NUTRITION KNOWLEDGE OF OHIO HIGH SCHOOL WRESTLING COACHES

A Thesis
Presented in Partial Fulfillment of the Requirements for the Degree Master of Science

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CHAPTER I
INTRODUCTION

Background and Need

There is much discussion over what constitutes an optimum diet for athletes. Misconceptions, misinformation, and food faddism abound in athletic circles. The young impressionable athlete often seeks the advice of peers, trainers, or coaches on the diet which may help to improve performance. In a national study of the practices of secondary coaches in recommending diets, Horwood (1) concluded most coaches based their food advice on personal experience rather than following guidelines of nutritionists. Cho (2) in a study of nutrition knowledge conducted at Kansas State University revealed male physical education majors considered high school and college coaches an important source of nutrition knowledge.

Bullen et al. (3) stated that one of the ironies of modern athletics is that there are specialized sports in which a degree of overweight is useful or at least not detrimental. In younger athletes, particularly those of high school age, normal increments in weight should be expected for growth, which requires increased caloric allowances. Weight is the major criterion for participation in the sport
of wrestling. It was reported by the American Journal of Clinical Nutrition (4) coaches and trainers often advise young wrestlers to lose body weight by "crash" caloric restriction or by dehydration in order to reach their competition weight, and these practices can result in a severe burden on the heart which may cause permanent impairment of health, and even death.

Purpose

The purpose of this study was to evaluate the nutritional knowledge of Ohio high school wrestling coaches. The objectives of the study were (1) to compare the knowledge of the coaches who had majored in either physical education or health, to those coaches who had majored in other areas; (2) to compare the coaches' scores when grouped by school size (Class AAA, AA, or A); and to (3) compare the coaches' scores when grouped by years of coaching. Additional concerns were to develop an instrument by which this knowledge could be compared with a group of students whose area of specialization is nutrition.

The target population was a stratified random sample of high school wrestling coaches in the state of Ohio. The wrestling coaches selected for the sample were mailed a questionnaire with a cover letter written by Chris Ford, assistant professor and head wrestling coach at Ohio State.
It was hypothesized that: wrestling coaches who majored in health or physical education would score significantly higher on the test of nutrition knowledge than those who did not. It was further hypothesized that there would be a significant difference between the coaches' scores when grouped by school size, and between the coaches' scores when grouped by years of coaching. Stated in the null form, the hypotheses were:

1. There is no significant difference between the mean scores of those subjects who majored in physical education or health, and those who did not.

2. There is no significant difference between the mean test scores when coaches are grouped according to number of years of coaching or school size.

Nutrition knowledge was determined by the score obtained on the questionnaire. It was assumed that the coaches' attitudes were a reflection of their knowledge of the subject.

Total possible score for the thirty questions was 150 points, and the minimum score possible was 30 points.

The major premise on which this study is based is that coaches who know basic principles of applied nutrition are not likely to encounter the problems of "making weight," specifically starvation and dehydration. Therefore, this study was conducted in an attempt to measure the coaches' knowledge of these principles.
CHAPTER II

LITERATURE REVIEW

The literature in the area of athletics and nutrition was reviewed as it was pertinent to the study. It is of considerable interest that the implications of nutrition to athletics have long been known. The nutritional practices of wrestlers and boxers have been written about since the beginning of organized sports.

Guyton (5) states that the basic living unit of the body is the cell, and each organ is actually an aggregate of many different cells held together by intercellular supporting structures. Cells are capable of living, growing, and performing their special functions so long as the proper concentration of oxygen, glucose, the different ions, amino acids, and fatty substances are available in the internal environment. The different substances (water, electrolytes, protein, lipids, and carbohydrates) that make up the cell are collectively called protoplasm. The fluid medium of all protoplasm is water, which is present in a concentration between 70 and 85 percent.

According to Pike and Brown (6), nutrition is the science that interprets the relationship of food to the
functioning of the living organism. It includes the uptake of food, liberation of energy, elimination of wastes, and all synthesis essential for maintenance, growth, and reproduction. These fundamental activities are characteristic of all living organisms from the simplest to the most complex plants and animals.

Durnin (7) reports there is probably no sphere of nutrition in which faddism and ignorance are more obvious than in athletics. Ryan and Allman (8) conclude that an athlete is no better than the adequacy of his nutrition.

Bullen et al. (3) state for centuries, trainers and coaches have advocated special dietary schemes for their athletes stemming from older superstitions and traditions. Many of these schemes were based on the belief that the ingestion of particular foods would augment the physical capacity or efficiency of the performer.

Harris (9) reports that well before 600 B.C. the program of athletic events at Olympia became stereotyped, and it remained unchanged until the games were abandoned in the fourth century A.D. The Olympic games consisted of three fighting events, boxing, wrestling, and a specialized form of wrestling called the pankration, two running events, and finally the pentathlon, which also included wrestling. The wrestling and boxing events were the most popular with spectators, and for this reason, Greek writers, when they speak of athletes, are often referring only to the boxers or
wrestlers. In the fighting events, there were no division of competitors into classes by weight, and so, only the heavy weights had any chance of winning.

