THE UNIVERSITY OF MANITOBA

AN ASSESSMENT OF THE RELATIONSHIPS AMONG NUTRITION KNOWLEDGE, ATTITUDES AND DIETARY PRACTICES OF COMPETITIVE SWIMMERS IN WINNIPEG

by

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ABSTRACT

In October, 1976, a study was conducted to assess the relationships among nutrition knowledge, attitudes and practices of 101 top level competitive swimmers in Winnipeg. Research instruments included a three-day food record and a group-administered questionnaire. Twenty-two multiple choice questions were used to assess nutrition knowledge and determine a fad score for each respondent. To assess nutrition attitudes, responses to twenty-one statements were arranged on a five point continumn ranging from "strongly agree" to "strongly disagree." Two different measures were used to evaluate dietary practices. An indication of dietary habits during training and before a competition was obtained by responses to six open-ended questions on the questionnaire. A more detailed assessment of dietary practices was obtained from a three-day food record kept by each respondent. Most of the data were statistically analyzed by computer, all tests being conducted at the 5 percent level of significance. Responses to the questions on dietary practices during training and before a competition were tabulated by the author. In general, respondents had a low level of nutrition knowledge; however, certain fad beliefs, considered common to athletes, were not prevalent. Some poor nutrition attitudes were evident. Dietary practices were modified more in preparation for an event than during training. Dietary practices assessed by three-day food records showed generally high intakes of energy and most nutrients. Little relationship was observed between nutrition knowledge and dietary practices. Some significant relationships were observed

between nutrition knowledge and nutrition attitudes. The greatest number of significant relationships were observed between nutrition attitudes and dietary practices. Neither age nor sex were significantly related to measures of knowledge, attitudes or practices.

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INTRODUCTION

Knowledge about food and nutrition is valuable only to the extent to which it is applied. Although nutrition educators like to think that those who know the basic concepts and principles of nutrition also apply this knowledge, research indicates this is not always the case. Evidence of a positive relationship between knowledge and practice is limited and conflicting (Young et al., 1956; Eppright et al., 1970; Woolcott, 1971; Schwartz, 1975; Thompson and Schwartz, 1975; Carruth et al., 1977). Few practices are altered because of knowledge alone. Dwyer et al., (1970) have concluded that

> Food habits are affected and altered by such a myriad of factors that it is little wonder that the effects of nutrition knowledge or education seem to be relatively slight. Nutritional considerations (in the sense of knowledge of scientifically correct information on nutrition or interest in the nutritional value of foods) have never played the major role in determining the dietary habits of the American people.

Since the goal of nutrition educators is to influence a positive change in an individual's food habits, the effect of factors other than knowledge, on practice, have been studied. Recently, research has focused on assessing the relationship between attitudes and practice (Jalso et al., 1965; Eppright et al., 1970, Schwartz, 1975; Carruth et al., 1977). Results of these studies have indicated that attitudes are influential in changing one's behavior. However, if attitudes must be altered to effect a positive change in behavior, the problem becomes more complex. Gifft et al., (1972) have suggested that the potential for changing an attitude is affected by the complexity

of three components contributing to the formation of attitudes: cognition, affect and action. In addition, the authors suggest that the motivational support for an attitude is a factor affecting the susceptibility of the attitude to change. Dillehay, cited by Gifft et al., (1972) has suggested that only when attitudes are based mainly on knowledge can information alone cause a change in the attitude.

Although few studies have examined the relationships among nutrition knowledge, attitudes and practices of adolescents, the Nutrition Canada Survey (1975) has shown that this age group consume nutritionally inadequate diets. In addition, it is interesting to note that little research has been conducted on the adolescent athlete despite the suggestion by Durnin (1967) that "in no other area of nutrition are faddism and misconceptions more prevalent than in athletics." Therefore, further study of the factors influencing the dietary habits of adolescent athletes seems warranted.

The objectives of the present study were:

1) To assess the nutrition knowledge of competitive swimmers
2) To assess the nutrition attitudes of competitive swimmers
3) To assess the dietary practices of competitive swimmers
4) To determine the relationships among nutrition knowledge, attitudes and practices of competitive swimmers
5) To determine the athletes' main source of nutrition information.

It was hypothesized that:

1) Knowledge of nutrition is not related to dietary practices
2) Attitudes toward nutrition are related to dietary practices
3) Knowledge of nutrition is related to attitudes toward nutrition.

REVIEW OF LITERATURE

Food habits, like other forms of human behavior, are the result of numerous psycho-social influences (Jenner, 1973). For this reason, it is often difficult to change an individual's food intake pattern. Nevertheless, the goal of nutrition education is to create a positive change in an individual's food habits (Gifft et al., 1972).

Traditionally, nutrition education programs have focused on increasing nutrition knowledge with the hope that this knowledge would be reflected in better food practices. However, a review of the literature indicates that this is not always the case. Therefore, more recent attention has focused on other factors, such as attitudes, that might influence a change in dietary habits. The following review will elaborate on the more significant studies which have examined the relationships among nutrition knowledge, attitudes and dietary practices.

RELATIONSHIPS BETWEEN NUTRITION KNOWLEDGE AND DIETARY PRACTICES

Since knowledge about nutrition is of little value unless it is applied, the relationship of knowledge to practice is of key importance and has been the focus of various research studies. Some researchers have observed a relationship between these two variables. For instance, Woolcott (1971) has reviewed a number of studies where the nutrition knowledge and practices of homemakers were assessed. In general, knowledge of nutrition was found to have some effect on dietary practices; however, the relationship was often not strong.

In her research, Woolcott (1971) found a significant relationship between nutrition knowledge and one measure of dietary practice after surveying 129 homemakers in an isolated Manitoba community. The significant ($P < 0.05$) relationship was observed between nutrition knowledge (assessed by responses to sixteen multiple-choice questions and nine "agree--disagree" statements) and dietary practices (determined by scores on a twenty-four hour recall). No significant relationship was found between nutrition knowledge and another measure of practice, that of constructing a hypothetical meal plan.

Young et al., (1956) studied the nutrition knowledge and practices of 646 homemakers in Rochester and Syracuse, New York. Using an open-ended questionnaire administered by personal interview, a general assessment of nutrition knowledge was based on the number of food groups the homemaker could give a nutritionally correct reason for including in the diet. A correct reason could be either a function of that food group or a nutrient for which the food group is known. Some indication of dietary practices was obtained by asking

about foods served in the previous twenty-four hours and about foods either purchased or used in the previous week. The authors observed that the homemakers with higher knowledge seemed to do better on both measures of feeding practices; however, dietary habits were much better than nutrition knowledge would indicate.

A detailed study conducted by Eppright et al., (1970) assessed the relationship between the nutrition knowledge and practices of mothers of preschool children in twelve North Central states. Trained interviewers administered a test of nutrition knowledge consisting of thirty-five true--false questions. In order to asses dietary practices, each mother was asked to keep a three-day food record for her child. (The discussion of the results was limited to simple correlation coefficients greater than .058 since this value is significant at the one percent level for a sample of 2000). An overall nutrition score based on the total nutrient intake (food plus supplements) was obtained for each child from the mean percentiles of calories and nutrients. This score was positively correlated and significant with scores on nutrition knowledge (.070). Furthermore, low nutrition knowledge scores were noticed in mothers of children in the lowest ten percentile group according to total intake of each nutrient, except protein and phosphorus.

Test scores on the knowledge test and the nutritive value of the diets without supplements also were compared. The nutrition knowledge scores of the mothers were significantly and positively correlated with the ascorbic acid, niacin (equivalent), phosphorus, protein,

riboflavin, calcium and caloric value of the food consumed. In a summary of the study, the authors concluded that nutrition knowledge scores were generally positively correlated with intake of food energy and nutrients.

Contrary to these researchers, others (Thompson and Schwartz, 1975; Schwartz, 1975; Carruth et al., 1977) have found no significant relationship between nutrition knowledge and practice. For instance, Thompson and Schwartz (1975) surveyed 366 grade eight secondary school students in Vancouver, British Columbia. Mean percentage scores in the questionnaire designed to assess nutrition knowledge and practice were 66 percent and 81 percent, respectively. No significant correlation was found between these two variables.

Similarly, Schwartz (1975) observed no significant relationship between the nutrition knowledge and practices of 313 female Ohio high school graduates who were surveyed four years after graduation. Nutrition knowledge was assessed by a thirty statement true--false questionnaire. Nutrition practices were determined by comparing food consumed using a three-day food record with foods recommended in the Basic Four Food Guide. No significant correlation was found between nutrition knowledge and practice.

A more recent assessment of the relationship between knowledge and practice has been conducted by Carruth et al., (1977). A disguised-participant-observer design was used in the five-week study to examine the nutrition behavior of Nutrition Education Assistants (NEAS) in Missouri. Each of the NEAS in the experimental group (N = 9)

was matched with two other NEAS in the state on factors assumed to influence knowledge, attitudes and nutrition-related behaviors. The matched NEAS comprised the control group (N = 18). The knowledge questionnaire assessed weight modification concepts of the respondents before and after training. Nutrition-related behavior was defined as one of three variables: 1) requests for free nutrition literature, 2) verbal statements relating to good nutrition practices, or 3) observed good nutrition practices.

The authors observed that a gain in nutrition knowledge was not significantly associated with an individual's initiative to request literature. Furthermore, since pre-test scores on the nutrition knowledge test correlated with both observed and verbal behaviors, ($r = .74$ and $r = .64$ respectively), and post-test results were associated with only verbal behavior ($r = .63$), the authors suggested that increasing knowledge was reflected in increasing the NEAS' verbalization about nutrition but did not significantly improve practices.

A review of the literature suggests that nutrition knowledge does not always influence dietary practices. Similar conclusions have been observed in some studies where nutrition education programs have attempted to change behavior.

Milton (1972) has reviewed a number of studies which have examined the effects of nutrition education on knowledge and practice. Although nutrition education has some influence on these variables, sometimes the effect is less than expected.

Bell and Lamb (1973) studied the influence of a six-week

nutrition education program on modifying the nutrition knowledge and practices of 1464 fifth-grade students in five states in United States. Food consumption was determined by measuring plate wastes in the school lunch program for a period of five days before the teaching took place for the experimental and control groups, and five days after, for the experimental group and the non-teaching period for the control group. Knowledge was assessed using a fifteen item objective test which also included questions on application of this knowledge. Although the experimental group achieved a significantly ($P < 0.001$) higher score on the written nutrition test than the control group, there was only a slight improvement in the dietary practices of the experimental group.

To determine if a nutrition education program would cause changes in food habits, Head (1974) evaluated a five-month nutrition education program for fifth, seventh and tenth grade students in North Carolina. Approximately 4700 students formed the control and experimental groups. Four fifth-grade, four seventh-grade and four tenth-grade classes, with an average class size of twenty-six, were given nutrition education. Nutrition knowledge, measured by cognitive tests, was significantly ($P = .05$) greater among those having had nutrition education for only the four fifth-grade classes and one seventh-grade class.

Dietary practices were assessed by a three-day food record where foods consumed were scored using the Basic Four Food Guide. Diets improved significantly ($P = .05$) for only the seventh-grade students who received nutrition education.

The authors suggested that the improvement in the diets of the fifth grade nutrition education groups may have been masked since both the control and experimental groups showed greatly improved diets.

Plate waste, for one meal, was used as an indicator of practice change and was found significantly ($P = .05$) decreased for only the four fifth-grade classes in the experimental group. In general, the authors observed that the amount of change decreased progressively at higher grade levels.

From the studies reviewed, it would appear that evidence of a positive relationship between knowledge and practice is limited. Level of nutrition knowledge does not seem to be indicative of, or necessarily sufficient to change level of practice. Although nutrition educators would like to think that those who know the basic concepts and principles of nutrition apply this knowledge in their food choices on a daily basis, research indicates that this is not always the case.

The evidence that change rarely occurs because of knowledge alone has caused researchers to investigate the relationship between other variables, such as attitudes, on behavior. It is thought that attitudes may comprise a stronger motivating force than knowledge in directing man's behavior.

RELATIONSHIPS BETWEEN NUTRITION ATTITUDES AND DIETARY PRACTICES

Rosenberg et al., (1960) have defined attitudes as "predispositions to respond in a particular way toward a specified class of objects." Because of the very nature of attitudes as predispositions, it is difficult to devise accurate measurement techniques. Instead, attitudes are inferred from the way we react to particular stimuli and involve three types of responses: cognition, affect and behavior. That is, every attitude is the result of some information which is evaluated by a person, undergoes some emotional reasoning and is acted upon. These three factors are interdependent. The complexity of each aspect affects the potential for changing the attitude (Gifft et al., 1972).

Although Travers (1967) has suggested that expressed attitudes bear little relation to behavior and concludes that "we don't always do what is best for us," Gifft et al., (1972) have suggested that attitudes direct man's behavior by establishing a framework on which to base decisions. Research has attempted to assess whether or not attitudes are in fact related to behavior. The discussion which follows will review several studies which have examined the nature of the relationship between nutrition attitudes and dietary practices.

In the study by Eppright et al., (1970) cited previously, mothers of preschool children responded to attitude statements on meal planning, food preparation, nutrition and permissiveness in feeding children. Possible responses were "agree or disagree" and "favorable or unfavorable." The overall nutrition score (diet with supplements)

was significantly (and positively) correlated with scores on attitudes toward nutrition (.087), food preparation (.081) and meal planning (.067). A significant, but negative, relationship was observed between the nutrition score and permissiveness (-.123). It should be noted that since the sample size was 2000, a simple correlation coefficient of .058 is significant at the one percent level. The authors concluded that there was a tendency for the quality of the diet to improve when mothers had certain favorable attitudes toward child feeding.

Scores on the attitude test and the nutritive value of the diets without supplements were also compared. Attitudes toward meal planning, food preparation and nutrition were, in most cases, positively correlated with intakes of food energy and nutrients. However, permissiveness was the attitude most significantly, but negatively, related to the nutritive value of the food eaten. In general, the authors concluded that attitudes toward meal planning, food preparation, nutrition and permissiveness in feeding children were factors influencing the nutritive quality of the children's diets with or without supplementation. Of the attitudes, the most influential, but negative, was permissiveness.

Similar conclusions were made by Schwartz (1975), whose study has been described previously. Using a mail questionnaire, respondents indicated agreement or disagreement to eleven statements reflecting attitudes toward nutrition and eating habits, eight about meal planning, and eleven about food preparation. A three-day food record was kept

as a measure of dietary practices. Mean scores were calculated for individual attitude statements and for each food group in the Basic Four Food Guide. Significant correlation coefficients were observed between some nutritional attitudes and practices.

Jalso et al., (1965) surveyed 340 subjects in New York State representing a variety of ages, incomes and educational backgrounds. A group-administered nutritional opinion questionnaire consisting of thirty statements was devised to distinguish between "faddist" and "non faddist" individuals. A questionnaire on nutrition practices assessed the use of food supplements, health foods, methods of weight control, special diets and avoidance of certain foods. A significant ($P < 0.01$) correlation was found between scores on nutrition opinions and practices.

These results are similar to those of Carruth et al., (1977) whose study has been cited previously. Nutrition attitudes of the Nutrition Education Assistants (NEAS) were evaluated by responses to forty statements designed to determine both flexible and rigid attitudes toward changing nutritional practices. Groups of attitude statements were correlated separately from scores on the total forty-item test instrument. For both the experimental and control groups, scores on selected subsets of statements and the overall score on the forty statements were 1) positively correlated with mail requests for literature; 2) negatively correlated with verbal behavior; and 3) positively correlated with observed behaviors. Those results suggested that a more flexible attitude toward changing nutrition behavior was reflected

in more observed behavior rather than as increased verbalization. Furthermore, it was concluded that attitudes not only influence dietary practices but also were better predictors of nutrition-related behavior ($P < 0.01$) than was knowledge.

In general, the literature suggests that there is some relationship between attitudes and behavior. The fact that some researchers have observed a stronger relationship between these variables, than have other researchers , may be explained by Gifft et al., (1972) who suggest that a number of factors influence attitude formation. Furthermore, the complexity of these factors affect the potential for changing the attitude, and ultimately the potential for changing behavior.

RELATIONSHIPS BETWEEN NUTRITION KNOWLEDGE AND NUTRITION ATTITUDES

If attitudes are related to practices, what influences attitudes? Gifft et al., (1972) suggest that one of the major factors causing a change in attitudes is the motivational support for the attitude. Dillehay, as cited by Gifft et al., (1972), describes three forms of such support: 1) knowledge, 2) social adjustment and 3) defense of the ego, and suggests that it is only when attitudes are based mainly on knowledge that information alone can result in a change in attitudes.

Several researchers have examined whether or not a relationship exists between nutrition knowledge and attitudes. For example, Petersen and Kies (1972), using a mailed questionnaire, examined the nutrition knowledge and attitudes of 910 kindergarten and first, second and third grade teachers in Nebraska. Nutrition knowledge was assessed using a modification of the test instrument developed by Eppright et al., (1970). It should be noted that attitude assessment was more of an evaluation of the teacher's attitudes toward the linkage between knowledge and attitudes, whereas other studies in this section assess the actual relationship between knowledge and attitudes. Petersen and Kies (1972) evaluated the teacher's attitudes toward teaching nutrition and school feeding programs by responses to attitude statements which were rated on a five point scale from "strongly agree" to "strongly disagree." Nutrition knowledge was significantly ($P < 0.10$) correlated with the attitude that knowledge of the Basic Four would not be sufficient to ensure selection of an adequate diet. In comparison,

no significant relationship existed between knowledge scores and the attitude that development of a favourable attitude toward food is more important in changing dietary patterns than learning facts. Furthermore, the attitude that learning facts is the best way to achieve behavioral change was significantly and negatively ($P \leq -.10$) correlated with the teacher's nutrition knowledge. From these data, the researchers concluded that more nutrition knowledge will not necessarily be reflected in more positive attitudes toward teaching nutrition.

In contrast, studies by Eppright et al., (1970) and Schwartz (1975), cited previously, showed significant correlations between nutrition knowledge and attitudes. In particular, Eppright et al., (1970) found that knowledge of nutrition was positively and significantly ($P < 0.01$) correlated with attitude toward nutrition, meal planning and food preparation. Sims (1976), using a mailed questionnaire, drew similar conclusions after assessing the nutrition knowledge and attitudes of mothers of 163 preschool children in a midwestern city. Knowledge was assessed using a twenty-three statement true--false test developed by Eppright et al., (1970). The mother's attitudes about childrearing, family life and their role as parents were assessed by responses to items in a Parent Attitudes Research Instrument. Attitudes toward feelings of permissiveness were measured on a Powerless Scale while a "Nutrition Is Important" attitude scale was designed to measure the mother's attitudes toward the importance of proper nutrition for her child. Agreement or disagreement with the attitude statements was

assessed using a Likert-type scale. A significant ($P < 0.001$) correlation was found between nutrition knowledge and the attitude that "Nutrition Is Important" while the correlation between nutrition knowledge and the attitudes about "equalitarianism" was significant at the one percent level. A significant but negative ($P < -0.001$) correlation was found between nutrition knowledge and both the "Parents Are All Wise" attitude and the "Powerless" attitude. Mothers who strongly agreed with items on the "Parents Are All Wise" scale and believed themselves to be "Powerless," knew less about nutrition.

Dwyer et al., (1970) also studied the relationship between nutrition knowledge and attitudes in 1338 students from five Massachusetts high schools. The students completed an open-ended questionnaire designed to measure attitudes toward nutrition (as part of the health education curriculum) and a multiple-choice questionnaire to assess nutrition knowledge. Nutrition was found to be equal to or less interesting than other parts of the health education curriculum that the students had taken. Responses as to why nutrition was considered less interesting included: "boring" subject matter, "old hat" material (that is, the information had been studied previously), learning involved memorizing "useless" facts, and other responses. Students' mean score on the nutrition knowledge test was 55 percent. The authors suggested that this low score may have been a reflection of the students having generally poor attitudes on nutrition education.

