profession.

Results summarized in Table 27 suggest that nutrition training in dental school may have altered dentists' perceptions of the role of nutrition in certain aspects of dental health. These results also indicate that if nutrition had been a part of the dentist's training, incorporated into other coursework, he perceives the importance of nutrition in certain aspects of dental health differently from the dentist who was not trained in this manner. Neither of these relationships hold for all areas of dental health evaluated. The reasons for this are unknown. Perhaps nutrition training in dental school emphasizes the importance of the role of nutrition more in one area of dental health than in others, and this is the reason for the significance observed. It is noteworthy that no differences were seen between the year of graduation and the dentist's attitude towards the importance

of nutrition; apparently, the emphasis on nutrition has not shifted throughout the years, even though our knowledge of nutrition has greatly increased in recent years. Results also suggest the school the dentist graduated from may make a difference in how he views the importance of nutrition in two aspects of nutrition and dental health, wound healing and oral surgery (Table 27). Since these are closely related, this may indicate that schools may differ in their approach to teaching the role of nutrition in oral surgery and consequently, wound healing, but may not differ in how they approach the importance of nutrition in the other subject areas (Table 27). Consequently, a difference in how the dentists view the importance of nutrition in areas of dental health is independent of whether they had nutrition training, in what manner it was presented, from what school they graduated, and the year of graduation (Table 27). This suggests that their attitudes are based on knowledge other than that received in dental school.

It is apparent from this study that dentists perceive a need for continuing education in nutrition. The majority of them felt their dental school training had been inappropriate (Figure 3)(Figure 4), and few have received any further training since graduation (Figure 5). Over half of the dentists who do not provide nutrition counseling feel they lack knowledge to provide this service (Table 22), yet, only 7.4% cited that they did not feel nutrition was important as the

reason for not providing counseling (Table 22). Many dentists are unsure of the importance of the role of nutrition in selected areas of dental health (Table 26), yet a slight trend was observed for those who had training to feel that nutrition played a more important role in selected areas of dental health than for those dentists who had not received nutrition information in dental school (Table 27). More continuing nutrition education seems appropriate to provide the dentist with a clearer understanding of the importance nutrition has in dental disease and related aspects of health. Written comments indicated that many dentists felt nutrition plays a very important part in dental health, but are unsure of the role nutrition has in specific areas of dental disease, and would like more information in these areas.

Table 30 indicates that the majority of dentists have received nutrition information in a number of subjects, either in dental school, continuing education, or by reading. This suggests that while the dentist may have had basic exposure to all of the areas in Table 30, the information was probably limited and many are still uncertain about their nutrition knowledge. Further studies are necessary to determine in what specific areas of nutrition knowledge the dentist needs/would like more training. Note that after dental school, many of the dentists have received their information through reading; few have received any nutrition training

through continuing education in any of the areas investigated (Table 30), except for the two major dental diseases: dental caries and periodontal disease. This suggests that certain continuing education programs in specific areas of nutrition should be emphasized more heavily than others according to interest expressed and whether programs have been available to the dentist previously.

The majority of dentists favor a nutrition newsletter as the best method of continuing education (Table 29). When the proposed study was discussed with Dr. John Nolen, Executive Director of the Michigan Dental Association, he felt that it was more appropriate for a project related to nutrition for dentists to originate at Michigan State University than at any other school in the state, since Michigan State University has a tradition of outstanding work in this area. For this same reason, the newsletter should be published by Michigan State University's Food Science and Human Nutrition department or a representative of the department, in conjunction with the Michigan Dental Association. If it were not economically feasible to publish and mail this separately, it could appear as a regular item in the Journal of the Michigan Dental Association.

In conjunction with the newsletter, a list of nutrition reference materials for the dentist should be made readily available to the practitioners. Many dentists indicated that they had no knowledge of where or who to refer patients to in

their community. Some form of directory should be made available for dentists in need of referral services to a nutrition professional.