According to Harris (9), much of the evidence available clearly related to the eating habits of these heavy weights, whose eating habits were very different from those of the sprinters. The temptation to eat large quantities of meat must have been particularly strong for competitors in the fighting events where sheer body mass counted so much. The earliest Greek athlete of whose special diet we are told is Charmis of Sparta who is said to have trained on a diet of dried figs.

Van Itallie et al. (10) state for many centuries the popular belief existed that violent muscular exercise required the eating of a large amount of meat. The practice was first recorded in the 5th century B.C., and was ascribed to two Greek athletes who deviated from the chiefly vegetarian diet to a regimen entailing the ingestion of large quantities of meat. Harris (9) reports that the daily diet of Milo of Croton is said to have consisted of 20 pounds of meat, 20 pounds of bread, and 8 pints of wine.

According to Bullen et al. (3) during the fifth century a change in the cultural outlook on physical fitness became apparent. Instead of a broad prerequisite for participation in the defense of the country, physical fitness became
subordinate to training for specific sports, and excellence in which became superior to almost all other values. Van Itallie et al. (10) report the interest in the diet of athletes paralleled the growing interest in sports which became apparent in England toward the end of the 18th century. Early in the 19th century, it was customary for the athlete to begin his training with a series of strong purges to clear away "all noxious matter he may have had in his stomach and intestines."

Guyton (5) states that heavy exercise is one of the most stressful conditions to which the body is ever subjected. Bullen et al. (3) feel it is extremely difficult to evaluate the effect of a single food component on physical performance because of the interference of such variables as motivation, differences in experimental conditions, types of work performed, and the wide range of individual response.

According to the Dairy Council (11), one possible factor in determining the nutrition needs of the athlete is that there is a difference in physiological demands imposed upon the body by different types of exertion. Steel (12) agrees that the caloric requirement of the athlete is influenced by caloric expenditure and also varies according to the body weight of the individual and type and amount of training undertaken. An overweight person expends more energy and burns more of his body reserves to accomplish the same amount
of work than he would if he were at his desirable weight.

Mayer and Bullen (13) conclude that the first nutritional requirement in athletic performance is the caloric cost of the type of activity considered. Bullen et al. (3) report the over-all caloric requirement might range from 3,00-6,00 kilocalories per day for an athlete, depending upon the intensity and duration of the daily exercise.

Ryan and Allman (8) say that the nutrients obtained from ingested food provide the building blocks for the athlete's growth, development, and maturation, plus the fuel elements for routine energy expenditure, and for initiation and maintenance of high level performance. Morehouse and Rasch (14) report that minimal nutritional deficiencies which an individual could tolerate well while doing light work can markedly impair his maximal athletic performance. Durnin (7) concludes that it is self-evident that undernutrition will eventually lead to a decreased general state of fitness.

Keys (15) stated that the basis of all theories about diet and the relation to muscular performance is the belief that the kind and relative amounts of food supplied make an important difference. Bourne (16) reported that the composition of the diet, particularly from the point of view of the ratio of protein, fat, and carbohydrate in the diet in relation to athletic performance is controversial. Astrand (17) in a review of diet in relation to athletic performance
reported that for a long time textbooks have concluded that carbohydrate was the exclusive fuel for skeletal muscle. Keys (15) indicated that at any one time the substances metabolized depend upon the relative availability of substrates, the accumulation of metabolites, the intensity of work, and the amounts of various enzymes present.

Mayer and Bullen (13) stated that while short duration sprints may be run almost anaerobically, performance in long term events is obviously dependent on respiratory efficiency.

Keys (15) reported some substances such as glucose are advocated because they are obviously combusted in muscles and they require a minimum of digestive and metabolic preparation for absorption and use. Astrand (17) found the utilization of carbohydrate depends on the oxygen supply to the working muscles; the more inadequate the oxygen supply, the higher the carbohydrate utilization. Mayer and Bullen (13) concluded that while ingestion of a sugar supplement prior to light exercise or short duration intense exercise has no demonstrable factor in prolonged events such as long-distance cycling, prolonged golfing, and marathons.

Van Itallie et al. (10) reported that in sustained exercise, the carbohydrate reserves diminish and the respiratory quotient falls, which indicates an increasing proportion of fat is being oxidized. If carbohydrate is available as a fuel for exercise, the respiratory quotient usually
rises, and the contribution of fat to energy metabolism diminishes in proportion. In prolonged physical activity there is a definite correlation between symptoms of fatigue and a decrease in blood sugar levels.

Astrand (17) concludes that exercise with glycogen depletion enhances the resynthesis of glycogen, and the factor is shown to operate locally in the exercised muscle. The ability to perform heavy, prolonged exercise is correspondingly affected and the higher the glycogen content, the better the performance.