These studies suggest that knowledge and certain attitudes are interrelated. Although some investigators have observed more

relationships than have other researchers, perhaps this is explained by Dillehay, cited by Gifft et al., (1970), who suggests that a number of factors influence attitude formation and only when attitudes are based mainly on knowledge can information alone cause a change in that attitude.

RELATIONSHIPS AMONG NUTRITION KNOWLEDGE, ATTITUDES AND PRACTICES

Only a few studies have examined the relationships among nutrition knowledge, attitudes and practices in the same subjects. For example, Picardi and Pariser (1976) studied the nutrition knowledge, attitudes and practices of eleventh and twelfth grade students who had taken a food and nutrition minicourse. Knowledge was measured by a test of multiple-choice and completion problems. Health concerns and food choice behaviors were evaluated by a paired comparison method where students were to choose one of the pair, based on some stated criterion. Because the number of positive correlation coefficients of statistical significance was low for knowledge-attitude, attitude-practice and knowledge-practice, the authors concluded that perhaps a single thirty-hour course cannot be expected to cause much change in attitudes or behavior.

In contrast, other researchers have found some relationships among nutrition knowledge, attitudes and practices. For example, Thompson and Schwartz (1975) distributed questionnaires among 366 grade eight secondary school students in Vancouver, British Columbia and have stated that "mean percentage scores in tests of nutrition knowledge, attitudes and practices were 66 percent, 66 percent and 81 percent respectively." Partial correlation analysis of test scores revealed significant correlation coefficients for nutrition knowledge and attitudes (.500) and for nutrition attitudes and practices (.208). The correlation between nutrition knowledge and practices was very low and not significant. These results agree with those of a previous

study by Schwartz (1975) where a significant relationship was also found between nutrition knowledge and attitudes and between nutrition attitudes and practices, but not between nutrition knowledge and practices.

The results of these studies which have examined the relationships among all three variables (knowledge, attitudes and practices), in the same subjects, tend to agree with those studies which have examined the relationship between only two of the three variables. Nutrition attitudes were more often found related to dietary practices than nutrition knowledge. In addition, relationships between nutrition knowledge and certain nutrition attitudes have been observed. Knowledge, attitudes and practices are interrelated; however, since the relationships are not completely understood, it would appear that future study is warranted in this area.

METHODOLOGY

A. The Sample

Swimmers from the five competitive swim clubs in Winnipeg, Manitboa were chosen for the sample (Appendix A). From this group, only those athletes classed as top level performers by Canadian Amateur Swimming Association (C.A.S.A.)--Manitoba Section standards[1] by the end of August 1976 and thirteen years of age or older at the time of the study, were eligible to participate. These individuals were selected with the hope that they would have a stronger "competitive edge" and keep more accurate food records than the younger swimmers.

After obtaining permission to conduct the study from the C.A.S.A.--Manitoba Section, names and telephone numbers of all eligible swimmers and their coaches were obtained. Coaches were contacted individually, by telephone, to arrange suitable dates to conduct the study. Each eligible swimmer was contacted in a similar manner, informed of the objectives of the study and the obligations of participants, and asked if he/she would like to participate. If there was a positive response, the swimmer was told that a reward of $3.00 would be given to each person who completed a three-day food record and questionnaire. Of the 120 eligible swimmers, 101 comprised the final sample.

B. Research Instruments

1. The Questionnaire

A group--administered questionnaire was used to assess nutrition

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[1]To be classified as an A or AA swimmer, a competitor must have met the time standard in two events of 100 yards/meters or over and in one event of 50 yards/meters or over.

knowledge, attitudes and practices (Appendix B). Nutrition knowledge was assessed in Part A of the questionnaire which consisted of twenty-two multiple-choice questions. Each question was followed by six possible responses indicative of knowledge, a fad belief, neither knowledge nor a fad belief (three responses), and a "don't know" response to minimize guessing.

A nutrition knowledge score for each athlete was determined by the number of correct responses obtained on the knowledge test. Respondents were considered to have low, medium or a high nutrition knowledge if their scores were between zero and eight, nine and twelve, or thirteen and twenty-two, respectively. The same procedure was used to determine the fad score. In this case, scores between zero and one, two and three, or four and seven represented a low, medium or high fad score, respectively.

Nutrition attitudes were assessed in Part B of the questionnaire using the Likert scale (Edwards, 1957). Responses were arranged on a five point continumm ranging from "Strongly Agree" to "Strongly Disagree."

Nutrition practices were evaluated in Part C of the questionnaire by means of written responses to six open-ended questions. Information was requested on foods eaten and avoided during training and before a major competition, supplements taken during these periods and the respondents' main source of nutrition information.

The questionnaire was reviewed at various intervals by members of the Department of Foods and Nutrition and by the author's committee to reach a consensus on the choice of questions which would best measure the knowledge, attitudes and practices of the sample; the wording

of questions, and the organization of the questionnaire. Following the pretest of the questionnaire on syncronized swimmers from the YMCA in Winnipeg, final revisions were made in the test instrument by the author and her committee.

2. Food Record

Dietary practices were assessed by means of a three-day food record (Appendix C). Numerous studies have researched the validity and reliability of various procedures for collecting dietary data (Huenemann and Turner, 1942; Darby, 1947; Young et al., 1952; Eppright et al., 1952; Trulson, 1955). Trulson and McCann (1959) have come to the conclusion that no one technique for collecting food intake records gives a completely reliable picture of an individual's food habits. The method chosen should depend on the researcher's objectives and hypothesis, characteristics of the sample, number of subjects and limitations of time, personnel and funds (Young et al., 1960; Beal, 1967). Bearing this in mind, as well as the research supporting the use of three or seven-day food records as the preferred technique for collecting dietary information from individuals (Tinsely, 1947; Young et al., 1952; Chalmers et al., 1952; Trulson and McCann, 1959), the three-day food record was chosen for this study.

The next question to be considered was which days ought to be used for data collection. Days generally accepted for a three-day food record are Monday, Tuesday and Wednesday (Chalmers et al., 1952). Since several authors have reported studies of adolescents where weekend diets differed significantly from those during the week (Leverton and Marsh,

1939; Gray and Blackman, 1947; Eppright et al., 1952; Chalmers et al., 1952), it has become customary to include one atypical day and two typical days when recording food intake (Young and Trulson, 1960; Head, 1974).

The days chosen for this study, Thursday, Friday and Sunday, October 21, 22 and 24 respectively, were selected to suit the time schedules of the swimmers and coaches. Furthermore, since the swimmers did not have a scheduled swimming practice on Sunday, this was considered an atypical day.

C. Data Collection

1. Selection and Instruction of Nutritionists

Eight nutritionists, five of whom were enrolled in a dietetic internship program , were selected to assist in the data collection. Prior to data collection, the nutritionists met with the author and received instruction on the procedure for data collection and were given a food model kit[1] to show average servings of certain foods.

2. Data Collection

The procedure for data collection is outlined in Appendix D. Several departures from this procedure were unavoidable due to the different training times of the various clubs. For example, two of the clubs were briefed at 6:15 P.M. on Wednesday, October 20, rather than at 6:00 A.M. on Thursday, October 21. Furthermore, since one club

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[1]Each food model kit contained serving dishes and foods, including a dinner plate, cereal bowl, 2 glasses--4 oz. and 8 oz., set of measuring spoons, 3 oz. cooked hamburger patty, 3 oz. sliced cooked beef, 4 oz. diced raw carrots, 4 oz. canned green peas and 1 oz. ready-to-eat cereal.

cancelled Saturday morning practice, the Friday records were collected on Monday, October 25. In addition, one club completed the questionnaire before the evening practice on Monday, October 25 rather than during the morning practice.

Following the data collection, each participant who submitted a three-day food record and questionnaire received a $3.00 token. This was distributed in person, by the author, on Tuesday, Wednesday and Thursday, October 26, 27 and 28, respectively. At that time the author also thanked the swimmers and coaches for their cooperation and support throughout the study.

D. Analysis of Data

Foods consumed by each participant during the three-day period were coded numerically using the food codes described in the United States Department of Agriculture Handbook No. 8 (Watt and Merrill, 1963), food codes developed by Nutrition Canada for items not listed in Handbook No. 8 and codes for other specific foods not listed in either of the above sources. After the quantity of each food consumed was converted from household units to grams, the food codes and gram portions of food consumed were transferred to 80 column data sheets and keypunched using Fortran computer analysis to determine the nutrients and kilocalories consumed by each athlete.

The adequacy of each athlete's food intake was assessed by comparing the three-day mean intake of nutrients and kilocalories to the recommended intake for that age and sex group in the Canadian Dietary Standard (1975).

Individual responses to each question in Part A and B of the questionnaire and the "yes," "sometimes," and "no" response for each question in Part C, were coded to determine frequency distributions. For future analysis, the "agree" and "strongly agree" response for each attitude statement were combined, as were the "disagree" and "strongly disagree" responses for each attitude statement. In order to determine the relationships among knowledge, attitudes, and practices, chi-square analysis was performed on the data by computer. All analysis were performed at a 5 percent level of significance. The responses to the open-ended questions in Part C of the questionnaire were assigned to categories and tabulated by the author.

ASSESSMENT OF NUTRITION KNOWLEDGE AND FAD SCORES

A. Nutrition Knowledge Score

The distribution of scores on the nutrition knowledge test according to the age and sex of respondents is shown in Table I. In order to examine the influence of age and sex on knowledge, knowledge scores were cross tabulated with age of the respondents (Table I, Appendix E) and also with sex of the respondents (Table II, Appendix E). Since chi-square analysis indicated that nutrition knowledge score was not related to either age or sex of the respondents, the following results and discussion are based on the total sample.

Of 101 respondents, 24.8 percent were classed as having "high" knowledge, 48.5 percent "medium" knowledge and 26.7 percent "low" knowledge (Table I). This observation, together with the low mean knowledge score (10.64 out of 22) suggests a lack of nutrition knowledge among the respondents. Cho and Fryer (1974a) also found a low mean nutrition knowledge score (40%) after administering a true--false questionnaire to 138 physical education majors at Kansas State University. Low nutrition knowledge scores also have been observed among high school students (Dwyer et al., 1970; Thompson and Schwartz, 1975), homemakers (Young et al., 1956; Eppright et al., 1970; Emmons and Hayes, 1973) and other groups (Petersen and Kies, 1972; McCarthy and Sabry, 1973).

B. Fad Score

The distribution of fad scores by age and sex of the respondents is found in Table II. Because fads were not prevalent among respondents, chi square analysis was not applied.

TABLE I

DISTRIBUTION OF NUTRITION KNOWLEDGE SCORES BY AGE AND SEX OF THE RESPONDENTS

Age (years) and Sex of Respondents	NUTRITION KNOWLEDGE SCORE			
	Low[1]	Medium[2]	High[3]	Total
	% of Respondents[4]			
13-15 Male	7.8	9.7	4.0	21.5
Female	12.9	20.8	11.8	45.5
16-18 Male	4.0	6.0	1.0	11.0
Female	1.0	10.0	5.0	16.0
19 and Over Male	1.0	2.0	2.0	5.0
Female	0.0	0.0	1.0	1.0
TOTAL	26.7	48.5	24.8	100.0

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

[4] Since n=101, the number and percent of respondents is similar. Thus, only percent of respondents in indicated.

Of the 101 athletes, 23.8 percent were classed as having "low" fad scores, 56.4 percent "medium" fad scores and 19.8 percent "high" fad scores. This observation, together with the low mean fad score (2.60 out of 22), suggests that the fads designated by the author were not prevalent among the sample.

TABLE II

DISTRIBUTION OF FAD SCORES BY AGE AND SEX OF THE RESPONDENTS

Age (years) and Sex of Respondents	FAD SCORE Low[1]	Medium[2]	High[3]	Total
	% of Respondents[4]			
13-15 Male	5.0	9.8	6.9	21.7
Female	11.8	23.8	9.9	45.5
16-18 Male	1.0	8.9	1.0	10.9
Female	4.0	9.9	2.0	15.9
19 and Over Male	2.0	3.0	0.0	5.0
Female	0.0	1.0	0.0	1.0
TOTAL	23.8	56.4	19.8	100.0

[1]0-1 fad responses

[2]2-3 fad responses

[3]4-7 fad responses

[4]Since n=101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

The distribution of responses to nutrition knowledge questions on energy-yielding nutrients is found in Tables III, IV and V. The questions on carbohydrate were answered better than those on protein and fat. It is interesting that 82.1 percent of the sample knew the function of carbohydrate and 85.1 percent knew the best source (Table III). In addition, although the literature suggests that carbohydrate loading is a common practice among athletes (Anonymous, 1975; Smith, 1976), this study showed that only 10.9 percent of the sample thought that carbohydrate consumed before competition gives added energy.

TABLE III

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO FUNCTION AND SOURCE OF CARBOHYDRATE

		Percent of Respondents[1]
	Carbohydrates are important in the body because	
	a. they increase resistance to colds	1.0
	b. they help in healing wounds	1.0
	c. they bring oxygen to the lungs	1.0
K[2]	d. they provide a source of energy	82.1
F[3]	e. they give extra energy when taken immediately before a swimming event	10.9
	f. don't know	4.0
	Total	100.0
	Which of the following foods is the best source of carbohydrate?	
	a. celery	1.0
F	b. orange	4.0
	c. ground beef	1.0
	d. cheddar cheese	5.9
K	e. macaroni	85.1
	f. don't know	3.0
	Total	100.0

[1]Since n = 101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

[2]Knowledge

[3]Fad

Furthermore, it has been reported that some athletes eat oranges as a quick source of carbohydrate (Nelson, 1961); however, only 4.0 percent of this sample thought oranges were an important carbohydrate source.

The questions on fat were answered poorly (Table IV). It is surprising that only 10.9 percent of the sample knew that fat slows digestion, since digestion time is an important factor in scheduling the pre-event meal (Anonymous, 1971; Darden, 1972; Smith, 1976). The large number of "don't know" responses to this question (48.4%) may suggest either a lack of knowledge or a too difficult question.

Two misconceptions about fat were prevalent in the sample. Restricting fat intake during training, a fad belief of many athletes (Anonymous, 1971; Darden, 1972), was indicated by 23.8 percent of the sample. In addition, the fallacy that butter and margarine have a different calorie content was observed in 70.3 percent of the sample. This fallacy is not peculiar to athletes, but is also a common misconception of the general public (Anonymous, 1974a).

The athletes in this study have few of the common fallacies about protein, nevertheless, they still lack knowledge on specific aspects of this nutrient. For example, Table V shows that only 3.0 percent of the sample thought that protein provided extra muscle strength when taken in large amounts; however, nearly as many respondents thought protein was the main source of muscular energy as knew the correct function (35.6% and 37.7% respectively).

It is reassuring that 89.1 percent of the respondents knew

TABLE IV

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO FUNCTION AND SOURCE OF FAT

		Percent of Respondents[1]
	Which of the following statements is true?	
F[3]	a. fatty foods should be restricted during a swimmer's training	23.8
K[2]	b. fat in our diet slows the breakdown of food in the body	10.9
	c. fat is used to build red blood cells	4.0
	d. fat is our diet helps to keep water balance in the body	2.0
	e. fat in our diet affects how minerals are used in the body	10.9
	f. don't know	48.4
	Total	100.0
	Which one of the following statements is true?	
K	a. butter and margarine are similar in calorie content	15.8
	b. butter contains iron	1.0
	c. margarine contains vitamin C	1.0
	d. margarine contains iron	0.0
F	e. butter and margarine have a different calorie content	70.3
	f. don't know	11.9
	Total	100.0

[1]Since n = 101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

[2]Knowledge

[3]Fad

TABLE V

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO FUNCTION AND SOURCE OF PROTEIN

		Percent of Respondents[1]
	Protein is important in the body because	
	a. it is the main source of muscular energy	35.6
K[2]	b. it is a major part of all body tissue	37.7
	c. it is a regulator of body processes	6.9
	d. it prevents rickets	1.0
F[3]	e. it gives extra muscle strength when taken in large amounts	3.0
	f. don't know	15.8
	Total	100.0
	Experts say that one way to increase the total amount of muscle is to	
	a. eat more wheat germ	0.0
K	b. exercise more	89.1
F	c. eat more beef	1.0
	d. eat more honey	0.0
	e. eat more beef and vitamin supplements	5.9
	f. don't know	4.0
	Total	100.0
	A swimmer obtains the highest quality protein from	
	a. eggs	21.8
F	b. steak	15.8
	c. cheese	6.9
	d. wieners	0.0
K	e. all of the above	48.6
	f. don't know	6.9
	Total	100.0

[1]Since n = 101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

[2]Knowledge

[3]Fad

that exercise is the best way to increase muscle mass and that only 1.0 percent of the respondents thought that eating more beef would have a similar effect. The latter is a common belief of athletes (Anonymous, 1971; Nelson and Gastineau, 1974; Smith, 1976). In addition, about half the sample knew the best source of protein, while the fallacy regarding steak (Anonymous, 1971; Smith, 1976) was indicated by only 15.8 percent. It is interesting to note that 21.8 percent thought eggs provided the highest quality protein when the literature seems to suggest that athletes generally believe that beef is the better source.

In regard to weight control, a higher percent of the respondents knew the cause of weight gain than the correct methods of weight loss (Table VI). For instance, 93.0 percent of the respondents knew that an excessive calorie intake causes weight gain, whereas only 17.8 percent knew that the best method of weight reduction is decreased intake of all foods.

It is no surprise that 78.2 percent considered a decreased intake of carbohydrate foods as the best way to lose weight since this fallacy is common among the general public (Anonymous, 1974b). However, the unwise use of sauna baths for weight reduction by some athletes, especially wrestlers and boxers (Anonymous, 1971; Smith, 1976), was not considered important by swimmers in this study (Table VI).

Regarding vitamin supplements, 67.3 percent of the respondents thought that vitamin supplements should be included in a well-balanced diet (Table VII). Although this fallacy was prevalent, the

TABLE VI

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO WEIGHT CONTROL

		Percent of Respondents[1]
	Eating more calories than what is used in activity	
K[2]	a. results in weight gain	93.0
F[3]	b. is not a problem if you eat less carbohydrate	2.0
	c. results in weight loss	0.0
	d. causes increased water loss	1.0
	e. causes no weight change since calories are not related to weight	2.0
	f. don't know	2.0
	Total	100.0
	The best way for a swimmer to lose weight is to	
	a. eliminate fruits from the diet	0.0
F	b. take several sauna baths	1.0
K	c. eat less of all foods	17.8
	d. eliminate vegetables from the diet	0.0
	e. eat less bread and other carbohydrate foods	78.2
	f. don't know	3.0
	Total	100.0

[1]Since n = 101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

[2]Knowledge

[3]Fad

TABLE VII

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO FUNCTION AND SOURCE OF VITAMINS

		Percent of Respondents[1]
	Of the following, which would you include in a well balanced diet?	
	a. vegetables, bread, milk, meat (or other protein food)	0.0
F[3]	b. fruits, vegetables, bread, milk, meat (or other protein food), vitamin supplements	67.3
	c. fruits, milk, meat (or other protein food)	1.0
K[2]	d. fruits, vegetables, bread, milk, meat (or other protein food)	26.7
	e. fruits, vegetables, bread, meat (or other protein food)	4.0
	f. don't know	1.0
	Total	100.0
	Which of the following statements is true?	
F	a. vitamin A should be taken in large amounts by all swimmers	0.0
	b. vitamin A prevents scurvy	5.9
	c. vitamin A is needed in our diet to build strong bones and teeth	22.8
	d. vitamin A helps prevent the common cold	5.9
K	e. vitamin A affects how quickly our eyes adjust to changes in light	48.6
	f. don't know	16.8
	Total	100.0
	Nutritionists have discovered that B vitamins	
	a. affect iron loss from the body	2.0
	b. increase our number of red blood cells	11.9
F	c. improve muscular efficiency when taken in large amounts	5.0
K	d. are needed for producing energy in the body	13.8
	e. affect calcium use in the body	2.0
	f. don't know	65.3
	Total	100.0

TABLE VII (continued)

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO FUNCTION AND SOURCE OF VITAMINS

		Percent of Respondents[1]
	Nutritionists tell us that vitamin C	
	a. helps us see at night	2.0
F	b. taken in large amounts helps prevent severe injury in athletics	8.9
	c. is stored in large quantities in our liver	9.9
K	d. is used to make collagen, needed to cement cells together	7.9
	e. affects calcium use in the body	12.9
	f. don't know	58.4
	Total	100.0
	Which one of the following statements is true?	
F	a. vitamin E increases endurance when taken in large amounts	13.9
	b. vitamin E affects water absorption and retention	4.0
K	c. vitamin E needs are met by eating a well balanced diet	9.9
	d. vitamin E is absorbed in our body as a protein	9.8
	e. vitamin E is used to make collagen, needed to cement cells together	5.0
	f. don't know	57.4
	Total	100.0
	Which one of the following foods is the best source of vitamin A?	
	a. spinach	15.8
	b. tangerine	1.0
K	c. carrot	61.4
	d. tomato	1.0
F	e. sunflower seeds	0.0
	f. don't know	20.8
	Total	100.0

TABLE VII (continued)

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO FUNCTION AND SOURCE OF VITAMINS

		Percent of Respondents[1]
	Which one of the following sources of vitamin C is best for body functions?	
F	a. rose hips	4.0
	b. strawberries	0.0
	c. grapefruit	4.0
	d. orange	56.3
K	e. all of the above are equally useful	32.7
	f. don't know	3.0
	Total	100.0

[1]Since n = 101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

[2]Knowledge

[3]Fad

misconceptions that specific vitamin supplements (A, B, C or E) benefit performance (Gey et al., 1970; Darden, 1972; Nelson and Gastineau, 1974; Smith, 1976) were indicated by less than 15 percent of the sample. Although almost half the sample knew the correct function of vitamin A, the large number of "don't know" responses to the questions on the function of vitamins C, E and B may suggest that either the sample lacked knowledge or the questions were too difficult.