A large number of dentists favored regional workshops as the best method of continuing education (Table 29). A series of nutrition workshops, either conducted regionally or in separate dental districts, should be initiated for the practicing dentist. The educational objectives of these workshops should be formulated by trained nutrition professionals in conjunction with a representative of the M.D.A. and/or their Committee on Education. Before programs can be initiated, further research is needed to ascertain specific needs and interests of the dentist. Since the greatest number of respondents (28.5%) felt that not enough practical applications had been presented in their training (Table 9), and very few (6.3%) indicated they had received nutrition in practical or clinical experience in dental school (Table 8), it seems appropriate to suggest that workshops focus on aspects of nutrition and dental health where applications to the dental practice can be presented. One dentist wrote "we need a good practical continuing education course in nutrition in the dental practice", and another dentist supported this by commenting "for practicing dentists, many more convenient continuing education courses, including workshops, need to be provided".

The poor quality of continuing education in nutrition for the dentist was documented by one dentist who wrote: "recently, I attended a two day seminar in nutrition and was very disappointed in finding absolutely nothing to bring back to my practice." In 1978, this researcher attended the Mid-Winter Meeting of the Chicago Dental Society, the second largest dental meeting in the nation; nutrition and dental health was covered in two seminars. The list of references recommended for dental practitioners can be found in Appendix C; the quality of information presented was questionable. Prescription of vitamin and mineral supplements, hair analysis to determine nutrition status, and advocation of megavitamin therapy were the three major areas of nutrition and dental health presented. In addition, seminars relative to balancing body chemistry (Appendix D) were recommended to the dentist. At a local meeting attended by this researcher (Central District Dental Society), in 1977, nutrition was presented in a day-long seminar, "Nutrition Against Disease". Little practical information and a great deal of misinformation concerning the need for trace minerals and diet supplementation, overprocessing of foods, thereby depleting their nutrient content, and that all diseases are usually caused by faulty diet, was presented. Since approximately 20% of those dentists who made comments indicated the abundance of contradictory and the biased nature of nutrition information available to them, and considering the misinformation encountered in

existing continuing education programs, it seems extremely important that trained nutrition professionals be instrumental in constructing these programs, to insure that the dentist is receiving reliable and useful information.

The findings of this study also suggest that revisions need to be made in the curriculum or method of presentation, at both the University of Michigan and the University of Detroit. Dr. Joseph Chasteen, Chairman of the Michigan Dental Association Education Committee wrote that results of this study "should dictate changes in the curriculum." Although the majority of dentists perceived their dental school training in nutrition to be inappropriate for their needs, no effort was made in the present research to evaluate the nutrition information present in the dental school curriculum at either the University of Michigan or the University of Detroit. Before any recommendations can be made for revision of the curriculum at these schools, relative to the nutrition component, present programs in nutrition for dental students, should be evaluated.

The large response rate to this study strongly supports that dentists in Michigan are interested in nutrition and dental health. The large number of written comments (25.4%) received also supports that this is an area of concern for the dental practitioner, since approximately 95% of the comments supported this research and felt that dentists would benefit from the findings. Secondly, the fact that one

quarter of the respondents took time to comment on the study is also an indication that the interest exists, in this state, amongst the dental profession, in nutrition and dental health.

Because of the large number of respondents to this study, the great number who expressed interest in the area of nutrition and dental health, and the support of and interest in this project by the Michigan Dental Association, it is evident that this is an area of research that should be pursued further. Evaluation of the nutrition component in the curricula of the dental schools in this state should be an important aspect of future studies in this area. Furthermore, the establishment of a continuing education program in nutrition for practicing dentists and the subsequent evaluation of its effectiveness is deemed a necessary aspect of future research in this area.

APPENDICES

APPENDIX A

SURVEY INSTRUMENT: NUTRITION IN DENTISTRY

APPENDIX A

SURVEY INSTRUMENT: NUTRITION IN DENTISTRY

Background Information (Check the one most appropriate answer)

1. Size of community where practice is located:

   _____ less than 2,500
   _____ 2,500-10,000
   _____ 10,000-50,000
   _____ 50,000-100,000
   _____ over 100,000

2. In which district of the M.D.A. are you a member? _____

3. Type of specialty:

   _____ general
   _____ o. surgery
   _____ periodontics
   _____ pedondontics
   _____ orthodontics
   _____ other (please specify) _____

4. Dental school graduated from: _____

5. Year of graduation from dental school:

   _____ prior to 1925
   _____ 1925-1935
   _____ 1936-1945
   _____ 1946-1955
   _____ 1956-1965
   _____ 1966-1978

6. Other personnel in your office working with patients:

   _____ another dentist
   _____ dental assistant
   _____ dental hygienist
   _____ receptionist
   _____ nutritionist or dietitian
   _____ other (please specify) _____

Professional Education (Check one or more)

7. Was nutrition information included in your dental school curriculum?

   _____ yes
   _____ no

   If yes, how was it presented?