As for sources of vitamins, 61.4 percent of the sample knew carrots were the best source of vitamin A, whereas no one thought sunflower seeds were the best source, although this is a common fallacy

(Anonymous, 1970). Only 32.7 percent knew that the correct response to the question on the best source of vitamin C was the statement "all of the above are equally useful." It is interesting that only 4.0 percent thought that rosehips were the best source of vitamin C. This would suggest that this misconception, held by faddists (Anonymous, 1970), is not prevalent among these respondents.

Responses to questions relating to minerals are found in Table VIII. Although some faddists think that calcium in sunflower seeds is better than that found in cheese (Anonymous, 1970), only 2.0 percent of the sample indicated this response. The large number of "don't know" responses (59.4%) to this question suggests that the question may have been too difficult or that the respondents lacked knowledge. Table VIII also shows that the fallacy that milk cuts a swimmer's wind (Nelson, 1961; Anonymous, 1971) is not prevalent among the sample. Most respondents (88.0%) knew that milk provided the body with calcium.

The two questions on the function and source of iron were answered correctly by over three-quarters of the sample. The fallacies that iron supplements increase endurance (Weswig and Winkler, 1974), and that blackstrap molasses contains more iron than beef liver (Anonymous, 1970),were not prevalent among the sample.

Although maintainence of water and electrolyte balance is essential for optimum performance (Anonymous, 1971; Anonymous, 1974c; Anonymous, 1975; Smith, 1976), questions relating to these topics were answered poorly (Table IX). Less than half of the sample (47.5%)

TABLE VIII

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO FUNCTION AND SOURCE OF MINERALS

		Percent of Respondents[1]
	Which one of the following statements is true?	
F[3]	a. calcium in sunflower seeds is better for us than calcium in cheese	2.0
	b. calcium strengthens the heart muscle	7.9
	c. calcium in our diet slows the break-down of food in the body	5.9
K[2]	d. calcium helps muscles in the body to contract	20.8
	e. calcium is needed to produce energy in the body	4.0
	f. don't know	59.4
	Total	100.0
	Nutritionists tell us that drinking milk	
	a. provides a source of iron for the body	2.0
	b. affects how the blood carries oxygen	2.0
	c. will protect us against scurvy	0.0
F	d. before a competition cuts a swimmer's wind	3.0
K	e. provides the best source of calcium for the body	88.0
	f. don't know	5.0
	Total	100.0
	Iron is important in the body because	
K	a. it helps build the blood	79.2
	b. it prevents rickets	5.0
	c. it is needed for healthy skin	1.0
F	d. it increases endurance when taken in large amounts	8.9
	e. it prevents scurvy	0.0
	f. don't know	5.9
	Total	100.0

TABLE VIII (continued)

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO FUNCTION AND SOURCE OF MINERALS

		Percent of Respondents[1]
	Which one of the following food contain the most iron?	
	a. banana	0.0
F	b. blackstrap molasses	0.0
	c. whole milk	4.0
K	d. beef liver	86.1
	e. whole grain bread	0.0
	f. don't know	9.9
	Total	100.0

[1]Since n = 101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

[2]Knowledge

[3]Fad

TABLE IX

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO WATER BALANCE IN THE BODY

		Percent of Respondents[1]
	Which one of the following statements is true?	
K[2]	a. water is needed to regulate body temperature	47.5
	b. water supplies B vitamins for the diet	2.0
	c. water affects how iron is used in the body	5.9
	d. water is a source of energy	3.0
F[3]	e. water does not need to be replaced with heavy sweating	6.9
	f. don't know	34.7
	Total	100.0
	Which one of the following statements is true?	
K	a. salt lost in sweat during exercise must be replaced	61.4
F	b. a natural source of salt (such as bio-salt) is better than ordinary table salt	8.8
	c. salt in our diet helps to make us strong	5.0
	d. salt affects how much vitamin A is stored in the body	2.0
	e. table salt helps us meet our daily needs for vitamin C	1.0
	f. don't know	21.8
	Total	100.0

[1]Since n = 101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

[2]Knowledge

[3]Fad

knew that a function of water in the body is to regulate body temperature and 34.7 percent indicated they did not know the correct response. Furthermore, although 61.4 percent of the respondents knew that salt lost in sweat during exercise must be replaced, 21.8 percent indicated they did not know. In addition, only 8.8 percent thought that a natural source of salt is better than ordinary table salt, contrary to the belief of faddists (Anonymous, 1970).

Results of this study suggest that the swimmers in this sample lack nutrition knowledge. The questions relating to the function and source of carbohydrate were answered better than those on protein and fat. Furthermore, most respondents knew the correct function and source of iron, and the best source of calcium, but few respondents knew the function of calcium, water or salt in the body. In addition, questions relating to the function and source of vitamins were answered poorly. More respondents knew how weight is gained than knew the best method of weight reduction.

It is interesting to note the low fad scores of the sample. This suggests that the respondents did not have the specific fads identified by the author; however, it does not necessarily mean that other fads are not prevalent. For example, in the question relating to weight loss, over three-quarters of the respondents thought that the best method of weight reduction was eating fewer carbohydrate foods, while only 1.0 percent chose sauna baths which was indicated as the fad in the questionnaire. Similarly, over one-third of the sample thought protein was the main source of muscular energy, whereas only 3.0 percent indicated the fad that protein increases muscle strength.

if taken in large amounts.

ASSESSMENT OF NUTRITION ATTITUDES

In order to examine the influence of age on nutrition attitudes, responses to each attitude statement were cross tabulated with the age of the respondents. Similar tables were constructed to determine the influence of sex on nutrition attitudes. Since chi-square analysis indicated that nutrition attitudes were not related to either age or sex of the respondents, the following results and discussion are based on the total sample.

The distribution of responses to nutrition statements on energy-yielding nutrients is found in Table X. Most respondents (63.4%) agreed that honey was a better source of quick energy than table sugar; while 34.6 percent felt that eating a candy bar before an event provided extra energy. The misconception that honey and candy bars are quick energy sources is common among athletes (Nelson, 1961; Anonymous, 1971; Darden, 1972).

Almost as many respondents agreed as were uncertain about the benefits of carbohydrate loading[1] (42.6% vs. 35.6%). This division of responses may be explained by the fact that although carbohydrate loading is practiced frequently by athletes (Anonymous, 1975; Smith, 1976), it has no benefit in short term events (Van Itallie et al., 1956; Anonymous, 1975; Serfass, 1977).

Another common misconception of athletes is that an increased intake of protein provides extra strength (Nelson and Gastineau, 1974;

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[1]Depletion of carbohydrate stores followed by several days of carbohydrate deprivation and then several days of high carbohydrate intake.

TABLE X

DISTRIBUTION OF RESPONSES TO NUTRITION ATTITUDE STATEMENTS RELATING TO ENERGY-YIELDING NUTRIENTS

Attitude Statement	RESPONSE TO ATTITUDE STATEMENT Agree	Uncertain	Disagree
	Percent of Respondents		
CARBOHYDRATE			
I feel honey is a better source of quick energy than table sugar.	63.4	28.7	7.9
I sometimes eat a candy bar immediately before a competition to give me extra energy.	34.6	8.9	56.4
I believe the higher the carbohydrate content of my diet before a major event, the better my performance.	42.6	35.6	21.8
PROTEIN			
I feel I get extra strength from eating a steak a few hours before a competition.	20.8	16.8	62.4
I believe a swimmer should take protein supplements to improve performance.	47.5	16.8	35.7
FAT			
I like to restrict my intake of fatty foods when I am in training.	45.5	22.8	31.7

Anonymous, 1975; Smith, 1976); however, in this study, only 20.8 percent of the respondents felt that they got extra strength from eating a steak before an event. Nevertheless, almost half of the sample agreed that protein supplements improved a swimmer's performance.

The misconception that fatty foods should be restricted during training (Anonymous, 1971) seems to be evident in this sample. Almost half of the respondents (45.5 %) had this attitude.

In regard to weight reduction, the swimmers had better attitudes toward a safe rate of weight loss than toward safe methods to achieve the loss (Table XI). Although 68.3 percent of the respondents felt that a rapid weight loss was not safe, only slightly more agreed (53.3%) than agreed (42.6%) that the best way to lose weight is to decrease intake of all foods. Although some athletes lose weight by water restriction (Anonymous, 1971; Smith, 1976), it is hoped that those swimmers do not use this technique, since only 33.6 percent of the sample disagreed that the body can adjust to taking in decreased amounts of water and 54.5 percent were uncertain. Maintaining water balance is essential for optimum performance (Anonymous, 1974c; Anonymous, 1975).

Attitudes toward the use of vitamin supplements were varied (Table XII). Although about half of the sample (54.4%) thought that a well-balanced diet, without supplements, was adequate for top performance, 66.3 percent agreed with the statement "I take vitamin supplements just in case I do not get all the nutrients I need from my meals." Perhaps these individuals do not feel they are consuming a balanced diet. Similar attitudes toward vitamin supplements were

TABLE XI

DISTRIBUTION OF RESPONSES TO NUTRITION ATTITUDE STATEMENTS RELATING TO WEIGHT LOSS

Attitude Statement	RESPONSE TO ATTITUDE STATEMENT Agree	Uncertain	Disagree
	Percent of Respondents		
If I wanted to lose weight, a loss of six pounds per week is a safe loss.	8.9	22.8	68.3
I believe the best way to lose weight is to decrease intake of all foods.	42.6	4.0	53.5
I believe a swimmer's body can adjust to taking in less water than is lost in sweat each day.	11.9	54.5	33.6

TABLE XII

DISTRIBUTION OF RESPONSES TO NUTRITION ATTITUDE STATEMENTS RELATING TO VITAMINS

Attitude Statement	RESPONSE TO ATTITUDE STATEMENT Agree	Uncertain	Disagree
	Percent of Respondents		
I feel a well-balanced diet, without additional supplements, is a good diet for top performance.	54.4	17.8	27.8
I take vitamin supplements just in case I do not get all the nutrients I need from my meals.	66.3	5.9	27.8
Everyone should take vitamin supplements.	49.5	16.8	33.7
I sometimes take vitamin C supplements to improve performance.	40.6	10.9	48.5
I sometimes take vitamin E supplements to improve my performance.	21.8	21.8	56.4
I sometimes take vitamin B supplements for added energy.	18.8	30.7	50.5

noted in a study of the American adult population (Anonymous, 1972), where over one-quarter of the population indicated they were uncertain whether eating a variety of foods would supply all the necessary vitamins and minerals needed in the diet. Furthermore, the attitude that the diet may be deficient in some nutrients may explain why 49.5 percent of the swimmers in this study felt everyone should take vitamin supplements.

In regard to attitudes toward specific vitamins, about half of the athletes disagreed with taking vitamin C, E or B supplements for improved performance. This finding is contrary to the literature which suggests that many athletes consume supplements to aid performance (Gey et al., 1970; Darden, 1972; Nelson and Gastineau, 1974; Smith, 1976).

It is interesting to note that the percentage who agreed that vitamin C improved performance was greater than the percentage who agreed that vitamins E and B had similar effects (40.6% vs. 21.8% and 18.8% respectively). This may reflect greater awareness of the possible effects of increased doses of vitamin C due to the publicity surrounding this controversial vitamin (Pauling, 1970). On the other hand, since less publicity has been given to vitamins E (Shute and Taub, 1972) and B, this may explain the larger number of uncertain responses to the statements regarding the effect of these vitamins on performance.

Looking at minerals (Table XIII), the swimmers were quite definite in their attitude toward consumption of salt tablets since 77.3 percent felt that too many could be hazardous. This is reassuring since research suggests that there is no need to consume more salt than

that lost in sweat (Anonymous, 1971; Smith, 1976). In contrast, responses to the statement "everyone should take iron supplements" were split about evenly between those who agreed and disagreed (33.6% and 40.6% respectively). Perhaps some respondents agreed to the statement since iron requirements may not be met if careful consideration is not given to the choice of foods in the diet. By comparison, others may have disagreed to the statement, since meeting iron needs is possible if the diet is carefully chosen.

Two attitudes toward diet modification before a competition were investigated (Table XIV). Although the literature suggests that many athletes restrict milk unnecessarily before a competition (Anonymous, 1971; Darden, 1972), 51.5 percent of the sample felt that drinking milk before a competition did not hinder performance, although 33.7 percent were uncertain. It is reassuring to note that 84.2 percent of respondents felt that a well-balanced diet is necessary at all times, not only before competitions.

Attitudes toward organic foods and food additives are shown in Table XV. About half of the respondents were uncertain of their attitudes to each of these statements. This may suggest that these attitudes were not strongly held by the sample in comparison with the general public (Jalso et al., 1965; Anonymous, 1972).

To summarize, the respondents seemed to feel that a well-balanced diet is important but that it should be complemented by vitamin supplements, not necessarily to improve performance per se, but to ensure that the diet is adequate in nutrients. Furthermore,

TABLE XIII

DISTRIBUTION OF RESPONSES TO NUTRITION ATTITUDE STATEMENTS RELATING TO MINERALS

Attitude Statement	RESPONSE TO ATTITUDE STATEMENT Agree	Uncertain	Disagree
	Percent of Respondents		
I believe a swimmer can take as many salt tablets as he/she wants without hazard.	1.0	21.8	77.3
Everyone should take iron supplements.	33.6	25.7	40.6

TABLE XIV

DISTRIBUTION OF RESPONSES TO NUTRITION ATTITUDE STATEMENTS RELATING TO DIETARY PRACTICES BEFORE COMPETITION

Attitude Statement	RESPONSE TO ATTITUDE STATEMENT Agree	Uncertain	Disagree
	Percent of Respondents		
Drinking milk the day of an event decreases my performance.	14.9	33.7	51.5
I believe a well-balanced diet is necessary only if there is an important meet coming soon.	11.9	4.0	84.2

TABLE XV

DISTRIBUTION OF RESPONSES TO NUTRITION ATTITUDE STATEMENTS RELATING TO ORGANIC FOODS AND FOOD ADDITIVES

Attitude Statement	RESPONSE TO ATTITUDE STATEMENT		
	Agree	Uncertain	Disagree
	Percent of Respondents		
I feel organic foods are better for you than foods bought in a grocery store.	25.7	49.5	24.8
Food additives are harmful.	24.7	53.5	21.8

many of the fad beliefs that are discussed in the literature were not prevalent in this sample. For instance, only about one-third of the respondents thought that a candy bar taken just before an event would provide extra energy, 20.8 percent equilibrated steak with strength and only 14.9 percent thought that drinking milk the day of an event would hinder performance. Nevertheless, poor nutrition attitudes were noted in many instances. Almost half of the respondents had the attitude that swimmers should take protein supplements to improve performance and that fatty foods should be restricted in training. Furthermore, nearly two-thirds of the sample thought that honey was a better source of quick energy than table sugar.

ASSESSMENT OF DIETARY PRACTICES

A. Dietary Practices During Training And Before Competition

The dietary intake of athletes in training is often different from their food habits before a competition (Anonymous, 1971; Smith, 1976). Pre-game tension and myths suggesting that "wonder foods" will spark performance are factors which may influence an athlete to alter his regular dietary intake.

In the present study, changes in dietary habits were noted during training and before a competition. As shown in Table XVI, only 7.9 percent of the respondents consumed special foods during training, in comparison with 44.6 percent of the respondents who consumed special foods before a major competition. Furthermore, only 14.9 percent avoided certain foods in the training period while 65.3 percent had this practice before a competition. It is also noteworthy that more respondents indicated they did not consume certain foods or avoid certain foods during training than before a competition.

Considering both the percent of respondents who avoided and those who sometimes avoided certain foods during training and before a competition (34.7% and 75.2%, respectively), and those who consumed and sometimes consumed certain foods during these two periods (15.8% and 67.4% respectively), more individuals modified their diet before a competition than during training. This conclusion concurs with results from a study by Cho and Fryer (1974b) who observed that most phyical education majors recommended that a well-balanced variety of foods be eaten in training.

Widespread use of vitamin supplements in athletics is well-documented (Anonymous, 1971; Nelson and Gastineau, 1974; Anonymous, 1975;

Smith, 1976) and was also found prevalent in this study. Table XVI shows that nearly two-thirds of the respondents (61.4%) took supplements during training while only 20.8 percent did not adopt this practice. Almost as many respondents took supplements before competition as did not (44.6% vs. 42.6% respectively).

More respondents took supplements during training than before a competition (61.4% vs. 44.6% respectively). Cho and Fryer (1974b) also found physical education majors recommended that supplement be taken more often during training than in the pre-game meal. Since most respondents in the present study believe it is more important to consume a well-balanced diet at all times, not just before a competition (see Table XIV), and that vitamin supplements should be taken in case the diet is lacking in some nutrients (see Table XII), perhaps this explains why more supplements are taken during training than before competition.

The number of times that a particular food category was avoided or consumed during training or before a competition is shown in Table XVII. These figures do not indicate numbers of individuals since one individual may have listed more than one food.

During training, there were no special foods consumed with any frequency. However, items in the high-calorie, low-nutrient food category, were often avoided during training, being mentioned twenty-five times. Of this number, chocolate bars were listed nine times and candy bars and french fries four times each. The avoidance of foods with a high fat content, such as chocolate bars and french fries, is likely related to the fat content which delays

TABLE XVI

PERCENT OF RESPONDENTS WHO EITHER AVOIDED OR CONSUMED CERTAIN FOODS, OR TOOK SUPPLEMENTS DURING TRAINING AND BEFORE A MAJOR COMPETITION

Response To Diet Practice Question	Consumed Special Foods		Avoided Certain Foods		Took Supplements	
	During Training	Before Competition	During Training	Before Competition	During Training	Before Competition
	Percent of Respondents					
Yes	7.9	44.6	14.9	65.3	61.4	44.6
Sometimes	7.9	22.8	19.8	9.9	17.8	12.9
No	84.2	32.7	65.3	24.8	20.8	42.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

TABLE XVII

NUMBER OF TIMES A FOOD CATEGORY WAS AVOIDED OR CONSUMED DURING TRAINING AND BEFORE A MAJOR COMPETITION

Food Category	During Training		Before A Major Competition	
	No. Times Consumed	No. Times Avoided	No. Times Consumed	No. Times Avoided
Milk and milk products	0	3	3	26
Beverages	2	5	5	7
Fruits and vegetables	3	7	2	4
Cereal, cereal products, carbohydrate foods	3	7	40	7
Meat, meat substitutes, protein foods	10	3	19	32
High-caloric, low-nutrient foods[1]	8	25	14	15
Miscellaneous[2]	10	10	24	41

[1]Chocolate bars, candy, french fries, junk food, popcorn, potato chips, donuts, cake, cookies, sugar.

[2]Fatty, heavy, bulky, greasy, fried, starch, spicy, and light foods, pizza, soup, sandwiches, dextrosol, sustagen, nutrament, vitamins A, C and E, energy pills.

the emptying time of the stomach. Although this should be considered in the pre-game meal, there is no justification for this practice during the entire training period (Anonymous, 1971).

Before a major competition there were three main categories of special foods that were eaten: 1) cereal, cereal products and carbohydrate foods; 2) meat, meat substitutes and protein foods; and 3) miscellaneous.

Cereal, cereal products and carbohydrate foods were the food items most frequently consumed before a competition, being mentioned forty times. Of this number, carbohydrate foods were mentioned twenty-one times and pasta and bread seven times each. Other responses included rice, cereal and pancakes. Preference for this food category may reflect carbohydrate loading, a practice common to athletes, but beneficial only in endurance sports (Anonymous, 1975; Smith, 1976; Serfass, 1977).

Meat, meat substitutes and protein foods also were consumed frequently before a competition, being mentioned nineteen times. This may reflect those respondents who had the misconception that protein is the main source of muscular energy (Table V).

A number of foods eaten before a major competition were classed as miscellaneous and were mentioned twenty-four times. Of this number, dextrosol (a high caloric supplement) was mentioned eight times while sustagen (a high protein nutritive supplement) was noted three times.

Milk and milk products were avoided frequently before a competition, being mentioned twenty-six times. Milk was indicated twenty-one times. Other respondents included cheese, ice cream and "milk products." It is difficult to explain why milk was avoided twenty-one times since the misconception that milk "cuts wind" (and therefore should be avoided in the pre-game meal) was not prevalent in either the knowledge or attitude tests (Table VIII and XIV respectively). Perhaps the respondents omit milk just in case performance is hindered.

Meat, meat substitutes and protein foods also were avoided before a competition, being mentioned thirty-two times. More specifically, protein was noted eleven times, meats seven times and steak six times. Other responses included beef, hamburger, pork, hotdogs, eggs and nuts. Perhaps the decreased intake of this food category and the increased consumption of carbohydrate foods before a competition suggest carbohydrate loading. The decreased intake of this food category may also be related to the recommendation to avoid urinary excretion during a competitive event (Anonymous, 1971). Protein, when used for energy production, yields end-products which are eliminated by urinary excretion.

Foods categorized as miscellaneous were the food items most frequently avoided before competition, being mentioned forty-one times. Of these, fatty and heavy foods were listed ten times each and pizza six times. Since fatty foods slow digestion time, it is justified that athletes consider the fat content of their pre-game meal (Anonymous,

1971; Smith, 1976). Cho and Fryer (1974b) also noted that fatty foods were mentioned most often as foods to avoid before an event. Furthermore, if heavy foods are considered synonymous with bulky foods, these foods may be restricted in the pre-event meal in order to minimize fecal bulk (Anonymous, 1971). The fact that pizza was avoided six times may be explained since pizza is a spicy, irritating food and, in addition, has a high protein content.

The number of times that supplements were taken during training and before a major competition is shown in Table XVIII. During training, vitamin C, iron, vitamin B complex, vitamin E and "vitamins" were listed sixty-five, twenty-nine, twenty-eight, twenty-six and fifteen times respectively, whereas before a major competition, vitamin C, vitamin E, iron, vitamin B complex and "vitamins" were listed forty-one, eighteen, eighteen, sixteen, and ten times, respectively. A variety of other supplements were indicated less frequently. It is interesting to note that the type of supplements consumed during training or before a competition is markedly similar; however, the frequency of intake varies.

TABLE XVIII

NUMBER OF TIMES SUPPLEMENTS WERE TAKEN DURING TRAINING AND BEFORE A MAJOR COMPETITION

Supplement	FREQUENCY	
	During training No. of times	Before a major competition No. of times
VITAMINS		
vitamins	15	10
vitamin A	6	6
vitamin B complex	28	16
vitamin C	65	41
vitamin E	26	18
vitamin D	1	0
multivitamins	6	5
other[1]	4	4
MINERALS		
minerals[2]	2	1
iron	29	18
VITAMIN AND MINERAL COMBINATIONS		
multivitamins with iron	4	2
mineral-vitamins	2	0
FOOD SUPPLEMENTS		
health foods[3]	3	2
fish liver oils	4	3
sugar[4]	0	3

[1]Beminal C Fortis-vitamins B and C

[2]Includes "minerals," calcium, salt

[3]Includes wheat germ, primary yeast, rosehips, desicated liver tablets

[4]Includes sugar, glucose, dextrosol

DIETARY PRACTICES

B. Dietary Practices Assessed Using a Three-Day Food Record

Distribution of the three-day mean daily intake of kilocalories and nine nutrients by age and sex of respondents is shown in Table XIX. Intakes were generally above the recommendations found in the Canadian Dietary Standard (1975); however, iron intakes were marginal in all females. Thiamine intakes were below the recommended levels for males and females nineteen and over, while riboflavin intakes were below the recommended level for only females nineteen and over. It should be noted that the nineteen and over age group consisted of only five males and one female.

A comparison of the three-day mean daily intake of respondents in this study, with the mean daily intake of a similar age and sex group in the Nutrition Canada Survey (1975) is shown in Table XX. Since a comparable category in the Nutrition Canada survey included only those twelve to nineteen years of age, the three respondents over nineteen years in the present study were not included in the comparison.

The mean nutrient intakes of those twelve to nineteen years of age in both the Nutrition Canada survey and the present study exceeded the recommended intake for all nutrients except iron, which was below the recommended intake for females in the Nutrition Canada study and marginal in the present study.

The caloric consumption of respondents in this study was greater than that of respondents in the Nutrition Canada survey. This is not surprising since the energy output of the Winnipeg swimmers

TABLE XIX

THREE-DAY MEAN DAILY INTAKE OF KILOCALORIES AND NINE NUTRIENTS BY AGE AND SEX OF RESPONDENTS COMPARED TO THE RECOMMENDED DAILY INTAKE IN THE C.D.S.[1]

Energy and Nutrients	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
Energy (kcal.)	3600.5 (2800)	2728.3 (2200)	4616.2 (3200)	2781.8 (2100)	3472.9 (3000)	2519.1 (2100)
Protein (g.)	140.1 (52)	101.3 (43)	196.8 (54)	95.9 (43)	130.6 (56)	76.3 (41)
Calcium (mg.)	2502.1 (1200)	1561.2 (800)	4026.1 (1000)	1379.3 (700)	1908.0 (800)	786.5 (700)
Phosphorus (mg.)	2116.9 (1200)	1523.8 (800)	2620.6 (1000)	1365.3 (700)	1707.3 (800)	1236.3 (700)
Iron (mg.)	18.3 (13)	14.2 (14)	20.6 (14)	14.1 (14)	15.9 (10)	13.9 (14)
Vitamin A (RE)	1179.9 (1000)	958.4 (800)	1226.0 (1000)	1069.9 (800)	986.0 (1000)	1547.9 (800)
Thiamine[2] (mg.)	2.0 (1.8)	1.5 (1.4)	2.6 (2.3)	1.5 (1.4)	1.6 (1.7)	1.2 (1.3)
Riboflavin[2] (mg.)	4.7 (2.2)	3.0 (1.6)	6.6 (2.8)	2.7 (1.7)	3.3 (2.1)	1.4 (1.5)
Niacin[2] (mg.)	33.3 (23.8)	24.3 (18.0)	41.0 (30.5)	23.5 (18.4)	25.6 (22.9)	23.0 (16.6)
Vitamin C (mg.)	179.2 (30)	154.7 (30)	210.1 (30)	147.1 (30)	127.5 (30)	191.8 (30)

[1] Canadian Dietary Standard recommendations are in brackets.

[2] The recommended intake was adjusted according to the 3 day mean caloric intake: Thiamine (0.5 mg/1000 kcal)
Riboflavin (0.6 mg/1000 kcal)
Niacin (6.6 mg/1000 kcal)

TABLE XX

COMPARISON OF THE THREE DAY MEAN DAILY INTAKE OF WINNIPEG SWIMMERS (13-19 YEARS OF AGE) WITH THE MEAN DAILY INTAKE OF A SIMILAR AGE AND SEX GROUP IN THE NUTRITION CANADA SURVEY

Energy and Nutrients	Males		Females	
	Winnipeg Study	Nutrition Canada Survey	Winnipeg Study	Nutrition Canada Survey
Energy (kcal.)	3944.6	3251	2742.1	2243
Protein (g.)	158.0	111	100.0	76
Calcium (mg.)	2947.1	1337	1514.2	967
Iron (mg.)	19.1	17	14.1	11
Vitamin A (RE)	1204.0	1455	987.1	1036
Thiamine (mg.)	2.1	1.7	1.4	1.1
Riboflavin (mg.)	5.2	3.0	2.9	1.9
Niacin (mg.)	35.3	43	24.1	27
Vitamin C (mg.)	190.0	101	152.7	92

would likely be greater. Furthermore, the increased caloric consumption of the swimmers is no doubt responsible for the generally higher nutrient intakes of the swimmers than of the adolescents in the Nutrition Canada study.

It is difficult to explain why respondents in the present study had intakes of vitamin A and niacin similar to those of respondents in the Nutrition Canada survey (when kilocalories and some nutrients were consumed in much greater quantities). This may be a result of the different procedures used to calculate intakes of vitamin A and niacin. In the present study, mean values of vitamin A in International Units (I.U.), were converted to retinol equivalents (RE) using a proportion of B-carotene and performed vitamin A discussed in the Canadian Dietary Standard (1975), whereas in the Nutrition Canada survey, the vitamin A content of individual foods was calculated using the proportions outlined in the Canadian Dietary Standard (1975). Furthermore, in the Nutrition Canada survey, niacin values in milligrams were replaced with niacin equivalents (NE), (1 NE = 60 mg tryptophan or 1 mg of niacin), whereas in the present study, one niacin equivalent was considered equal to one milligram of niacin. Tryptophan values were not taken into account.

The percentage of respondents by age and sex who met or did not meet the recommended intakes for kilocalories and nine nutrients when compared to the Canadian Dietary Standard (1975) is shown in (Table XXI). In addition, tables showing the distribution of intakes of kilocalories and nine nutrients are found in Tables 1-10, Appendix F.

TABLE XXI

PERCENTAGE OF RESPONDENTS BY AGE AND SEX WHO MET OR DID NOT MEET THE C.D.S.[1] FOR KILOCALORIES AND NINE NUTRIENTS

Energy And Nutrients	AGE(YEARS) AND SEX OF RESPONDENTS											
	13-15				16-18				19 and Over			
	Male(N=22)		Female(N=46)		Male(N=11)		Female(N=16)		Male(N=5)		Female(N=1)	
	Met	Did Not Meet	Met	Did Not Meet	Met	Did Not Meet	Met	Did Not Meet	Met	Did Not Meet	Met	Did Not Meet
Energy (Kcal)	63.6	36.4	71.7	28.3	100.0	0.0	87.5	12.5	60.0	40.0	100.0	0.0
Protein (g)	100.0	0.0	97.8	2.2	100.0	0.0	93.7	6.3	100.0	0.0	100.0	0.0
Calcium (mg)	90.9	9.1	84.8	15.2	100.0	0.0	87.5	12.5	100.0	0.0	100.0	0.0
Phosphorus (mg)	90.9	9.1	89.1	10.9	100.0	0.0	93.7	6.3	100.0	0.0	100.0	0.0
Iron (mg)	77.3	22.7	63.0	37.0	100.0	0.0	56.2	43.8	100.0	0.0	0.0	100.0
Vitamin A (RE)	41.0	59.0	52.2	47.8	45.5	54.5	43.7	56.3	20.0	80.0	100.0	0.0
Thiamine (mg)	100.0	0.0	97.8	2.2	100.0	0.0	93.7	6.3	60.0	40.0	0.0	100.0
Riboflavin (mg)	100.0	0.0	97.8	2.2	100.0	0.0	93.7	6.3	100.0	0.0	0.0	100.0
Niacin (mg)	100.0	0.0	100.0	0.0	100.0	0.0	93.7	6.3	100.0	0.0	100.0	0.0
Vitamin C (mg)	100.0	0.0	97.8	2.2	100.0	0.0	93.7	6.3	80.0	20.0	100.0	0.0

[1] Canadian Dietary Standard

Among respondents thirteen to fifteen years of age, a higher percentage did not meet the recommended intake for kilocalories, iron and vitamin A than for other nutrients (Table XXI). Looking at kilocalories, a slightly lower percentage of males than females (63.6% vs. 71.7%) met the recommended intake (Table XXI). Of the 63.6 percent of the males who met the recommended intake of 2800 kcal/day, 31.8 percent had intakes between 3250 and 3999 kcal/day and 31.7 percent had intakes of at least 4000 kcal/day (Table 1 Appendix F). None of the males had intakes less than 2000 kcal/day. Similarly, the intake of most females surpassed the recommended intake of 2200 kcal/day. About one-half (52.2%) had intakes greater than 2749 kcal/day although none consumed more that 3999 kcal/day (Table 1 Appendix F). Although calorie intakes were generally high, the fact that about one-third of the males and one-quarter of the females in this age group did not meet their recommended intake for kilocalories is noteworthy since these respondents are in a growing phase and an optimum diet is desirable.

Table XXI shows that 77.3 percent of the males and 63.0 percent of the females, thirteen to fifteen years of age, met the recommended intake for iron (13 mg/day and 14 mg/day respectively). Although 18.2 percent of the males had intakes from 8-11.9 mg/day and 18.1 percent from 12-15.9 mg/day, nearly two-thirds had intakes from 16-31.9 mg/day (Table 5 Appendix F). In contrast, 8.8 percent of the females had intakes less than 10 mg/day, 28.2 percent from 10-13.9 mg/day and 32.6 percent from 14-15.9 mg/day. The remainder had intakes up to 23.9 mg/day.

The recommended intake of vitamin A was met by only 41.0 percent of the males and 52.2 percent of the females in the thirteen to fifteen year old age group (Table XXI). Since 45.5 percent of the males consumed from 750 - 1249 RE/day, their intakes were close to the recommended level of 1000 RE/day (Table 6 Appendix F). However, nearly one-third had intakes less than 750 RE/day. A similar pattern is noted among the females whose recommended intake is 800 RE/day. Almost one-quarter of the females had intakes from 750-999 RE/day and 43.5 percent had intakes less than 750 RE/day (Table 6 Appendix F).

Other nutrients were consumed in large quantities by this age group. For instance, about 90 percent of the males met the recommended intake of calcium and phosphorus (1200 mg/day), and about two-thirds had intakes over 1799 mg/day (Tables 3 and 4 Appendix F). Similarly, about 85 percent of the females met the recommended intake of calcium and phosphorus (800 mg/day) and almost half had intakes greater than 1399 mg/day (Tables 3 and 4 Appendix F). All of the males and 97.8 percent of the females thirteen to fifteen years of age met the recommended intake for vitamin C (30 mg/day) (Table 10 Appendix F). In spite of these high intakes, it is interesting to note that vitamin C supplements were consumed sixty-five times during training and forty-one times before a competition (Table XVIII).

The quantity of protein consumed by this age group was also very high. As shown in Table XXI, all of the males and 97.8 percent of the females met the recommended intakes of protein (52 g/day and 43 g/day, respectively). Furthermore, about three-quarters of the males

had intakes of at least 100 g/day and two-thirds of the females had intakes of at least 80 g/day (Table 2 Appendix F).

When the recommended intake for niacin was adjusted according to the mean caloric intake (6.6 mg/1000 kcal), both the males and the females in this age group met the recommended level (Table XXI). All of the males consumed a minimum 13.5 mg/1000 kcal and about two-thirds had intakes of at least 22.5 mg/1000 kcal. Although niacin intakes for the females covered a wide range, only 4.4 percent had intakes less than 10.5 mg/100 kcal while 37.1 percent consumed from 10.5-17.9 mg/1000 kcal and 44.5 percent from 18.0-26.9 mg/1000 kcal.

The recommended intakes for thiamine and riboflavin also were adjusted according to the mean calorie intake (0.5 mg/1000 kcal and 0.6 mg/1000 kcal respectively). None of the males consumed less than 1.10 mg/1000 kcal of either thiamine or riboflavin and about two-thirds consumed more than 1.79 mg/1000 kcal of these nutrients (Table 7 and 8 Appendix F). In addition, most of the females exceeded these recommended levels. For instance, 39.2 percent consumed from 0.80-1.29 mg/1000 kcal of thiamine and 56.6 percent consumed from 1.30-1.99 mg/1000 kcal. Furthermore, 30.5 percent consumed from .90-1.49 mg/1000 kcal of riboflavin and slightly more than two-thirds consumed from 1.50-2.39 mg/1000 kcal.

Most respondents sixteen to eighteen years of age met the recommended intake for kilocalories and nutrients, with the exception of vitamin A in both males and females and iron in the females (Table XXI).

Slightly more than half of the males and females (54.5% and 56.3% respectively) did not meet the recommended intake for vitamin A (Table XXI). However, intakes of those who met the Canadian Dietary Standard (1975) were quite high. For example, the distribution of intakes (Table 6 Appendix F) shows that 45.5 percent of the males consumed at least 1250 RE/day (1000 RE/day is recommended) and 44.0 percent of the females consumed at least 1000 RE/day (800 RE/day is recommended.

Only 56.2 percent of the females sixteen to eighteen years of age met the recommended iron intake (Table XXI). The frequency distribution (Table 5 Appendix F) shows that about one-third of the females had intakes from 8.0-11.9 mg/day, about one-third had intakes from 12-15.9 mg/day and 18.9 percent consumed at least 18 mg/day.

The nutrients consumed in large quantities by this age group were the same as those consumed in large amounts by those thirteen to fifteen years of age and included calcium, phosphorus, protein, vitamin C and the B vitamins. In addition, the caloric intake of those sixteen to eighteen years of age was noticeably high. For example, all of the males met the recommended intake for kilocalories (3200 kcal/day) and nearly two-thirds had intakes of at least 4000 kcal/day (Table 1 Appendix F). Although 12.6 percent of the females consumed between 1750-2249 kcal/day (2100 kcal/day is recommended), 43.8 percent had intakes from 2250-2999 kcal/day and 37.7 percent consumed at least 3000 kcal/day.

The recommended intake for calcium and phosphorus for males

of this age group (1000 mg/day), was exceeded by all of the respondents. (Table XXI). In fact, 45.5 percent consumed at least 3000 mg of calcium per day, while 45.5 percent had phosphorus intakes of at least 2800 mg/day (Tables 3 and 4 Appendix F). In addition, the intake of calcium and phosphorus of over 85 percent of the females exceeded the recommended intake (700 mg/day) (Tables 3 and 4 Appendix F). While 69.0 percent of the females had calcium intakes of at least 1000 mg/day, 81.4 percent had phosphorus intakes of at least 1000 mg/day.

Although the recommended intake of vitamin C for this age group is only 30 mg/day, no male consumed less than 100 mg/day and 45.5 percent had intakes of at least 200 mg/day (Table 10 Appendix F). In addition, less than 10 percent of the females did not meet the recommended intake for vitamin C (Table XXI), while nearly two-thirds of the females had intakes of at least 100 mg/day (Table 10 Appendix F).

Protein consumption also was noticeably higher than the recommended intakes of 54 g/day for males and 43 g/day for males and females. All males consumed at least 120 g/day and 37.5 percent of the females had intakes of at least 100 g/day (Table 2 Appendix F). Only 6.3 percent of the females did not meet the recommended intake (Table XXI).

When the recommended intake for niacin was adjusted according to the mean caloric intake (6.6 mg/1000 kcal) all of the males and 93.7 percent of the females met the recommended level (Table XXI). Furthermore, all of the males consumed at least 22.5 mg/1000 kcal and 36.4 percent had intakes of at least 30.0 mg/1000 kcal. In addition, one half of the females consumed from 12.0-17.9 mg/1000 kcal and 31.4 percent had intakes from 18.0-23.9 mg/1000 kcal. (Table 9 Appendix F).