   _____ separate nutrition course
   _____ in practical experience
   _____ incorporated into other course work
   _____ other (please specify) _____

8. From your experience, was the AMOUNT of nutrition information presented in your dental school curriculum:

_____ greater than is needed by your patients
_____ adequate to meet the needs of your patients
_____ less than what is needed by your patients
_____ none was presented
_____ other (please specify) _____

9. Was the CONTENT of nutrition information presented in your dental school curriculum appropriate for the needs of your practice?

_____ practical and appropriate for needs
_____ information too general for practical use
_____ information more detailed than needed
_____ practical applications not presented
_____ none presented
_____ information became outdated
_____ information was too specific

10. Since graduating, have you acquired any nutrition education pertaining to dental health in: (please indicate frequency)

	never	once	2-4 times	more than 4 times
workshops/seminars	_____	_____	_____	_____
self-instructional materials	_____	_____	_____	_____
post-graduate courses	_____	_____	_____	_____
professional meetings				
state	_____	_____	_____	_____
national	_____	_____	_____	_____
other _____	_____	_____	_____	_____
professional journals	_____	_____	_____	_____
other _____	_____	_____	_____	_____

11. How important do you feel it is for the dentist to receive basic nutritional knowledge in dental school?

_____ essential
_____ helpful, but not necessary
_____ not required
_____ not pertinent
_____ totally unimportant

If important, how best can it be included?

_____ a separate general nutrition course
_____ integration of nutrition information dealing with specific oral problems
_____ a combination of the two above
_____ specific application of nutrition principles, working with patients, in clinical training
_____ other (please specify) _____

Nutrition Education in Practice (Nutrition counseling as used in 12-19 refers to counseling other than information concerning sugar and its relation to dental caries.)

12. Do you provide nutritional counseling for your patients either directly or by referral?

_____ yes
_____ no

If yes, answer questions 13-18; if no, proceed to question 19.

If yes, which of the following methods do you use for presenting nutrition education to your patients?

_____ video cassettes
_____ brochures/pamphlets
_____ nutrition counseling
_____ referral services to other professionals in the community
_____ none of the above
_____ other (please specify) _____

13. Who is responsible for the nutrition counseling of your patients?

_____ dentist
_____ dental assistant
_____ hygienist
_____ outside professional (dietitian, nutritionist)
_____ other (please specify) _____

14. Which patients receive nutrition counseling?

_____ all patients
_____ elderly patients
_____ all patients with rampant caries
_____ all patients with periodontal disease
_____ other (please specify) _____

15. What percentage of your patients receive nutrition counseling? ~ _____ %

16. When providing nutrition counseling for your patients do you:

	yes	no
Evaluate general dietary intake	____	____
Evaluate eating habits and note foods being consumed that cause dental problems	____	____
Evaluate eating habits and counsel on problems of systemic disease	____	____

17. If you evaluate intake, do you:

	yes	no
Evaluate nutrient intake by comparison with Basic 4	____	____
Evaluate intake of all nutrients	____	____
Evaluate nutrient intake by computer analysis	____	____

18. If the patient's diet appears to need modification, do you:

_____ Give the patient a list of foods that can be used to supplement the diet
_____ Write a diet that would promote good dental health
_____ Have the patient write a diet that would promote good dental health
_____ Explain the necessities of an adequate diet
_____ Prescribe vitamin supplements
_____ Prescribe mineral supplements
_____ Prescribe vitamin and mineral supplements
_____ Other (please specify) _____

19. For which reason(s) is nutritional counseling not provided in your practice?

_____ Feel you lack time to provide adequate service
_____ Feel you lack adequate knowledge
_____ Feel your staff lacks adequate knowledge
_____ Patient disinterest
_____ Don't believe it is important
_____ Refer patients to nutrition professional in community

20. 1 - nutrition is the most important contributing factor
2 - nutrition is equally as important as other factors
3 - nutrition makes a small contribution
4 - nutrition is a contributing factor, but unsure of significance
5 - nutrition does not contribute

Using the scale above, how important do you think nutrition is? (Place the number for the correct response to each statement in the appropriate blank.)