When the recommended intakes for thiamine and riboflavin were adjusted according to the mean caloric intake, all of the males and 93.7 percent of the females met the recommended intake of thiamine (0.5 mg/1000 kcal) and riboflavin (0.6 mg/1000 kcal). (Table XXI). All males consumed at least 1.80 mg/1000 kcal of either nutrient. In fact, 54.5 percent consumed over 2.09 mg/1000 kcal of thiamine and 27.3 percent consumed over 2.84 mg/1000 kcal of riboflavin. (Tables 7 and 8 Appendix F). Thiamine and riboflavin intakes from 1.00-1.49 mg/1000 kcal were consumed by 50.2 percent and 31.4 percent of the females respectively, while intakes of thiamine and riboflavin over 1.49 mg/1000 kcal were consumed by 37.6 percent and 62.7 percent of the famales respectively.

Only six respondents were nineteen years of age and over. As a result, detailed discussion of the dietary status of this group is not presented.

To summarize, the intake of kilocalories and most nutrients (except for vitamin A for males and females and iron for females), generally exceeded the recommended levels forboth age groups. In addition, among those thirteen to fifteen years of age, about one-third of the males and one-quarter of the females did not meet their recommended caloric intake. The most striking result is the unnecessarily high intake of calcium, phosphorus, protein, vitamin C and the B vitamins by a large percentage of swimmers in both age groups.

SOURCE OF NUTRITION INFORMATION

In response to the question concerning where swimmers would go to acquire information on suitable foods for athletes, 82.2 percent of the respondents indicated one source, while the remainder listed several sources. Of those listing one source, 39.8 percent indicated they would contact a nutritionist, while the coach, doctor and parent were mentioned by 28.9 percent, 16.9 percent and 9.6 percent of the respondents respectively (Table XXII).

Considering those respondents who listed one source of nutrition information together with those listing several sources, the nutritionist, coach and doctor were mentioned 34.4 percent, 27.2 percent and 18.4 percent of the times respectively, while parents, books and magazines were mentioned 8.0 percent, 4.8 percent and 2.4 percent of the times, respectively.

It is questionable whether over one-third of the swimmers would actually seek the help of a nutritionist. An open-ended question to determine the athletes' main source of nutrition information may have provided different results.

In a similar manner, Cho and Fryer (1974a) asked 138 physical education majors to indicate which sources contributed most to their knowledge of nutrition. The researchers used a more extensive list of sources and an older sample than that used in the present study. They found that college courses, parents and high school courses were mentioned by 44.9 percent, 18.1 percent and 13.0 percent of the respondents respectively, while the coach, doctor and nutritionist were

TABLE XXII

DISTRIBUTION OF RESPONDENTS[1] ACCORDING TO SOURCE OF NUTRITION INFORMATION

Source of Information	RESPONDENTS	
	No.	Percent
Nutritionist	33	39.8
Coach	24	28.9
Doctor	14	16.9
Parent	8	9.6
Books	2	2.4
Magazines	1	1.2
Nurse	0	0.0
Friends	0	0.0
Other (Biology teacher)	1	1.2
Total	83	100.0

[1]Respondents indicated one source of nutrition information.

mentioned by only 7.2 percent, 1.4 percent and 0.7 percent of the respondents, respectively.

It is difficult to explain why fewer physical education majors indicated the coach as a nutrition source than the swimmers in the present study. Perhaps if high school teachers had been included as a category in this study results would have been different.

It is interesting that more physical education majors noted parents as a source than the swimmers in the present study. Perhaps this may be due to the fact that adolescents generally like to feel independent of their parents (Stare and McWilliams, 1973).

RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE AND DIETARY PRACTICE INDICES

To examine the hypothesis that nutrition knowledge and dietary practices would be independent, nutrition knowledge scores were cross tabulated with responses to each of six questions about dietary practices during training and before competition. In addition, nutrition knowledge scores were cross tabulated with dietary practice scores from the three-day food records.

Chi-square tests of independence between variables indicated that the relationship between nutrition knowledge score and dietary practices assessed using a three-day food record was not significant. The relationship between nutrition knowledge score and dietary practices during training and before competition was significant for only the question concerning vitamin supplementation during training (Table XXIII). Eighty percent of those with "high" knowledge took supplements in training compared with 48.1 percent of those with "low" knowledge and 59.2 percent with "medium" knowledge. Marked differences were noted among those who did not take supplements. Of those with "low" knowledge, 40.7 percent indicated they did not take supplements while only 4.0 percent of those with "high" knowledge did not have this practice.

Although it is possible that the relationship between "high" knowledge and poor practices may have occured by chance, perhaps supplements are taken with the hope that they will provide the "competitive edge" needed to win. Craig, cited by Reed (1977), has reiterated this suggestion by commenting:

TABLE XXIII

RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE SCORE AND RESPONSE TO THE DIETARY PRACTICE QUESTION: "DURING TRAINING DO YOU TAKE SUPPLEMENTS?"

DIETARY PRACTICE RESPONSE

Nutrition Knowledge Score	Yes		Sometimes		No		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Low Knowledge[1]	13	48.1	3	11.1	11	40.7	27	100.0
Medium Knowledge[2]	29	59.2	11	22.4	9	18.4	49	100.0
High Knowledge[3]	20	80.0	4	16.0	1	4.0	25	100.0
Total	62	61.4	18	17.8	21	20.8	101	100.0

$X^2 = 12.23$ df = 4 $P < 0.02$

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

> Athletes' concern with diet is naturally from a performance point of view; they look for an elixir to give them a slight advantage over their opponents.

The five other relationships between nutrition knowledge and the practice of avoiding or consuming special foods during training or before a competition, and taking supplements before a competition were not significant. In addition, the relationship between nutrition knowledge scores and dietary practice scores assessed using a three-day food record, was not significant.

In general, these data concur with results of other researchers who have observed that nutrition knowledge and dietary practices are often not closely related (Young et al., 1956; Emmons and Hayes, 1973; Woolcott, 1971; Schwartz, 1975; Thompson and Schwartz, 1975).

RELATIONSHIPS BETWEEN NUTRITION ATTITUDES AND DIETARY PRACTICES

It was hypothesized that a relationship exists between nutrition attitudes and dietary practices. To test this hypothesis, responses to each attitude statement were cross tabulated with responses to each of six questions about dietary practices during training and before a competition. In addition, responses to each attitude statement were cross tabulated with dietary practice scores derived from the three-day food records. Chi-square tests of independence between variables indicated that significant relationships exist between a number of nutrition attitudes and dietary practices. These relationships are discussed below and concur with those of other researchers (Jalso et al., 1965; Eppright et al., 1970; Schwartz, 1975; Carruth et al., 1977) who also have found a relationship between nutrition attitudes and dietary practices.

A. Relationship Between Nutrition Attitudes And Dietary Practices During Training And Before A Competition

Chi-square analysis indicated that a significant relationship exists between attitudes concerning the benefits derived from taking vitamin supplements and the practice of taking vitamin supplements either during training or before a competition (Tables XXIV - XXVI). For instance, Table XXIV shows that of those who disagreed with the attitude that a well-balanced diet is adequate for top performance, 82.1 percent took supplements during training, while no one indicated they did not take supplements. By comparison, 47.3 percent of the respondents who agreed with the attitude indicated they took supplements, while only 30.9 percent did not. It is interesting that 72.2

percent of those who were uncertain also took supplements.

TABLE XXIV

RELATIONSHIP BETWEEN RESPONSE TO THE ATTITUDE STATEMENT: "I feel a well-balanced diet, without additional supplements, is a good diet for top performance" AND RESPONSE TO THE DIETARY PRACTICE QUESTION: "During training do you take supplements?"

DIETARY PRACTICE RESPONSE

Response To Attitude Statement		Yes %	Sometimes %	No %	Total %
Agree	(N=55)	47.3	21.8	30.9	100.0
Uncertain	(N=18)	72.2	5.6	22.2	100.0
Disagree	(N=28)	82.1	17.9	0.0	100.0
Total	(N=101)	61.4	17.8	20.8	100.0

$X^2 = 14.65$ df = 4 $P<0.01$

The attitude regarding the use of vitamin E supplements for improved performance was significantly ($P< 0.004$) related to the practice of taking supplements during training (Table XXV). Of those who agreed that taking vitamin E supplements improved performance, 90.9 percent also took supplements in training while only 4.5 percent did not take supplements. In contrast, nearly half (47.4%) of the respondents who disagreed, also took supplements, whereas 31.6 percent did not. It is noteworthy that 68.2 percent of those who were uncertain of the attitude also took supplements. Furthermore, it is interesting that of all the supplements taken during training, vitamin E was indicated with the same frequency as iron and vitamin B, but less frequent

than vitamin C (Table XVIII).

TABLE XXV

RELATIONSHIP BETWEEN RESPONSE TO THE ATTITUDE STATEMENT: "I sometimes take vitamin E supplements to improve performance" AND RESPONSE TO THE DIETARY PRACTICE QUESTION:"During training do you take supplements?"

DIETARY PRACTICE RESPONSE

Response To Attitude Statement		Yes %	Sometimes %	No %	Total %
Agree	(N=22)	90.9	4.5	4.5	100.0
Uncertain	(N=22)	68.2	22.7	9.1	100.0
Disagree	(N=57)	47.4	21.1	31.6	100.0
Total	(N=101)	61.4	17.8	20.8	100.0

$X^2 = 15.35$ df = 4 $P < 0.004$

There was also a significant relationship between the attitude that a well-balanced diet, without supplements, is a good diet for top performance, and taking supplements before a major competition (Table XXVI). Of the respondents who disagreed that a well-balanced diet was adequate for top performance, 67.9 percent also took supplements, whereas only 17.9 percent did not take supplements. In contrast, about one-third of those who agreed with the attitude took supplements while slightly over half did not have this practice. Of those who were uncertain of their attitudes, nearly as many took supplements (38.9%) as did not take supplements (44.4%).

TABLE XXVI

RELATIONSHIP BETWEEN RESPONSE TO THE ATTITUDE STATEMENT: "I feel a well-balanced diet, without additional supplements, is a good diet for top performance" AND RESPONSE TO THE DIETARY PRACTICE QUESTION: "Before a major competition do you take supplements?"

DIETARY PRACTICE RESPONSE

Response To Attitude Statement		Yes %	Sometimes %	No %	Total %
Agree	(N=55)	34.5	10.9	54.5	100.0
Uncertain	(N=18)	38.9	16.7	44.4	100.0
Disagree	(N=28)	67.9	14.3	17.9	100.0
Total	(N=101)	44.6	12.9	42.6	100.0

$X^2 = 11.07$ df = 4 $P < 0.03$

The relationship between the attitude that carbohydrate loading benefits performance was significantly ($P < 0.002$) related to the practice of eating special foods before a major competition. Table XXVII shows that 60.5 percent of those respondents who felt carbohydrate loading was beneficial to performance, also ate special foods before a major competition, versus 22.7 percent of those who disagreed. In addition, 59.1 percent of those who disagreed with the attitude did not eat special foods before major events, while only 11.6 percent of those who agreed to the attitude did not eat any special foods. Furthermore, of those who were uncertain, nearly as many ate something special before a major competition (38.9%) as did not eat any special foods (41.7%). The fact that respondents actually

ate carbohydrate-rich foods in preparation for a major event is shown in Table XVII. Cereal, cereal products and carbohydrate foods were the most frequently mentioned food that was eaten preferentially before a major competiton.

TABLE XXVII

RELATIONSHIP BETWEEN RESPONSE TO THE ATTITUDE STATEMENT: "I believe the higher the carbohydrate content of my diet before a major event, the better my performance" AND RESPONSE TO THE DIETARY PRACTICE QUESTION: "Before a major competition do you eat anything special?"

DIETARY PRACTICE RESPONSE

Response To Attitude Statement		Yes %	Sometimes %	No %	Total %
Agree	(N=43)	60.5	27.9	11.6	100.0
Uncertain	(N=36)	38.9	19.4	41.7	100.0
Disagree	(N=22)	22.7	18.2	59.1	100.0
Total	(N=101)	44.6	22.8	32.7	100.0

$X^2 = 17.35$ df = 4 $P < 0.002$

The fad belief that fatty foods should be restricted in training also was significantly related to the practice of avoiding certain foods before a major event (Table XXVIII). Of the respondents who agreed to restricting fatty foods in training, 76.1 percent also avoided certain foods before a major competition. Of those who disagreed with the attitude, the same number (46.9%) avoided as did not avoid certain foods before a major competition. In addition, 69.6

percent of those with uncertain attitudes also had this practice. It is interesting to note in Table XVII that of those foods avoided before a competition, fatty foods (included in the miscellaneous category), were avoided ten times.

TABLE XXVIII

RELATIONSHIP BETWEEN RESPONSE TO THE ATTITUDE STATEMENT: "I like to restrict my intake of fatty foods when I am in training" AND RESPONSE TO THE DIETARY PRACTICE QUESTION:"Before a major competition do you avoid certain foods?"

DIETARY PRACTICE RESPONSE

Response To Attitude Statement		Yes %	Sometimes %	No %	Total %
Agree	(N=46)	76.1	8.7	15.2	100.0
Uncertain	(N=23)	69.6	17.4	13.0	100.0
Disagree	(N=32)	46.9	6.3	46.9	100.0
Total	(N=101)	65.3	9.9	24.8	100.0

$X^2 = 13.64$ df = 4 $P < 0.01$

The significant relationships observed between the nutrition attitudes and dietary practices shown in Tables XXIV to XXVIII suggest that attitudes affect practices. However, there is no logical explanation why the attitudes and practices shown in Tables XXIX and XXX would be significantly related.

Table XXIX shows that 56.5 percent of the respondents who agreed that they liked to restrict intake of fatty foods while training,

also took supplements before a major competition, in comparison with 34.4 percent of those who disagreed to the attitude and had the practice of taking supplements.

TABLE XXIX

RELATIONSHIP BETWEEN RESPONSE TO THE ATTITUDE STATEMENT: "I like to restrict my intake of fatty foods when I am in training" AND RESPONSE TO THE DIETARY PRACTICE QUESTION: "Before a major competition do you take supplements?"

DIETARY PRACTICE RESPONSE

Response To Attitude Statement		Yes %	Sometimes %	No %	Total %
Agree	(N=46)	56.5	10.9	32.6	100.0
Uncertain	(N=23)	34.8	26.1	39.1	100.0
Disagree	(N=32)	34.4	6.3	59.4	100.0
Total	(N=101)	44.6	12.9	42.6	100.0

$X^2 = 10.33$ df = 4 $P < 0.04$

Furthermore, 59.4 percent of those who disagreed with the attitude statement did not take supplements before a major competition, while 32.6 percent of those who agreed, did not take supplements. It is interesting to note that about one-third who were uncertain of the attitude, also took supplements.

The attitude that the body can adjust to a decreased intake of water was significantly related to the practice of taking supplements during training (Table XXX). Of the respondents who agreed with

the attitude statement, 91.7 percent also took supplements during training. Furthermore, no individual agreed to the statement and did not take supplements, in comparison with those who disagreed with the statement and took supplements (61.8%) or did not take supplements (11.8%). Of those who were uncertain of the attitude, slightly more than half took supplements while nearly one-third did not have this practice.

TABLE XXX

RELATIONSHIP BETWEEN RESPONSE TO THE ATTITUDE STATEMENT: "I believe a swimmer's body can adjust to taking in less water than is lost in sweat each day" AND RESPONSE TO THE DIETARY PRACTICE QUESTION: "During training do you take supplements?"

DIETARY PRACTICE RESPONSE

Response To Attitude Statement		Yes %	Sometimes %	No %	Total %
Agree	(N=12)	91.7	8.3	0.0	100.0
Uncertain	(N=55)	54.5	14.5	30.9	100.0
Disagree	(N=34)	61.8	26.5	11.8	100.0
Total	(N=101)	61.4	17.8	20.8	100.0

$X^2 = 11.11$ df = 4 $P < 0.03$

These data show that a relationship exists between certain nutrition attitudes and dietary practices. Negative attitudes tended to be reflected in poor nutrition practices; positive attitudes tended to be reflected in better nutrition practices. It is not easy to explain

why some respondents with positive or uncertain attitudes toward nutrition have poor dietary practices. Perhaps these respondents take vitamin supplements during training and before a major competiton just in case performance is benefited. In addition, perhaps certain foods are avoided in case performance may be hindered. An athlete's drive to win may be an important factor influencing the dietary practices of even those athletes with positive nutrition attitudes. Serfass (1977) has reiterated this suggestion by stating:

> It matters little that there is no conclusive evidence that supplementing a well-balanced diet will improve performance; the search for something to provide the "competitive edge" continues to be perpetuated by testimonials of successful athletes and coaches, the commercialization of food supplements and the inadequate distribution of relevant nutrition information.

B. Relationships Between Nutrition Attitudes And Dietary Practices Assessed by A Three-Day Food Record

Chi-square analysis indicated that a significant relationship exists between nutrition attitudes and dietary practice scores assessed by the three-day food record. Table XXXI shows that 55.6 percent of those who agreed that a weight loss of six pounds per week is safe also had the poorest dietary practices, while only 22.2 percent of those who scored eight or nine agreed with the attitude. Almost three-quarters of those with uncertain views (73.9%) scored eight or nine on dietary practices in comparison with only 13.0 percent of those who were uncertain and had higher or lower dietary scores.

Table XXXII shows that 60.0 percent of those who agreed with the faddish attitude that drinking milk the day of an event decreases

TABLE XXXI

RELATIONSHIP BETWEEN RESPONSE TO THE ATTITUDE STATEMENT: "If I wanted to lose weight, a loss of six pounds per week is a safe loss" AND DIETARY PRACTICE SCORE

DIETARY PRACTICE SCORE[1]

Response To Attitude Statement		0-7 %	8-9 %	10 %	Total %
Agree	(N=9)	55.6	22.2	22.2	100.0
Uncertain	(N=23)	13.0	73.9	13.0	100.0
Disagree	(N=69)	30.4	43.5	26.1	100.0
Total	(N=101)	28.7	48.5	22.8	100.0

$X^2 = 10.29$ df = 4 $P<0.04$

[1]Derived by comparing the three-day mean intakes of kilocalories and nine nutrients with the recommended intake in the Canadian Dietary Standard (C.D.S.). The score represents any combination of kilocalories and/or nutrients that met the C.D.S. recommendation. Maximum possible score = 10 (kilocalories + 9 nutrients).

performance, also had the poorest dietary practice score. This is in marked contrast with 6.7 percent of those who also agreed with the attitude but had a dietary practice score of ten. Nearly two-thirds (61.8%) of the respondents who were uncertain had a dietary practice score of eight or nine in comparison with 20.6 percent and 17.6 percent of those who had higher or lower dietary scores, respectively.

In sum, these data suggest that certain nutrition attitudes are related to dietary practices assessed by a three-day food record.

TABLE XXXII

RELATIONSHIP BETWEEN RESPONSE TO THE ATTITUDE STATEMENT: "Drinking milk the day of an event decreases my performance" AND DIETARY PRACTICE SCORE

DIETARY PRACTICE SCORE[1]

Response To Attitude Statement		0-7 %	8-9 %	10 %	Total %
Agree	(N=12)	60.0	33.3	6.7	100.0
Uncertain	(N=34)	17.6	61.8	20.6	100.0
Disagree	(N=52)	26.9	44.2	28.8	100.0
Total	(N=101)	28.7	48.5	22.8	100.0

$X^2 = 11.38$ df = 4 $P < 0.02$

[1]Derived by comparing the three-day mean intakes of kilocalories and nine nutrients with the recommended intake in the Canadian Dietary Standard (C.D.S.). The score represents any combination of kilocalories and/or nutrients that met the C.D.S. recommendation. Maximum possible score = 10 (kilocalories + 9 nutrients).

Poorer attitudes tended to be reflected in lower dietary scores; positive attitudes tended to be reflected in better dietary scores.