_____ for the prevention of dental caries
_____ for the prevention of periodontal disease
_____ to aid in wound healing
_____ to resist infection
_____ in treatment of the elderly dental patient
_____ in treatment of the oral surgery patient
_____ in treatment of the young patient

21. What type of continuing nutrition education would be most useful to the practicing dentist?

_____ regional workshops
_____ cassette tapes
_____ self-instructional units (printed)
_____ nutrition newsletter
_____ other (please specify) _____

22. Please check the appropriate spaces for areas of nutrition information for which you have received instruction.

			SOURCE			
	No	Yes	Dental School	Cont. Ed.	Readings	Other
dental caries	___	___	___	___	___	___
periodontal disease	___	___	___	___	___	___
nutrient requirements	___	___	___	___	___	___
hypertension	___	___	___	___	___	___
diabetes	___	___	___	___	___	___
aging	___	___	___	___	___	___
wound healing	___	___	___	___	___	___
nutrition and tooth development	___	___	___	___	___	___

23. Comments:

APPENDIX B

COVER LETTER

APPENDIX B

COVER LETTER

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF FOOD SCIENCE AND HUMAN NUTRITION — EAST LANSING • MICHIGAN • 48824

April 25, 1979

Dear Michigan Dentist:

The Michigan Dental Association has given me permission to mail this questionnaire to a sample of Michigan dentists. This survey will help to identify dentists' perceptions of nutrition and its relation to dental health and any need for continuing education in this area.

This survey is part of the requirement for my Master of Science Program in Nutrition under Dr. Jenny T. Bond, Assistant Professor.

There are two components in this survey packet:

1. The questionnaire. There is no identifying mark on the questionnaire.

2. A postage paid return envelope. There is no identifying mark on the envelope.

Information collected in this survey will be used for aggregate statistical purposes only. Data will not be released or disclosed in a manner that would identify an individual. Information will be shared with the MDA.

Your responses would be appreciated not later than May 11, 1979. Please take 5-10 minutes today to complete and return the questionnaire.

Our funds are limited so we hope for a large return with this single mailing. Thank you very much for your cooperation.

Sincerely,

Monica S. Renner

Monica Renner
Graduate Assistant

Enclosures

APPENDIX C

THE ABC'S OF NUTRITION:
LIST OF RECOMMENDED REFERENCES RECEIVED
AT 1978 MID-WINTER CHICAGO DENTAL SOCIETY MEETING

APPENDIX C

THE ABC'S OF NUTRITION:

LIST OF RECOMMENDED REFERENCES RECEIVED

AT 1978 MID-WINTER CHICAGO DENTAL SOCIETY MEETING

BASIC BOOKS

Abrahamson, E.M. & Pezet, A.W. "Body, Mind and Sugar". Holt, Rinehart & Winston, New York. 1951.
Good explanation of glucose tolerance test. Low blood sugar related to diet.

Atkins, R. & Duggal, H. "Dictionary of Nutrition" Pocket Books, New York. 1975.
Comprehensive alphabetical quick reference.

Atkins, R. "Dr. Atkin's Diet Revolution". David McKay Co., Inc. New York. 1972.
Low carbohydrate diet-psychological and physiological benefits explained.

Brennan, R.O. "Nutrigenetics". M. Evans & Co., Inc. New York. 1975.
Combined genetic (hereditary) and nutritional (environment) deficiencies may result in hypoglycemia. Nutrition-wise boosters to supplement diet.

Burton, B. "The Heinz Handbook of Nutrition." McGraw Hill, New York. 1965.
Good basic general information. Complete tables of food composition.

Cheraskin, E. & Ringsdorf, W.M. "Psychodietics" Bantam Books. New York. 1974.
Self evaluation questionnaire to determine extent one's diet is or will affect health.

Cheraskin, E. & Ringsdorf, W.M. & Clark, J.W. "Diet and Disease" Rodale Books, Emmans, Pa. 1968.
Trends in Am. diet and its relation to disease.
"New Hope for Incurable Diseases". Exposition Press, Inc., Jericho, New York.
"Predictive Medicine: Study in Strategy". Pacific Press Publishing Assn., Mountain View, California.