RELATIONSHIPS BETWEEN NUTRITION KNOWLEDGE AND NUTRITION ATTITUDES

To examine the hypothesis that nutrition knowledge and nutrition attitudes would be related, nutrition knowledge scores were cross tabulated with responses to each attitude statement. Chi-square tests of independence between variables indicated that there was a significant relationship between nutrition knowledge and the attitude that fatty foods should be restricted when an athlete is in training. Furthermore, chi-square analysis indicated that there was a significant relationship between nutrition knowledge and the attitude that a balanced diet is sufficient for performance. Other researchers also have observed a relationship between nutrition knowledge and certain attitudes (Eppright et al., 1970; Schwartz, 1975; Sims, 1976). However, contrary to the studies noted above, the results of the present study show that high nutrition knowledge was related to poor nutrition attitudes.

Table XXXIII shows that 64.0 percent of those with "high" knowledge agreed with the attitude of restricting fatty foods during training in comparison with only 36.7 percent of those with "medium" knowledge. In addition, only 12.0 percent of those with "high" knowledge disagreed with the attitude while 44.9 percent with "medium" knowledge disagreed.

The peculiar trend that those with "high" knowledge have attitudes contrary to what one might expect is also seen in Table XXXIV. Only 32.0 percent of those with "high" knowledge agreed with the attitude that a well-balanced diet, without supplements, is adequate for top performance and 36.0 percent were uncertain. By comparison, 63.3 percent of those having "medium" knowledge agreed with the statement and only 8.2 percent indicated uncertainty.

TABLE XXXIII

RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE SCORE AND RESPONSE TO THE ATTITUDE STATEMENT: "I like to restrict my intake of fatty food when I am in training."

Nutrition Knowledge Score		RESPONSE TO ATTITUDE STATEMENT			
		Agree %	Uncertain %	Disagree %	Total %
Low Knowledge[1]	(N=27)	44.4	29.6	25.9	100.0
Medium Knowledge[2]	(N=49)	36.7	18.4	44.9	100.0
High Knowledge[3]	(N=25)	64.0	24.0	12.0	100.0
Total	(N=101)	45.5	22.8	31.7	100.0

$X^2 = 9.74$ df = 4 $P < 0.05$

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

TABLE XXXIV

RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE SCORE AND RESPONSE TO THE ATTITUDE STATEMENT: "I feel a well-balanced diet, without additional supplements, is a good diet for top performance."

Nutrition Knowledge Score		RESPONSE TO ATTITUDE STATEMENT			
		Agree %	Uncertain %	Disagree %	Total %
Low Knowledge[1]	(N=27)	59.3	18.5	22.2	100.0
Medium Knowledge[2]	(N=49)	63.3	8.2	28.6	100.0
High Knowledge[3]	(N=25)	32.0	36.0	32.0	100.0
Total	(N=101)	54.5	17.8	27.7	100.0

$X^2 = 10.81$ df = 4 $P < 0.03$

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

It is interesting to note that a similar trend was found between knowledge and four other attitudes toward vitamin supplementation (Table XXXV - XXXVIII). Although three of these relationships were not significant at the .05 level of probability, and one did not have an expected frequency large enough to permit chi-square analysis, the data are presented since they show the same trend that those with high knowledge have poor attitudes.

For example, Table XXXV shows that 56.0 percent of those with high knowledge agreed to taking vitamin C supplements to aid performance while only 32.0 percent disagreed. By comparison, 34.7 percent of those with medium knowledge agreed, and 59.2 percent disagreed.

TABLE XXXV

RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE SCORE AND RESPONSE TO THE ATTITUDE STATEMENT: "I sometimes take vitamin C supplements to improve performance."

Nutrition Knowledge Score		RESPONSE TO ATTITUDE STATEMENT			
		Agree %	Uncertain %	Disagree %	Total %
Low Knowledge[1]	(N=27)	37.0	18.5	44.4	100.0
Medium Knowledge[2]	(N=49)	34.7	6.1	59.2	100.0
High Knowledge[3]	(N=25)	56.0	12.0	32.0	100.0
Total	(N=101)	40.6	10.9	48.5	100.0

$X^2 = 7.11$ df = 4 $P < 0.13$ (NS)[4]

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

[4] not significant

Similarly, in Table XXXVI, 88.0 percent of the respondents with high knowledge agreed with the attitude of taking supplements just in case meals are deficient, whereas 40.7 percent of those with low knowledge agreed. Furthermore, 48.1 percent of those with low knowledge disagreed, while only 12.0 percent of those with high knowledge disagreed.

TABLE XXXVI

RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE SCORE AND RESPONSE TO THE ATTITUDE STATEMENT: "I take vitamin supplements just in case I do not get all the nutrients I need from my meals."

Nutrition Knowledge Score		RESPONSE TO ATTITUDE STATEMENT			
		Agree %	Uncertain %	Disagree %	Total %
Low Knowledge[1]	(N=27)	40.7	11.1	48.1	100.0
Medium Knowledge[2]	(N=49)	69.4	6.1	24.5	100.0
High Knowledge[3]	(N=25)	88.0	0.0	12.0	100.0
Total	(N=101)	66.3	5.9	27.7	100.0

X^2 analysis was not performed since the expected frequency in two cells was too small.

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

The same pattern is shown in Table XXXVII. Fewer of those with high knowledge disagreed with taking vitamin E to improve performance than those with medium and low knowledge (44.0% vs. 59.2% and 63.0%, respectively). In addition, more of those with high knowledge were uncertain of this attitude than those with medium and low knowledge.

TABLE XXXVII

RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE SCORE AND RESPONSE TO THE ATTITUDE STATEMENT: "I sometimes take vitamin E supplements to improve my performance."

Nutrition Knowledge Score		RESPONSE TO ATTITUDE STATEMENT			
		Agree %	Uncertain %	Disagree %	Total %
Low Knowledge[1]	(N=27)	18.5	18.5	63.0	100.0
Medium Knowledge[2]	(N=49)	24.5	16.3	59.2	100.0
High Knowledge[3]	(N=25)	20.0	36.0	44.0	100.0
Total	(N=101)	21.8	21.8	56.4	100.0

$X^2 = 4.40$ df = 4 $P < 0.35$ (NS)[4]

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

[4] not significant

A similar trend can be seen in Table XXXVIII where 40.0 percent of those with high knowledge disagreed with the attitude of taking vitamin B for added energy in comparison with slightly more than half of the respondents in the other knowledge categories.

TABLE XXXVIII

RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE SCORE AND RESPONSE TO THE ATTITUDE STATEMENT: "I sometimes take vitamin B supplements for added energy."

Nutrition Knowledge Score		RESPONSE TO ATTITUDE STATEMENT			
		Agree %	Uncertain %	Disagree %	Total %
Low Knowledge[1]	(N=27)	18.5	29.6	51.9	100.0
Medium Knowledge[2]	(N=49)	16.3	28.6	55.1	100.0
High Knowledge[3]	(N=25)	24.0	36.0	40.0	100.0
Total	(N=101)	18.8	30.7	50.5	100.0

$X^2 = 1.59$ df = 4 $P < 0.81$ (NS)[4]

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

[4] not significant

It would appear that the athletes with high knowledge have poor attitudes. They believed that fatty foods should be restricted in training (Table XXXIII) and that a balanced diet, without supplements, is inadequate for top performance (Table XXXIV). Furthermore, there are trends (although non-significant) suggesting that those with high knowledge have other poor attitudes (Tables XXXV - XXXVIII). For instance, it appears that those with high knowledge think vitamin supplements should be consumed in case certain nutrients are lacking in the diet (Table XXXVI) and that specific vitamins aid performance (Tables XXXV, XXXVII and XXXVIII).

It is interesting to speculate why those having high knowledge have poor attitudes. Perhaps these respondents have enough knowledge to be aware of the controversy concerning the role of nutrition in athletics, but may not have enough knowledge to distinguish between misconceptions and facts.

Feelings of uncertainty, coupled with the drive to win, and the search for something to provide a "competitive edge" (Van Itallie et al., 1956; Darden, 1972; Serfass, 1977), may be the deciding factors which sway the athlete to adopt certain faddish attitudes. Although some respondents may have higher knowledge than others, this may not be the major criterion on which they base their beliefs.

If this explanation is correct, perhaps the poor attitudes among those with high knowledge may explain why more respondents with high knowledge also had poor practices (Table XX) since this study showed that poor attitudes were significantly related to poor practices (Tables XXIV - XXXII).

CONCLUSIONS

The conclusions of this study will be discussed in light of the objectives which have been cited previously in the introduction. A general discussion of the first three objectives will be followed by a discussion of the two remaining objectives.

The first three objectives are listed below:

1) To assess the nutrition knowledge of competitive swimmers

2) To assess the nutrition attitudes of competitive swimmers

3) To assess the dietary practices of competitive swimmers

Although respondents had a low level of nutrition knowledge, many of the fads considered common to athletes were not evident in the test of nutrition knowledge. Furthermore, responses to the attitude statements indicated that fad beliefs peculiar to athletes were not too pronounced, however, other nutrition related misconceptions were evident. Perhaps the low incidence of fad responses is explained, in part, by the fact that the literature discusses fads of the athlete in general, when in fact it would appear that specific fads are related to specific sports.

Assessment of dietary practices during training and before a competition indicated that the swimmers had a number of faddish practices. In addition, diets were modified more in preparation for a major event than they were during training. These results were in contrast with dietary practice scores from the three-day food records which showed that intakes of energy and nutrients (with the exception of vitamin A in males and females, and iron in females), were generally

higher than the recommendations in the Canadian Dietary Standard (1975). In addition, intakes of calcium, phosphorus, protein, vitamin C and the B vitamins were, in most cases, much higher than the Canadian Dietary Standard (1975) recommendations. These data give nutrition educators some indication of the areas in the diet of these athletes which need strengthening and which areas could be less emphasized. In addition, these data suggest that dietary practices evaluated by three-day food records were better than dietary practices during training and before a competition. Perhaps the three-day food record reflects eating behavior based on habits and family traditions, whereas eating practices during training and before a competition may reflect specific misconceptions of athletes about nutrition and sports.

The two remaining objectives of this study were:

4) To determine the relationships among nutrition knowledge attitudes and practices of competitive swimmers

5) To determine the athletes' main source of nutrition information

An assessment of the relationship among nutrition knowledge, attitudes and practices showed that nutrition knowledge had little relationship to either measure of dietary practice. Nutrition knowledge was significantly related to two nutrition attitude statements; however, the relationship suggested that high knowledge was related to poor attitudes. Furthermore, a trend was noted which indicated a relationship between high knowledge and poor attitudes. It appears that even athletes with knowledge do not always use this knowledge in forming

certain beliefs. Perhaps the athletes "drive to win" and search for something to provide a "competitive edge" are more motivating factors (than knowledge) in forming attitudes. The greatest number of significant relationships was observed between nutrition attitudes and dietary practices. Better attitudes were related to better practices; poorer attitudes were related to poorer practices.

In the final analysis, the question designed to determine the athletes' main source of nutrition information was found to be deficient. Since an open-ended question would have been preferable, it is difficult to determine if the objective was attained.

Although there appears to be an interrelationship among knowledge, attitudes and practices, the exact linkage remains unclear. Nevertheless, if it is desirable to cause a change in any one of the three factors, it is necessary to know more precisely how these variables interact. Since one of the goals of nutrition education is to cause a positive change in an individual's dietary practices, it is important to know what affects food habits. People behave as they do for reasons other than knowledge alone. Smokers do not necessarily stop smoking even if they know the habit is a health hazard; dieters do not necessarily consume fewer calories than they expend even if they realize this is the best way to lose weight.

The present study supports the literature which suggests that knowledge may not be the main determinant of an individual's practices. A number of factors influence behavior. Attitudes are only one of many variables.

BIBLIOGRAPHY

Anonymous, 1970. "Light to Healthy Living," ed. Vita Health Company Ltd., Winnipeg.

Anonymous, 1971. Nutrition for athletes - a handbook for coaches. American Association for Health, Physical Education, and Recreation, Washington, D.C.

Anonymous, 1972. A study of health practices and opinions. National Technical Information Service. U. S. Dept of Commerce.

Anonymous, 1974a. "Let's Talk About Food," p. 147. ed. White, P. L. and Selvey, N. American Medical Association Publishing Sciences Group, Inc., Massachusetts.

Anonymous, 1974b. A critique of low-carbohydrate ketogenic weight reduction regimes--a review of Dr. Atkins' diet revolution. Nutr. Rev. Suppl. 32:15.

Anonymous, 1974c. Water deprivation and performance of athletes. A Statement of the Food and Nutrition Board. National Academy of Sciences.

Anonymous, 1975. Nutrition and athletic performance. Dairy Council Digest. 46:7.

Beal, V. A. 1967. The nutritional history in longitudinal research. J. Am. Diet. Assoc. 51:426.

Bell, C. G. and Lamb, M. W. 1973. Nutrition education and dietary behavior of fifth graders. J. Nutr. Educ. 5:196.

Carruth, B. R., Mangel, M. and Anderson, H. L. 1977. Assessing change--proneness and nutrition-related behaviors. J. Am. Diet. Assoc. 70:47.

Chalmers, F. W., Clayton, M. M., Gates, L. O., Tucker, R. E., Wertz, A. W., Young, C. M. and Foster, W. D. 1952. The dietary record--how many and which days? J. Am. Diet. Assoc. 28:711.

Cho, M. and Fryer, B. A. 1974a. Nutritional knowledge of collegiate physical education majors. J. Am. Diet. Assoc. 65:30.

Cho, M. and Fryer, B. A. 1974b. What foods do physical education majors and basic nutrition students recommend for athletes? J. Am. Diet. Assoc. 65:541.

Committee for revision of the Canadian Dietary Standard 1975. Dietary Standard for Canada. Department of National Health and Welfare. Information Canada, Ottawa.

Darby, W. J. 1947. The influence of some recent studies on the interpretation of the findings of nutrition surveys. J. Am. Diet. Assoc. 23:204.

Darden, E. 1972. Nutrition and athletic performance. Sch. Coach. 42:88.

Durnin, J. V. G. A. 1967. The influence of nutrition. Can. Med. Assoc. J. 96:715.

Dwyer, J. T., Feldman, J. J. and Mayer, J. 1970. Nutritional literacy of high school students. J. Nutr. Educ. Fall:59.

Edwards, A. L. 1957. Techniques of Attitude Scale Construction. Appleton-Century-Crafts, Inc., New York.

Emmons, L. and Hayes, M. 1973. Nutrition knowledge of mothers and children. J. Nutr. Educ. 5:134.

Eppright, E. S., Patton, M. B., Marlatt, A. L. and Hathaway, M. L. 1952. Dietary study methods. V. Some problems in collecting dietary information about groups of children. J. Am. Diet. Assoc. 28:43.

Eppright, E. S., Fox, H. M., Fryer, B. A., Lamkin, G. H., and Vivian, V. M. 1970. 2. Nutrition knowledge and attitudes of mothers. J. H. Ec. 62:327.

Gifft, H. H., Washbon, M. B. and Harrison, G. G. 1972. "Nutrition, Behavior and Change," pp. 254-295. Prentice-Hall Inc., New Jersey.

Gey, G. O., Cooper, K. H., and Bottenberg, R. A. 1970. Effect of ascorbic acid on endurance performance and athletic injury. J. Am. Med. Assoc. 211:105.

Gray, C. E. and Blackman, N. R. 1947. More high school student diets evaluated. J. H. Ec. 39:505

Head, M. K. 1974. A nutrition education program at three grade levels. J. Nutr. Educ. 6:56.

Huenemann, R. L. and Turner, D. 1942. Methods of dietary investigation. J. Am. Diet. Assoc. 18:562.

Jalso, S. B., Burns, M. M. and Rivers, J. M. 1965. Nutritional beliefs and practices. J. Am. Diet. Assoc. 47:263.

Jenner, A. 1973. "Food: Fact and Folklore," McClelland and Stewart Ltd., Toronto.

Leverton, R. M. and Marsh, A. G. 1939. Comparison of food intakes for weekdays and for Saturday and Sunday. J. H. Ec. 31:111.

McCarthy, M. E. and Sabry, J. M. 1973. Canadian university students' nutrition misconceptions. J. Nutr. Educ. 5:193.

Milton, M. T. 1971. An investigation of the relationship between nutrition knowledge and dietary practices of two groups of high school girls, M. Sc. Thesis, University of Manitoba, Winnipeg, Manitoba.

Nelson, D. O. 1961. Idiosyncrasies in training and diet. Sch. Coach. May, 32.

Nelson, R. A. and Gastineau, C. F. 1974. Nutrition for athletes. In "The Medical Aspects of Sports, ed. Craig, T. T., pp. 19-21. Amer. Med. Assoc., Chicago.

Nutrition Canada 1975. The Manitoba survey report. Department of National Health and Welfare. Information Canada, Ottawa.

Pauling, 1970. "Vitamin C and the Common Cold" Bantam Books, Toronto.

Petersen, M. E. and Kies, C. 1972. Nutrition knowledge and attitudes of early elementary teachers. J. Nutr. Educ. 7:11.

Picardi, S. M. and Pariser, E. R. 1975. Food and nutrition mini-course for 11th and 12th grades. J. Nutr. Educ. 7:25.

Reed, J. D. 1977. They hunger for success. Sports Illustrated. 46:65.

Rosenberg, M. J., Hovland, C. I., McGuire, W. J., Abelson, R. P., and Brehm, J. W. 1960. "Attitude Organization and Change," pp. 1-78. Yale University Press, Conneticut.

Schwartz, N. E. 1975. Nutritional knowledge, attitudes, and practices of high school graduates. J. Am. Diet. Assoc. 66:28.

Serfass, R. C. 1977. Nutrition for the athlete. Contemporary Nutrition. 2:5.

Shute, W. E. and Taub, H. J. 1972. "Vitamin E for Ailing and Healthy Hearts." Pyramid Books, New York.

Sims, L. 1976. Demographic and attitudinal correlates of nutrition knowledge. J. Nutr. Educ. 8:122.

Smith, N. J. 1976. "Food for Sport," Bull Publishing Co., California.

Stare, F. J. and McWilliams, M. 1973. "Living Nutrition" John Wiley and Sons, Inc., Toronto.

Tinsley, W. V. 1947. Development of instruments for evaluating food practices, nutrition information and school lunch programs and their use in nutrition education at the elementary level. Ph.D. Thesis, University of Minnesota, St. Paul Minnesota.

Thompson, J. K. and Schwartz, N. E. 1975. The relationships of knowledge, attitudes and practices of grade 8 secondary school students in Vancouver, to selected environmental variates. M. Sc. Thesis, University of British Columbia, Vancouver, B.C.

Travers, R. M. 1967. "Essentials of Learning" pp. 161-200. MacMillan Co., New York.

Trulson, M. F. 1955. Assessment of dietary study methods. 2. Variability of eating practices and determination of sample, size and duration of dietary surveys. J. Am. Diet. Assoc. 31:797.

Trulson, M. F. and McCann, M. B. 1959. Comparison of dietary survey methods. J. Am. Diet. Assoc. 35:672.

Van Itallie, J. B., Sinisterra, L. and Stare, F. J. 1956. Nutrition and athletic performance. J. Am. Med. Assoc. Nov:1120.

Watt, B. K. and Merrill, A. L. 1963. Composition of Foods: Raw, Processed, Prepared. Agr. Res. Serv. Handbook No. 8. U. S. Government Printing Office, Washington, D.C.

Weswig, P. H. and Winkler, W. 1974. Iron supplementation and hematological data of competitive swimmers. J. Sport Med. and Phys. Fitness. 14:112.

Woolcott, D. M. 1971. An assessment of the knowledge and application of nutrition principles and their relationship to availability and use of nutrition information by homemakers in an isolated community. M. Sc. Thesis, University of Manitoba, Winnipeg, Manitoba.

Young, C. M., Hagan, G. C., Tucker, R. E., and Foster, W. D. 1952. A comparison of dietary study methods 2. Dietary history vs. seven-day record vs. 24-hr. recall. J. Am. Diet. Assoc. 28:218.

Young, C. M. and Trulson, M. F. 1960. Methodology for dietary studies in epidemiological surveys. II. Strengths and weaknesses of existing methods. Am. J. Pub. Health. 50:803.

Young, C. M., Berresford, K., and Waldner, B. G. 1956. What the homemaker knows about nutrition III. Relation of knowledge to practice. J. Am. Diet. Assoc. 32:321.

APPENDIX A

Cardinal Swim Club	Mr. Tony Fraser 1336 Markham Drive Winnipeg
Manitoba Marlins	Dr. Don Wells 83 Thatcher Drive Winnipeg
St. Boniface-St. Vital- East Kildonan Swim Club	Mr. J. Baturin 51 Watercress Road Winnipeg
St. James Seals	Mr. Wilf Strom 2614 Assiniboine Crescent Winnipeg
St. John's Aqua Kings	Mr. Ben Penning 248 Nightingale Road Winnipeg

APPENDIX B

NAME: _____

AGE: _____ SEX: _____

Thank you for your cooperation in completing the first part of this research project. Your time and effort in keeping the 3-day food record has been greatly appreciated.

The last part of the study involves a questionnaire on nutrition. We would be grateful if you could take time to answer each of the questions. It should take about 20-30 minutes to complete.

The questionnaire was designed to contribute to the study as a whole, not to test your personal ability. The information will be kept in strict confidence.

The questionnaire is divided into 3 sections. Part A concerns questions on general nutrition, Part B concerns questions on how you <u>feel</u> about nutrition, and the final section, C, asks questions on your eating habits.

Please answer <u>all</u> questions as best you can but <u>do not guess</u> at any answers. <u>This is not a test</u>.

P A R T A

The following questions are concerned with general nutrition knowledge. Please circle the statement which best answers the question or completes the sentence. If you do not know the correct answer, circle "F" (don't know). Please do not guess at any answers. Remember, this is not a test.

EXAMPLE:

Which of the following foods can be bought in a grocery store?

a. boat
(b) vegetables
c. cement
d. house
e. tent
f. don't know

1. Protein is important in the body because

a. it is the main source of muscular energy
b. it is a major part of all body tissue
c. it is a regulator of body processes
d. it prevents rickets
e. it gives extra muscle strength when taken in large amounts
f. don't know

2. Carbohydrates are important in the body because

a. they increase resistance to colds
b. they help in healing wounds
c. they bring oxygen to the lungs
d. they provide a source of food energy
e. they give extra energy when taken immediately before a swimming event
f. don't know

3. Nutritionists tell us that vitamin C

a. helps us see at night
b. taken in large amounts helps prevent severe injury in athletics
c. is stored in large quantities in our liver
d. is used to make collagen, needed to cement cells together
e. affects calcium use in the body
f. don't know

4. Which one of the following statements is true?

a. water is needed to regulate body temperature
b. water supplies B vitamins for the diet
c. water affects how iron is used in the body
d. water is a source of energy
e. water does not need to be replaced with heavy sweating
f. don't know

5. Eating more calories than what is used in activity

a. results in weight gain
b. is not a problem if you eat less carbohydrate
c. results in weight loss
d. causes increased water loss
e. causes no weight change since calories are not related to weight
f. don't know

6. Which one of the following statements is true?

a. calcium in sunflower seeds is better for us than calcium in cheese
b. calcium strengthens the heart muscle
c. calcium in our diet slows the breakdown of food in the body
d. calcium helps muscles in the body to contract
e. calcium is needed to produce energy in the body
f. don't know

7. Experts say that one way to increase the total amount of muscle is to

a. eat more wheat germ
b. exercise more
c. eat more beef
d. eat more honey
e. eat more beef and vitamin supplements
f. don't know

8. Which one of the following foods is the best source of vitamin A?

   a. spinach
   b. tangerine
   c. carrot
   d. tomato
   e. sunflower seeds
   f. don't know

9. Which one of the following statements is true?

   a. fatty foods should be restricted during a swimmer's training
   b. fat in our diet slows the breakdown of food in the body
   c. fat is used to build red blood cells
   d. fat in our diet helps to keep water balance in the body
   e. fat in our diet affects how minerals are used in the body
   f. don't know

10. The best way for a swimmer to lose weight is to

   a. eliminate fruits from the diet
   b. take several sauna baths
   c. eat less of all foods
   d. eliminate vegetables from the diet
   e. eat less bread and other carbohydrate foods
   f. don't know

11. Which one of the following foods is the best source of carbohydrate?

   a. celery
   b. orange
   c. ground beef
   d. cheddar cheese
   e. macaroni
   f. don't know

12. Which one of the following statements is true?

   a. vitamin A should be taken in large amounts by all swimmers
   b. vitamin A prevents scurvy
   c. vitamin A is needed in our diet to build strong bones and teeth
   d. vitamin A helps prevent the common cold
   e. vitamin A affects how quickly our eyes adjust to changes in light
   f. don't know

13. Which one of the following statements is true?

   a. vitamin E increases endurance when taken in large amounts
   b. vitamin E affects water absorption and retention
   c. vitamin E needs are met by eating a balanced diet
   d. vitamin E is absorbed in our body as a protein
   e. vitamin E is used to make collagen, needed to cement cells together
   f. don't know

14. Iron is important in the body because

   a. it helps build the blood
   b. it prevents rickets
   c. it is needed for healthy skin
   d. it increases endurance when taken in large amounts
   e. it prevents scurvy
   f. don't know

15. Of the following, which would you include in a well-balanced diet?

   a. vegetables, bread, milk, meat (or other protein food)
   b. fruits, vegetables, bread, milk, meat (or other protein food), vitamin supplements
   c. fruits, milk, meat (or other protein food)
   d. fruits, vegetables, bread, milk, meat (or other protein food)
   e. fruits, vegetables, bread, meat (or other protein food)
   f. don't know

16. A swimmer obtains the highest quality protein from

   a. eggs
   b. steak
   c. cheese
   d. wieners
   e. all of the above
   f. don't know

17. Which one of the following statements is true?

a. butter and margarine are similar in calorie content
b. butter contains iron
c. margarine contains vitamin C
d. margarine contains iron
e. butter and margarine have a different calorie content
f. don't know

18. Which one of the following sources of vitamin C is best for body functions?

a. rose hips
b. strawberries
c. grapefruit
d. orange
e. all of the above are equally useful
f. don't know

19. Which one of the following foods contain the most iron?

a. banana
b. blackstrap molasses
c. whole milk
d. beef liver
e. whole grain bread
f. don't know

20. Nutritionists tell us that drinking milk

a. provides a source of iron for the body
b. affects how the blood carries oxygen
c. will protect us against scurvy
d. before a competition cuts a swimmer's wind
e. provides the best source of calcium for the body
f. don't know

21. Which one of the following statements is true?

a. salt lost in sweat during exercise must be replaced
b. a natural source of salt (such as biosalt) is better than ordinary table salt
c. salt in our diet helps to make us strong
d. salt affects how much vitamin A is stored in the body
e. table salt helps us meet our daily needs for vitamin C
f. don't know

22. Nutritionists have discovered that B vitamins

a. affect iron loss from the body
b. increase our number of red blood cells
c. improve muscular efficiency when taken in large amounts
d. are needed for producing energy in the body
e. affect calcium use in the body
f. don't know

P A R T B

The following statements are common attitudes. Please indicate how you feel about each of them by circling the appropriate response. If you are "uncertain," please indicate accordingly.

SA = Strongly Agree
A = Agree
? = Uncertain
D = Disagree
SD = Strongly Disagree

EXAMPLE:

	I sometimes like to watch television.	SA	(A)	?	D	SD
1.	I believe the best way to lose weight is to decrease intake of all foods.	SA	A	?	D	SD
2.	I feel organic foods are better for you than foods bought in a grocery store.	SA	A	?	D	SD
3.	I believe a swimmer should take protein supplements to improve performance.	SA	A	?	D	SD
4.	Everyone should take vitamin supplements.	SA	A	?	D	SD
5.	I believe a swimmer's body can adjust to taking in less water than is lost in sweat each day.	SA	A	?	D	SD
6.	I feel a well-balanced diet, without additional supplements, is a good diet for top performance.	SA	A	?	D	SD
7.	I sometimes take vitamin C supplements to improve performance.	SA	A	?	D	SD
8.	I feel honey is a better source of quick energy than table sugar.	SA	A	?	D	SD
9.	If I wanted to lose weight, a loss of six pounds per week is a safe loss.	SA	A	?	D	SD
10.	I believe a swimmer can take as many salt tablets as he/she wants without hazard.	SA	A	?	D	SD
11.	I sometimes eat a candy bar immediately before a competition to give me extra energy.	SA	A	?	D	SD
12.	I feel I get extra strength from eating a steak a few hours before a competition.	SA	A	?	D	SD
13.	I like to restrict my intake of fatty foods when I am in training.	SA	A	?	D	SD
14.	I take vitamin supplements just in case I do not get all the nutrients I need from my meals.	SA	A	?	D	SD
15.	Food additives are harmful.	SA	A	?	D	SD
16.	I believe the higher the carbohydrate content of my diet before a major event, the better my performance.	SA	A	?	D	SD
17.	Drinking milk the day of an event decreases my performance.	SA	A	?	D	SD
18.	I believe a well-balanced diet is necessary only if there is an important meet coming soon.	SA	A	?	D	SD
19.	I sometimes take vitamin E supplements to improve my performance.	SA	A	?	D	SD
20.	Everyone should take iron supplements.	SA	A	?	D	SD
21.	I sometimes take vitamin B supplements for added energy.	SA	A	?	D	SD

P A R T C

This is the last section to be completed. Please answer each of the following questions.

1. During training do you:

   (i) eat certain foods that you would not normally eat the rest of the year?

   _____Yes _____Sometimes _____No

   (ii) what foods?

   _____ _____

   _____ _____

2. During training do you:

   (i) avoid certain foods?

   _____Yes _____Sometimes _____No

   (ii) which foods?

   _____ _____

   _____ _____

3. During training do you:

   (i) take supplements?

   _____Yes _____Sometimes _____No

   (ii) which ones?

   _____ _____

   _____ _____

4. Before a major competition do you:

   (i) eat anything special?

   _____Yes _____Sometimes _____No

   (ii) what?

   _____ _____

   _____ _____

5. Before a major competition do you:

   (i) avoid certain foods?

   _____Yes _____Sometimes _____No

   (ii) what?

   _____ _____

   _____ _____

6. Before a major competition do you:

   (i) take supplements?

   _____Yes _____Sometimes _____No

   (ii) which ones?

   _____ _____

   _____ _____

7. If you needed information on what foods are good for athletes, where would you go? Please check (✓) one.

   _____doctor _____parent _____coach _____magazines _____books

   _____friend _____nurse _____nutritionist _____other (please specify)

THANK YOU for you willingness to participate in this study. Your cooperation in completing the 3-day diet record and answering this questionnaire was greatly appreciate

APPENDIX C

Tips For Keeping Your Diet Diary

1. Please record everything you eat or drink (except water) everyday for 3 days: THURSDAY, October 21, FRIDAY, October 22, and SUNDAY, October 24. Remember to include everything taken between meals; for instance, before coming to the pool in the morning, watching television, at bedtime, etc.

2. Eat as you usually do. Please do not change your diet for this survey.

3. List the food or drink (except water) in the order taken.

4. Use a separate line for each food or drink.

5. In the column "when," please write the time of day the food was eaten.

6. In the column "where," please write the place where the food was eaten.

7. In the "amount" column, record the amount as indicated on the sheet "Suggested Ways of Measuring and Describing Foods in the Diet."

8. In the "description" column, please record a description of the item as outlined on the sheet "Suggested Ways of Measuring and Describing Foods in the Diet."

9. For combination foods, please list each item separately. For example, stew would be entered as meat, potatoes, carrots, gravy, etc., and you would record the amount of each of these items you ate.

10. Do not forget to include items such as butter, margarine, jam, gravy, sauces, sugar, canned milk, etc. Include candy, pop, etc.--anything that is consumed.

11. Please try to be as accurate as possible when recording the "amount" and "description" of food eaten. If you like, have a member of your family help you complete this section.

12. There is a separate form for each day of the study--Thursday, Friday, and Sunday. Please remember to return each completed form at the next scheduled morning practise; that is, return Thursday's form on Friday morning, Friday's form on Saturday morning and Sunday's form on Monday morning. Note: there is no food record to be kept on Saturday.

13. Thank you for your willingness to participate in this study. In appreciation, there will be a $3.00 token made to all those who turn in the 3-day food record and answer the questionnaire.

Tips For Measuring and Describing Foods in Your Diet Diary

Milk (whole, 2%, skim, powdered, canned) (in tea, coffee, on cereal)	cups, tablespoons, teaspoons tumbler (large or small)
Cereals (dry, cooked, presweetened)	tablespoons, cups
Bread (white, brown, whole wheat, rye, home-made)	slices
Potatoes (mashed, boiled, fried, chips, french fries)	tablespoons, cups, or compare with size of an egg
Sugar (white, brown) (in tea, coffee, on cereal)	tablespoons or teaspoons
Puddings (with or without milk)	tablespoons or cups
Biscuits (baking powder, tea, cheese)	number
Jam, jelly, peanut butter	tablespoons or teaspoons
Sweets, chocolate	size, number
Meat, fish, poultry, etc.	slices $3\frac{1}{2}$" x $2\frac{1}{2}$" x $\frac{1}{2}$" OR $3\frac{1}{2}$" x $2\frac{1}{2}$" x $\frac{1}{4}$" 1 drumstick, 1 chop
Ice cream	tablespoons, scoop (large or small)
Cake - type Cookies type	length, width, height or diameter and height
Cod liver oil, nutrient supplements like vitamins (content/unit)	tablespoons, teaspoons, number of tablets

Here is an example for you to follow when keeping a record of your Diet Diary

WHEN	WHERE	AMOUNT	ITEM	DESCRIPTION
6 A.M.	pool	1 cup	milk	2%
8 A.M.	home	1 slice	bread	60% whole wheat
8 A.M.	home	1 tsp.	butter	
10:30 A.M.	school	1	candy	hard, chocolate coated, coconut center
12:00 Noon	school	1 tablet	vitamin pill	vitamin C (1 tablet= 100 mg Vitamin C)
Etc.				

NAME: ______________________

DATE: ______________________

YOUR DIET DIARY

WHEN	WHERE	AMOUNT	ITEM	DESCRIPTION

WHEN	WHERE	AMOUNT	ITEM	DESCRIPTION

Is this a typical day? _____ Yes _____ No

If not, please explain why. _____

_____

Did you take any supplements today? _____ Yes _____ No

If yes, please specify the nutrient, the amount taken (tsp. or # tablets) and describe the nutrient content of each tablet or spoonful (e.g. 1 tablet=500 mg., etc.)

_____

_____

PLEASE RETURN THESE 2 SHEETS AT THE NEXT MORNING PRACTICE

APPENDIX D

As a graduate student at the University of Manitoba, I am presently working on my thesis project. The following study has been designed to partially fullfill the requirements for a Master of Science degree in "Foods and Nutrition."

Competitive swimmers from the five competive swim clubs in Winnipeg were chosen for the sample population; however, only those swimmers who were classed as "A" or "AA" at the end of the summer and those 13 years of age and older will be studied.

The objective of the study is to determine the nutrition knowledge and practises of competitive swimmers in Winnipeg and to determine the athlete's attitudes toward nutrition. The swimmers involved will be asked to keep a 3-day dietary record of everything they eat or drink within a specified time period and to complete a short questionnaire. Confidentiality will be maintained under all circumstances.

Although I will be in touch with you throughout the duration of this study, please feel free to contact me at anytime.

Business Address

Graduate Office
Department of Foods and Nutrition
Faculty of Home Economics
University of Manitoba

Business Telephone

474-9554

Residence

80 Bret Bay
(North Kildonan)
Winnipeg

Residence Telephone

668-3173

KAREN MACFADYEN

Karen MacFadyen

Dietary Interviewers' Instructions

THURSDAY, OCTOBER 21

1. Be at the pool by the time designated on the attached sheet. Introduce yourself to the coach. Ask him to show you the room for meeting with the athletes.

2. When all the swimmers have assembled, have those who have been contacted for the study (i.e. classed as "A" or "AA" and 13 years of age or older) go to the designated room. Please announce that any swimmer 13 years of age or older who achieved "A" times in the summer but because of a birthday dropped to a "B" category may participate in the study if he/she wishes. Similarly, any swimmer who meets the requirements but was not contacted may also participate. Announce that there is a $3.00 token for those who participate in the study, turn in 3 days of food records, and answer the questionnaire.

3. In a separate room, give the athletes a brief outline of the study.
   - Project was designed to supplement present information on nutrition in adolescents and will help fullfill part of the requirements for a Master's degree in Nutrition.
   - The study involves assessment of the relation between nutrition knowledge, attitudes and practises of competitive swimmers in Winnipeg; however, any group could have been studied.
   - As a dietary interviewer, they have been hired to assist the student involved.
   - Study involves "A" and "AA" swimmers, 13 years of age and older, from the five competitive swim clubs in Winnipeg.
   - Methodology includes a 3 day dietary intake and questionnaire.
   - The athlete must sign their names on the dietary record sheet in order to recheck any incomplete forms and on the questionnaire to compare (on an individual basis) the relation between knowledge, attitudes and practises.
   - Confidentiality will be maintained under all circumstances. Individual diet record sheets and questionnaires will be given a numerical code when the results are analyzed. No names will be released.
   - There will be feedback to the athletes and coaches on the results of the study.

4. Pass around a sheet to get the swimmers' names. Cross-check with the list provided. On subsequent days, check off the names as you go over the diet intake record. If any athlete is not there, please let me know and I will contact him/her.

5. Instructions on completing the diet intake record.
   - Distribute the dietary intake forms and instructions for recording food intake.
   - Go over the instructions and the example given.
   - Review the sheet on "Suggested Ways of Measuring and Describing Foods in the Diet." Also demonstrate techniques for measuring meat, fish, poultry, etc.; and discuss ways to describe any nutrient supplements which may be consumed (kind, content, brand name).

- Emphasize the importance of the athletes completing the forms accurately.
- All food or drink consumed (except water) on each of the 3 days of the study must be recorded--including any food or drink taken before coming to the pool in the morning. The first day of the study is THURSDAY, OCTOBER 21.
- Remind them to return the completed forms at the next morning practise.
- Emphasize that there are six dietary intake sheets, two sheets for each day of the study. If more space is needed, suggest the swimmers write on the backs of the sheets provided. Food records are to be kep THURSDAY, October 21; FRIDAY, October 22, and SUNDAY, October 24.

6. Answer any questions before the swimmers start their morning practise. Remain at the pool until practise is over. Check with the coach about the next meeting with the athletes to confirm the pre-arranged time.

FRIDAY, OCTOBER 22

1. Return to the pool at the pre-arranged time and meet with the athletes as you did on the first day.

2. Answer any questions. Collect the first day's diet record. Remind the athletes to include in Friday's forms anything consumed before coming to practise and to return the form on Saturday morning.

3. Check the first day's record while the swimmers are in the pool. If there are any incomplete forms, ask the coach if you may talk with the athlete involved for a few minutes. The coaches have granted permission for us to interrupt the swimmer's practise to clear up any such misunderstandings. Possible errors might be forgetting to include butter with toast, milk in coffee or tea, etc. When checking for errors, try to ask indirect questions; for instance: "Was there anything else on your bread?" rather than "Did you use butter and/or jam?"
Speak With only one athlete at at time when correcting any errors in the diet intake forms.

4. Check over the list of names you took on Thursday. If any athletes are absent, please contact me promptly.

5. Remain at the pool until after practise. Confirm with the coach when to come to the pool on Saturday morning.

SATURDAY, OCTOBER 23

1. Return to the pool at the scheduled time. Meet with the athletes, collect Friday's food records and remind the athletes that the next food record to keep is on Sunday. Re-emphasize that everything eaten that day, must be recorded; as well as the amount and a description of the food or beverage.

2. Check Friday's food record while the athletes are having their morning practise. If there are any incomplete forms, contact these athletes, (one at a time) during the practise session to clear up any problem areas in recording food intake accurately and correctly.