Clark, L. - Good Introduction for Patients.
"Be Slim & Healthy" Keats Publishing. New Canaan, Conn. 1972.
Unique carbohydrate counter.
"Get Well Naturally". Arc Books, New York.
"Know Your Nutrition". Keats Pub., New Canaan, Conn. 1973.
"Stay Young Longer". The Devin-Adair Co., New York. 1972.

Davis, A. - Good Primer.
"Let's Eat Right to Keep Fit". Harcourt Brace, New York. 1954.
"Let's Get Well". Harcourt Brace & World. New York. 1965.
"Let's Have Healthy Children" Harcourt Brace. New York. 1972.

Doyle, R. & Redding, I. "The Complete Food Handbook". Grove Press, New York. 1976.
Composition and nutritive value of most advertised foods.
Separates fact from advertising. Quick well-organized reference for all foods.

Dufty, Wm. "Sugar Blues". Chilton Book Co., Radnor, Pa. 1975.
Easily read, informative and shocking story of sugar. Excellent introduction for patients to extent of their sugar problem.

Eppright, Pattison & Barbour. "Teaching Nutrition" The Iowa State University Press. Ames, Iowa. 1963.

Fredericks, Carlton - low blood sugar.
"Eating Right for You". Grosset & Dunlap. New York. 1972.
"Food Facts & Fallacies" The Julian Press, Inc. 1965.
"Low Blood Sugar & You" Constellation International, New York. 1969.
"Psycho-Nutrition". Grosset & Dunlap. New York. 1976.
Low Blood sugar consequences-nutritional factors in psychological problems.

Goldbeck, N. & Goldbeck, D. "The Supermarket Handbook-Access to Whole Foods". Signet, New York. 1976.
Practical guide for wise food choices with exemplary brand name products.

Hunter, B.T. "Consumer Beware" Bantam Books. New York.
Analysis of preservatives in food.
"Natural Food Primer". Simon & Schuster. New York. 1972.
"Favorite Natural Foods". Simon & Schuster. New York. 1974.
"Food and Your Health" Articles from Consumer's Research.

Nittler, A. "A New Breed of Doctor". Pyramid House. New York. 1972.
Nutritional alternatives to questionable drugs.

Nichols, J. "Look Younger, Feel Healthier". Grosset & Dunlap. New York.

Nizel, A. "Nutrition in Preventive Dentistry: Science & Practice" W.B. Saunders Co., Philadelphia, Pa. 1972.
Oral relevance of nutrition-communication and counseling.

Oski, F. & Bell, J. "Don't Drink Your Milk". Wyden Books. 1977.
Lactose intolerance, alternatives to milk.

Page, M. "Degeneration-Regeneration" Page Foundation, St. Petersburg Beach, Florida. 1949.
Theory of body chemistry balancing through Micro-endocrinology.
"Body Chemistry in Health and Disease"
How to balance body chemistry.
"Your Body is Your Best Doctor" Pocket Book.
Good introduction to balancing body chemistry for the patient.

Passwater, R. "Super Nutrition". The Dial Press, New York. 1975.
How to utilize supplements adjusted to individual specific needs.

Pauling, L. "Vitamin C and The Common Cold". Freeman. San Francisco, California. 1970.

Pinckney, E. & Pinckney, C. "The Cholesterol Controversy". Sherbourn Press. Los Angeles, California. 1973.
Well researched and annotated report of whole story.

Rodale, J. "Magnesium" The Nutrient That Could Change Your Life". Pyramid Books. New York. 1971.
"The Complete Book of Vitamins". Rodale Press. Emmans, Pa. 1966.
"Complete Book of Minerals for Health". Rodale Press, Emmans, Pa. 1972.

Rosenberg, H. "The Doctor's Book of Vitamin Therapy". G.P. Putman' Sons. New York. 1974.
Megavitamins for health because of fallacies of "balanced diet" and decline of nutritional food.

Stone, I. "The Healing Factor. Vitamin C Against Disease". Grosset & Dunlap. New York. 1972.

Sweeney, E. "The Food That Stays: An Update on Nutrition, Diet, Sugar and Caries". Medcom, Inc. New York. 1977.
Excellent comparative charts and graphs of the effects of food on the tooth.

Williams, R. "You Are Extraordinary". Random House. New York. 1967.
Biochemical individuality.
"Nutrition Against Disease". Pitman Publishing Co., New York. 1971.
Hereditary-nutritional concept covering scope of degenerative disease. Pantothenic Acid findings.
"Nutrition in a Nutshell". Dolphin Press.
Nutritional counselling on lay level.
"The Wonderful World Within You: Your Inner Nutritional Environment". Bantam Books. New York. 1977.

Yudkin, J. "Sweet and Dangerous". Peter H. Wyden, Inc. New York. 1972.
Simple clear explanation of sugar's effects on body.

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ADVANCE INTEREST BOOKS

"Best of the Journal of ASPD-Vol. 1-Nutrition" The American Society for Preventive Dentistry, 435 N. Michigan Avenue, Chicago, Illinois 60611.

"Composition of Foods" U.S. Department of Agriculture Handbook, Washington, D.C.
Nutritional make-up of raw, processed and prepared foods.

"Dental Clinics of North America-Nutrition". W.B. Saunders Co., Philadelphia. July. 1976. Volume 29, Number 3.

Goodhart, R. & Shils, M. "Modern Nutrition in Health and Disease" Lea & Febiger. Philadelphia, Pa. 1973.

Martin, E. "Hazards of Medication". J.B. Lippincott Co., Philadelphia, Pa. 1971.

"Physicians Desk Reference". Medical Economics, Inc. Litton Publications, Inc., Oradell, New York. Yearly.

Price, W. "Nutrition and Physical Degeneration". Price-Pottinger Foundation. Monrovia, Ca.
Classic anthropological study on effects of refined diets on primitive cultures.

Pfeiffer, C. "Mental and Elemental Nutrients". Keats Publishing, New Canaan, Conn. 1975.

JOURNALS AND PERIODICALS

American Journal of Clinical Nutrition. 9650 Rockville Pike, Bethesda, Maryland, 20014. Scientific nutritional investigation.

Journal International Academy of Applied Nutrition. International College of Applied Nutrition, Box 286, La Habra, California, 90631. Nutritional research publication.

The Miller Message. Miller Pharmacal Co., P.O. Box 229, West Chicago, Illinois, 60185. Comprehensive technical review of nutritional literature.

Prevention Magazine. Rodale Press, Inc. Emmans, Pennsylvania. 18049. Health and Better living by prevention geared to understanding of general public.

Executive Health. Executive Publications. Pickfair Building, Rancho Sante Fe, California, 92067. Reports of nutritional aspects of health and prevention of disease.

COOK BOOKS

Alston, E. "The Best of Natural Eating Around the World" David McKay Co., New York. 1973.

Cadwallader, S. & Ohr, J. "Whole Earth Cook Book" Bantam Books. New York, 1972.

Davis, A. "Let's Cook It Right" Harcourt Brace. New York.

Davis, F. "The Low Blood Sugar Bookbook" Grosset and Dunlap. New York. 1972.

Fredericks, C. "Carlton Fredericks Cook Book for Good Nutrition".

Gare, F. & Monica, H. "Dr. Atkin's Diet Cook Book" Crown Publishers, Inc. New York. 1974.

Hunter, B.T. "Natural Foods Cook Book" Simon and Schuster. New York. 1961.

Kinderlehrer, "Confessions of a Sneaky Organic Cook" Rodale Press. Emmans, Pa. 1971.

Harrison, R. "1000 Plus. A Collection of Favorite Ways to Cook Meats, Fish, Eggs and Poultry." Page Foundation, Inc. St. Petersburg Beach, Florida. 1969.

Sauls, K. "Bee Natural" HAH Publications, Colorado Springs, Colorado. 1973.

COURSES AND CLINICIANS:

Cheraskin, Emmanuel-nutrition research.

Fredericks, Carlton-low blood sugar.

Huggins, Hal-body chemistry.

Diamond, John-kinesiology

Page, Melvin-microendocrinology and body chemistry.

Eversaul, George-kinesiology and nutrition.