3. Check over the list of names of the athletes in the study. Please let me know if any individuals are not cooperating or if any swimmers have decided not to participate.

4. Remain at the pool until after practise. Confirm with the coach when to come to the pool on Monday morning to check Sunday's food records and to give the questionnaire. The latter will take approximately 20-25 minutes to complete.

MONDAY, OCTOBER 25

1. Arrive at the pool at the scheduled time. Meet with the athletes, collect Sunday's food records and check these forms while the athletes are swimming.

2. Administer the questionnaire at the time specified by the coach.

3. Payment of the token will be arranged as soon as possible. Also remind those involved that there will be some feedback from the results of the study.

APPENDIX E

APPENDIX E

TABLE I

DISTRIBUTION OF NUTRITION KNOWLEDGE SCORES BY AGE OF RESPONDENTS

Age (years)	NUTRITION KNOWLEDGE SCORE			
	Low[1]	Medium[2]	High[3]	Total
	Percent of Respondents[1]			
13-15	20.8	30.7	15.8	67.3
16-18	5.0	15.8	5.9	26.7
19 and Over	1.0	2.0	3.0	6.0
Total	26.8	48.5	24.7	100.0
		$X^2 = 4.05$ df = 4	$P < 0.40$	

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

[4] Since n = 101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

APPENDIX E

TABLE II

DISTRIBUTION OF NUTRITION KNOWLEDGE SCORES BY SEX OF RESPONDENTS

Sex	NUTRITION KNOWLEDGE SCORE			
	Low[1]	Medium[2]	High[3]	Total
	Percent of Respondents[4]			
Male	12.9	17.8	6.9	37.6
Female	13.9	30.7	17.8	62.4
Total	26.8	48.5	24.7	100.0

$X^2 = 2.28$ df = 2 $P < 0.32$

[1] 0-8 correct responses

[2] 9-12 correct responses

[3] 13-22 correct responses

[4] Since n = 101, the number and percent of respondents is similar. Thus, only percent of respondents is indicated.

APPENDIX F

TABLE 1

PERCENTAGE DISTRIBUTION OF KILOCALORIES

KCAL/DAY	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0 - 249	0.0	0.0	0.0	0.0	0.0	0.0
250 - 499	0.0	0.0	0.0	0.0	0.0	0.0
500 - 749	0.0	0.0	0.0	0.0	0.0	0.0
750 - 999	0.0	2.2	0.0	6.3	0.0	0.0
1000 - 1249	0.0	2.2	0.0	0.0	0.0	0.0
1250 - 1499	0.0	0.0	0.0	0.0	0.0	0.0
1500 - 1749	0.0	4.4	0.0	0.0	0.0	0.0
1750 - 1999	0.0	6.5	0.0	6.3	0.0	0.0
2000 - 2249	9.1	13.0	0.0	6.3	0.0	0.0
2250 - 2499	9.1	6.5	0.0	18.8	0.0	0.0
2500 - 2749	18.2	13.0	0.0	25.0	20.0	100.0
2750 - 2999	0.0	10.9	0.0	0.0	20.0	0.0
3000 - 3249	0.0	21.7	0.0	6.3	20.0	0.0
3250 - 3499	4.5	6.5	18.2	18.8	0.0	0.0
3500 - 3749	9.1	8.7	18.2	0.0	20.0	0.0
3750 - 3999	18.2	4.4	0.0	0.0	0.0	0.0
4000 - 4249	4.5	0.0	9.1	0.0	0.0	0.0
4250 - 4499	13.6	0.0	18.2	6.3	20.0	0.0
4500 - 4749	4.5	0.0	0.0	6.3	0.0	0.0
4750 - 4999	0.0	0.0	9.1	0.0	0.0	0.0
5000	9.1	0.0	27.3	0.0	0.0	0.0
Sample Size	22	46	11	16	5	1

TABLE 2

PERCENTAGE DISTRIBUTION OF DIETARY PROTEIN

G/DAY	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0 - 19	0.0	0.0	0.0	0.0	0.0	0.0
20 - 39	0.0	0.0	0.0	6.3	0.0	0.0
40 - 59	0.0	6.5	0.0	0.0	0.0	0.0
60 - 79	13.6	28.3	0.0	31.3	20.0	100.0
80 - 99	9.1	19.6	0.0	25.0	0.0	0.0
100 - 119	18.2	23.9	0.0	25.0	40.0	0.0
120 - 139	22.7	10.9	27.3	0.0	0.0	0.0
140 - 159	13.6	6.5	18.2	12.5	20.0	0.0
160 - 179	4.5	2.2	27.3	0.0	0.0	0.0
180 - 199	0.0	2.2	18.2	0.0	0.0	0.0
200 - 219	13.6	0.0	0.0	0.0	20.0	0.0
220 - 239	0.0	0.0	0.0	0.0	0.0	0.0
240 - 259	4.5	0.0	0.0	0.0	0.0	0.0
260 - 279	0.0	0.0	0.0	0.0	0.0	0.0
280 - 299	0.0	0.0	0.0	0.0	0.0	0.0
300 - 319	0.0	0.0	0.0	0.0	0.0	0.0
320 - 339	0.0	0.0	0.0	0.0	0.0	0.0
340 - 359	0.0	0.0	0.0	0.0	0.0	0.0
360 - 379	0.0	0.0	0.0	0.0	0.0	0.0
380 - 399	0.0	0.0	0.0	0.0	0.0	0.0
400 +	0.0	0.0	0.0	0.0	0.0	0.0
Sample Size	22	46	11	16	5	1

TABLE 3

PERCENTAGE DISTRIBUTION OF DIETARY CALCIUM

MG/DAY	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0 - 99	0.0	0.0	0.0	0.0	0.0	0.0
100 - 199	0.0	0.0	0.0	0.0	0.0	0.0
200 - 299	0.0	0.0	0.0	0.0	0.0	0.0
300 - 399	0.0	0.0	0.0	0.0	0.0	0.0
400 - 499	0.0	0.0	0.0	12.5	0.0	0.0
500 - 599	0.0	2.2	0.0	0.0	0.0	0.0
600 - 699	0.0	6.5	0.0	0.0	0.0	0.0
700 - 799	4.5	6.5	0.0	12.5	4.5	100.0
800 - 899	0.0	2.2	0.0	6.3	0.0	0.0
900 - 999	4.5	4.4	0.0	0.0	4.5	0.0
1000 - 1199	0.0	13.0	0.0	12.5	0.0	0.0
1200 - 1399	9.1	17.4	0.0	6.3	9.1	0.0
1400 - 1599	9.1	4.4	0.0	18.8	9.1	0.0
1600 - 1799	4.5	8.7	9.1	0.0	4.5	0.0
1800 - 1999	9.1	15.2	18.2	18.8	9.1	0.0
2000 - 2199	18.2	4.4	9.1	6.3	18.2	0.0
2200 - 2399	18.2	2.2	0.0	0.0	18.2	0.0
2400 - 2599	0.0	4.4	0.0	0.0	0.0	0.0
2600 - 2799	0.0	4.4	9.1	0.0	0.0	0.0
2800 - 2999	4.5	0.0	9.1	0.0	4.5	0.0
3000 +	18.2	4.4	45.5	6.3	18.2	0.0
Sample Size	22	46	11	16	5	1

TABLE 4

PERCENTAGE DISTRIBUTION OF DIETARY PHOSPHORUS

MG/DAY	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0 - 99	0.0	0.0	0.0	0.0	0.0	0.0
100 - 199	0.0	0.0	0.0	0.0	0.0	0.0
200 - 299	0.0	0.0	0.0	0.0	0.0	0.0
300 - 399	0.0	0.0	0.0	0.0	0.0	0.0
400 - 499	0.0	2.2	0.0	0.0	0.0	0.0
500 - 599	0.0	2.2	0.0	6.3	0.0	0.0
600 - 699	0.0	0.0	0.0	0.0	0.0	0.0
700 - 799	0.0	6.5	0.0	6.3	0.0	0.0
800 - 899	0.0	2.2	0.0	0.0	20.0	0.0
900 - 999	0.0	2.2	0.0	6.3	0.0	0.0
1000 - 1199	9.1	23.9	0.0	37.5	20.0	0.0
1200 - 1399	4.5	13.0	0.0	12.5	0.0	100.0
1400 - 1599	13.6	10.9	0.0	18.8	20.0	0.0
1600 - 1799	9.1	6.5	0.0	0.0	0.0	0.0
1800 - 1999	18.2	10.9	27.3	0.0	0.0	0.0
2000 - 2199	4.5	6.5	0.0	0.0	0.0	0.0
2200 - 2399	13.6	6.5	18.2	0.0	20.0	0.0
2400 - 2599	9.1	2.2	9.1	6.3	0.0	0.0
2600 - 2799	4.5	0.0	0.0	0.0	20.0	0.0
2800 - 2999	4.5	2.2	27.3	0.0	0.0	0.0
3000 +	9.1	2.2	18.2	6.3	0.0	0.0
Sample Size	22	46	11	16	5	1

TABLE 5

PERCENTAGE DISTRIBUTION OF DIETARY IRON

MG/DAY	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0.0 - 5.9	0.0	2.2	0.0	6.3	0.0	0.0
6.0 - 7.9	0.0	2.2	0.0	0.0	0.0	0.0
8.0 - 9.9	9.1	4.4	0.0	12.5	0.0	0.0
10.0 - 11.9	9.1	15.2	0.0	18.8	20.0	0.0
12.0 - 13.9	13.6	13.0	0.0	6.3	20.0	100.0
14.0 - 15.9	4.5	32.6	9.1	27.3	20.0	0.0
16.0 - 17.9	13.6	15.2	9.1	0.0	20.0	0.0
18.0 - 19.9	9.1	6.5	36.4	6.3	0.0	0.0
20.0 - 21.9	18.2	2.2	9.1	6.3	0.0	0.0
22.0 - 23.9	0.0	2.2	27.3	6.3	0.0	0.0
24.0 - 25.9	9.1	0.0	0.0	0.0	20.0	0.0
26.0 - 27.9	9.1	0.0	0.0	0.0	0.0	0.0
28.0 - 29.9	0.0	0.0	0.0	0.0	0.0	0.0
30.0 - 31.9	4.5	0.0	9.1	0.0	0.0	0.0
32.0 - 33.9	0.0	0.0	0.0	0.0	0.0	0.0
34.0 - 35.9	0.0	0.0	0.0	0.0	0.0	0.0
36.0 - 37.9	0.0	0.0	0.0	0.0	0.0	0.0
38.0 - 39.9	0.0	0.0	0.0	0.0	0.0	0.0
40.0 - 41.9	0.0	0.0	0.0	0.0	0.0	0.0
42.0 - 43.9	0.0	0.0	0.0	0.0	0.0	0.0
44.0 +	0.0	0.0	0.0	0.0	0.0	0.0
Sample Size	22	46	11	16	5	1

TABLE 6

PERCENTAGE DISTRIBUTION OF DIETARY VITAMIN A

MCG RETINOL EQUIV./DAY	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0 - 249	0.0	0.0	0.0	0.0	0.0	0.0
250 - 499	13.6	15.2	0.0	25.0	20.0	0.0
500 - 749	18.2	28.3	27.3	18.8	20.0	0.0
750 - 999	27.3	23.9	27.3	12.5	40.0	0.0
1000 - 1249	18.2	15.2	0.0	6.3	0.0	0.0
1250 - 1499	4.5	2.2	9.1	12.5	20.0	0.0
1500 - 1749	0.0	6.5	18.2	6.3	0.0	100.0
1750 - 1999	9.1	0.0	9.1	6.3	0.0	0.0
2000 - 2249	4.5	4.4	0.0	6.3	0.0	0.0
2250 - 2499	0.0	0.0	9.1	0.0	0.0	0.0
2500 - 2749	0.0	2.2	0.0	0.0	0.0	0.0
2750 - 2999	4.5	0.0	0.0	6.3	0.0	0.0
3000 - 3249	0.0	0.0	0.0	0.0	0.0	0.0
3250 - 3499	0.0	0.0	0.0	0.0	0.0	0.0
3500 - 3749	0.0	2.2	0.0	0.0	0.0	0.0
3750 - 3999	0.0	0.0	0.0	0.0	0.0	0.0
4000 - 4749	0.0	0.0	0.0	0.0	0.0	0.0
4250 - 4499	0.0	0.0	0.0	0.0	0.0	0.0
4500 - 4749	0.0	0.0	0.0	0.0	0.0	0.0
4750 - 4999	0.0	0.0	0.0	0.0	0.0	0.0
5000 +	0.0	0.0	0.0	0.0	0.0	0.0
Sample Size	22	46	11	16	5	1

TABLE 7

PERCENTAGE DISTRIBUTION OF DIETARY THIAMIN

MG/1000 KCAL.	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0.00 - 0.19	0.0	0.0	0.0	0.0	0.0	0.0
0.20 - 0.29	0.0	0.0	0.0	0.0	0.0	0.0
0.30 - 0.39	0.0	0.0	0.0	0.0	0.0	0.0
0.40 - 0.49	0.0	2.2	0.0	6.3	20.0	100.0
0.50 - 0.59	0.0	2.2	0.0	0.0	20.0	0.0
0.60 - 0.69	0.0	0.0	0.0	0.0	0.0	0.0
0.70 - 0.79	0.0	0.0	0.0	0.0	0.0	0.0
0.80 - 0.89	0.0	4.4	0.0	0.0	0.0	0.0
0.90 - 0.99	0.0	4.4	0.0	6.3	20.0	0.0
1.00 - 1.09	0.0	15.2	0.0	6.3	0.0	0.0
1.10 - 1.19	13.6	2.2	0.0	18.8	0.0	0.0
1.20 - 1.29	4.5	13.0	0.0	6.3	0.0	0.0
1.30 - 1.39	13.6	4.4	0.0	18.8	20.0	0.0
1.40 - 1.49	0.0	10.9	0.0	0.0	20.0	0.0
1.50 - 1.59	0.0	15.2	0.0	6.3	0.0	0.0
1.60 - 1.69	0.0	10.9	0.0	12.5	0.0	0.0
1.70 - 1.79	4.5	6.5	0.0	6.3	0.0	0.0
1.80 - 1.89	13.6	6.5	27.3	0.0	0.0	0.0
1.90 - 1.99	13.6	2.2	9.1	0.0	0.0	0.0
2.00 - 2.09	0.0	0.0	9.1	0.0	0.0	0.0
2.10 +	36.4	0.0	54.5	12.5	0.0	0.0
Sample Size	22	46	11	16	5	1

TABLE 8

PERCENTAGE DISTRIBUTION OF DIETARY RIBOFLAVIN

MG/1000 CAL.	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0.00 - 0.29	0.0	0.0	0.0	0.0	0.0	0.0
0.30 - 0.44	0.0	0.0	0.0	0.0	0.0	0.0
0.45 - 0.59	0.0	2.2	0.0	6.3	0.0	100.0
0.60 - 0.74	0.0	2.2	0.0	0.0	0.0	0.0
0.75 0.89	0.0	0.0	0.0	0.0	0.0	0.0
0.90 - 1.04	0.0	2.2	0.0	0.0	0.0	0.0
1.05 - 1.19	0.0	6.5	0.0	6.3	0.0	0.0
1.20 - 1.34	9.1	17.4	0.0	6.3	0.0	0.0
1.35 - 1.49	9.1	4.4	0.0	18.8	0.0	0.0
1.50 - 1.64	13.6	10.9	0.0	18.8	20.0	0.0
1.65 - 1.79	4.5	10.9	0.0	6.3	20.0	0.0
1.80 - 1.94	0.0	21.7	0.0	6.3	20.0	0.0
1.95 - 2.09	4.5	8.7	18.2	18.8	0.0	0.0
2.10 - 2.24	4.5	6.5	18.2	0.0	0.0	0.0
2.25 - 2.39	22.7	6.5	0.0	0.0	0.0	0.0
2.40 - 2.54	4.5	0.0	18.2	0.0	20.0	0.0
2.55 - 2.69	13.6	0.0	18.2	0.0	0.0	0.0
2.70 - 2.84	4.5	0.0	0.0	12.5	0.0	0.0
2.85 - 2.99	0.0	0.0	9.1	0.0	20.0	0.0
3.00 - 3.14	0.0	0.0	9.1	0.0	0.0	0.0
3.15 +	9.1	0.0	9.1	0.0	0.0	0.0
Sample Size	22	46	11	16	5	1

TABLE 9

PERCENTAGE DISTRIBUTION OF DIETARY NIACIN

MG/1000 KCAL.	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0.0 - 1.4	0.0	0.0	0.0	0.0	0.0	0.0
1.5 - 2.9	0.0	0.0	0.0	0.0	0.0	0.0
3.0 - 4.4	0.0	0.0	0.0	0.0	0.0	0.0
4.5 - 5.9	0.0	0.0	0.0	6.3	0.0	0.0
6.0 - 7.4	0.0	2.2	0.0	0.0	0.0	0.0
7.5 - 8.9	0.0	2.2	0.0	0.0	0.0	0.0
9.0 - 10.4	0.0	0.0	0.0	0.0	0.0	0.0
10.5 - 11.9	0.0	4.4	0.0	0.0	0.0	0.0
12.0 - 13.4	0.0	10.9	0.0	6.3	0.0	0.0
13.5 - 14.9	13.6	10.9	0.0	6.3	0.0	0.0
15.0 - 16.4	4.5	4.4	0.0	12.5	0.0	0.0
16.5 - 17.9	13.6	10.9	0.0	25.0	20.0	100.0
18.0 - 19.4	4.5	10.9	0.0	6.3	20.0	0.0
19.5 - 20.9	0.0	17.4	0.0	6.3	20.0	0.0
21.0 - 22.4	0.0	10.9	0.0	12.5	0.0	0.0
22.5 - 23.9	4.5	4.4	18.2	6.3	0.0	0.0
24.0 - 25.4	18.2	6.5	18.2	0.0	0.0	0.0
25.5 - 26.9	9.1	4.4	0.0	0.0	20.0	0.0
27.0 - 28.4	4.5	0.0	0.0	0.0	0.0	0.0
28.5 - 29.9	18.2	0.0	27.3	6.3	0.0	0.0
30.0 +	9.1	0.0	36.4	6.3	20.0	0.0
Sample Size	22	46	11	16	5	1

TABLE 10

PERCENTAGE DISTRIBUTION OF DIETARY VITAMIN C

MG/DAY	AGE (YEARS) AND SEX OF RESPONDENTS					
	13-15		16-18		19 and Over	
	Male	Female	Male	Female	Male	Female
0 - 19	0.0	0.0	0.0	0.0	0.0	0.0
20 - 39	0.0	2.2	0.0	12.5	40.0	0.0
40 - 59	4.5	6.5	0.0	0.0	0.0	0.0
60 - 79	13.6	8.7	0.0	18.8	0.0	0.0
80 - 99	14.5	6.5	0.0	6.3	0.0	0.0
100 - 119	13.6	17.4	18.2	12.5	0.0	0.0
120 - 139	9.1	8.7	9.1	6.3	0.0	0.0
140 - 159	0.0	13.0	9.1	0.0	20.0	0.0
160 - 179	9.1	6.5	9.1	12.5	0.0	0.0
180 - 199	13.6	6.5	0.0	6.3	20.0	100.0
200 - 219	0.0	2.2	0.0	6.3	0.0	0.0
220 - 239	4.5	4.4	18.2	6.3	0.0	0.0
240 - 259	0.0	6.5	18.2	0.0	20.0	0.0
260 - 279	13.6	4.4	0.0	0.0	0.0	0.0
280 - 299	4.5	2.2	0.0	6.3	0.0	0.0
300 - 319	0.0	0.0	9.1	6.3	0.0	0.0
320 - 339	0.0	2.2	0.0	0.0	0.0	0.0
340 - 359	0.0	0.0	0.0	0.0	0.0	0.0
360 -379	0.0	0.0	0.0	0.0	0.0	0.0
380 - 399	0.0	0.0	0.0	0.0	0.0	0.0
400 +	0.0	2.2	0.0	0.0	0.0	0.0
Sample Size	22	46	11	16	5	1