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APPENDIX D

INFORMATION RECEIVED ON BALANCING BODY CHEMISTRY

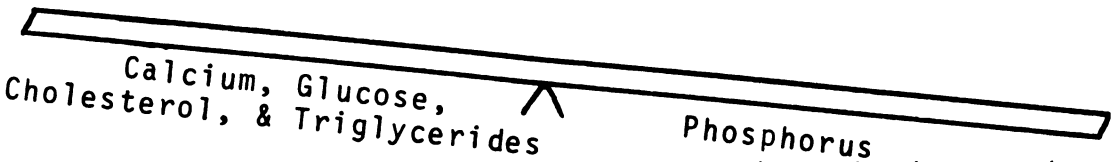
APPENDIX D

INFORMATION RECEIVED ON BALANCING BODY CHEMISTRY

Body chemistry has a great deal to do with Dental Health and resistance to Disease. The degenerative diseases all have similarities of IMBALANCE in Body Chemistry. Anything that is "bad" for oral health is likewise for general health and well being. Anything that is "good" for dental health is likewise good for general health and resistance to disease. Calcium and Phosphorus balance - the key to Dental Health. Ca & P are also involved in many - or most - of the bodies metabolic processes, especially protein metabolism and carbohydrate metabolism. Imbalance of the bodies chemistry is an indication of the beginning or progress of degenerative disease (Perio and arthritis have very similar chemical profile). Of the trace minerals - Manganese, Potassium, Copper, Iron, Zinc, Magnesium - 3 or 4 of these will be deficient or out of balance in both Perio and Arthritis. Zinc is important to growth and development and is involved in 80% of the enzyme systems of the bodies chemistry, and is essential to glucose metabolism. Magnesium is involved in 3/4 of the enzyme systems - and is the first of the "metabolic shields" to disappear before decay. Drops to 1/3 of normal before decay is apparent.

Calcium and Phosphorus are on a "teeter totter":

CALCIUM on one end_____ and PHOSPHORUS on the other end



Things that we put into our systems - through the mouth - elevate the calcium and depress the phosphorus - causing imbalance. Calcium is not alone on the left - elevated side of the teeter totter.

1. Sugar
2. Alcohol
3. Caffeine
4. Fruit Juices
5. Hi-Sugar fruits
6. Refined Carbohydrates
7. Honey

In this order these things cause an elevation of Calcium, Glucose, Cholesterol, Triglycerides and a depression of Phosphorus

The ingestion of sugar in any form lowers the resistance of the body to disease. The body can handle sugar at the rate of about 10 lbs per year but the average use in the USA is now about 160 lbs per person per year. "Cereals" really means grains and they are wholesome as whole grains -- but the refined and processed "cereals" have no resemblance to whole grains. They are negative foods and contribute to the development and increase of the degenerative diseases.

Suggested readings: most are paperback found in health food stores or book stores:

SUGAR BLUES - - - - - - - - - - - - Dufty

BODY MIND & SUGAR - - - - - - - - - Abrahamson & Pezer

LOW BLOOD SUGAR & YOU - - - - - - - - - - - Fredericks

*NUTRITION AGAINST DISEASE - - - - - - - - - Roger Williams

PSYCHO_DIETICS- - - - - - - - - - - - - - - Cheraskin & Ringsdorf

DIET & DISEASE- - - - - - - - - - - - - - - Cheraskin & Ringsdorf

EATING MAY BE HAZARDOUS TO YOUR HEALTH- - Verrett

*THE SAVE YOUR LIFE DIET - - - - - - - - - - Rubin

HIGH FIBER WAY TO TOTAL HEALTH- - - - - - Fredericks

LET'S TRY REAL FOODHARDBACK very very good. Author RENWICK publisher Zondervan

Some very good pamphlets by TALKING FOODS Box 81 Charlestown, Mass 02129 ("Sugar", "More on Sugar", "Our Daily Flour" "Natural is Best" etc)

APPENDIX E

STANDARD ERRORS FOR MEANS PRESENTED IN FIGURE 5

APPENDIX E

STANDARD ERRORS FOR MEANS PRESENTED IN FIGURE 5

Table 31. Standard errors for means presented in Figure 5: Nutrition training received since graduating from dental school

Method of training	Mean	Standard Error
Workshops	1.89	.063
Self-instructional units	2.55	.072
Post-graduate courses	1.81	.065
Professional meetings: State	2.12	.066
Professional meetings: National	1.86	.082
Professional meetings: Other	1.81	.085
Professional journals	3.07	.058
Other	1.81	.122

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