Keys (15) reports that for a long time fats have been held in low esteem as a fuel for muscular exercise. Diets high in fat are tolerated poorly and provoke ketosis; on the other hand, diets very low in fats generally produce no obvious symptoms, though they provide minimal amounts of certain fatty acids which are essential to health.

Darling et al. (18) found there are many statements that higher protein intakes are necessary for hard work. He also states that protein is not metabolized in significant amounts during muscular exercise in the well-nourished person. Astrand (17) reported that diets with a high protein content often seem to be the preferred choice of athletes and is probably related more to psychological factors than physiological factors.

Mayer and Bullen (13) concluded that although the concern of most investigators in relation to protein is to provide
the "optimal" amount for physical performance of various intensity, or the amount which will keep the individual in nitrogen balance, the fact should not be overlooked that during periods of growth, requirements for high quality protein are increased. In most types of athletic training an increase in muscle mass will occur, which will require additional essential amino acids for tissue building even if the subject has completed his normal growth period.

Steele (12) found any statement that a specific nutrient will benefit athletic performance causes an increase in the consumption of this nutrient, no matter how unfounded the statement may be. According to Johnson (19), in recent years coaches have turned to various types of ergogenic aids to help achieve this purpose. Keys (15) stated substances such as creatine, lecithin, and phosphates are often recommended in the diet because they are normally prominent in muscle and nervous tissue. Gelatin is also urged because it contains glycine, which is used in the formation of muscle creatine. Another recent fad has been the use of Gatorade. According to Turco and Savastano (20) the University of Florida is said to have credited a recent winning season to the use of this beverage.

It is well known (10, 15, 21) that vitamins, particularly those of the B complex, form part of the reaction chains which are concerned with carbohydrate and fat metabolism. Mayer and Bulleen (13) found that while supple-
mentation of water soluble vitamins in adequate diets appears to give no additional beneficial results, there is little evidence to rule out the possibility of increased demands imposed by hard muscular work. However, there is no conclusive evidence for improved performance with supplementation of the B complex vitamins. According to Bourne (16) some investigators have claimed a beneficial effect of vitamin C on work performance, particularly for individuals such as athletes in training and in sports contests. Mayer and Bullen (13) concluded that claims made concerning the beneficial effects of supplements of vitamin E and of wheat germ oil have not been substantiated. According to Van Itallie et al. (10) it remains to be demonstrated convincingly that supplementation of the diet of the athlete in training with vitamins of any sort has a beneficial effect on endurance, muscular efficiency, or coordination.

Keys (15) stated that the theories offered for aiding work performance by special dietaries generally attempt to maintain the muscle composition in its unfatigued state by:

1. Renewing the supply of energy-yielding substrates, or
2. Facilitating the energy-yielding reactions, or
3. Counteracting the physical-chemical changes accompanying the metabolic process in the muscle.

Durnin (7) concluded there are no ordinary foods which man eats which are either of special value or which are
contraindicated in training. Morehouse and Rasch (14) found racial and religious dietary practices and individual idiosyncrasies are the primary determinants in the athlete's selection of food. According to Ryan and Allman (8), the key for the athlete's nutrition as for everyone else's is a balanced diet—balanced in all the essential nutrients so that the body is provided the necessary fuels and building materials, and also the maintenance of competitive weight.

Bullen et al. (3) stated that one of the ironies of modern athletics is that there are specialized sports in which a degree of overweight is useful or at least not detrimental. Fat is of benefit to certain athletes in cushioning blows, in developing momentum, as in football, and in improving buoyancy and insulation in cold water swimming. Durnin (7) felt, however, marked obesity is unlikely to be compatible with fitness, and is not conducive to maximum efficiency.

Novak et al. (22) found that college athletes had higher average values for total body water (indicating more muscle mass) than non-athletic men of the same age. Results from the same study showed that athletes engaged in strenuous activities such as swimming, track (except shotputting and discus), and gymnasts had much leaner bodies than their non-athletic counterparts.
To determine the desirable weight for a given athlete, the best guide is the composition of his body. Mayer and Bullen (13) stated that in the case of younger athletes, particularly those of high school age, normal increments in weight should be expected for growth and increased caloric allowances should be made accordingly.

Morehouse and Rasch (14) reported athletic events in which there are weight classifications place a premium on the athlete competing at the minimal weight at which he can maintain his strength and endurance. Ryan and Allman (8) stated there are few sports in which weight categories are so rigorously defined as in wrestling. It is generally agreed (8, 13, 14) that the larger individuals with a weight classification have a competitive advantage in terms of height, reach, leverage, and usually strength. According to Henson (23) wrestlers should lose the excess weight they carry until they achieve their ideal weight. Weight reduction in athletics is generally accomplished by two processes:

1. Long-range—a diet slightly deficient in calories for several weeks, or

2. Rapid weight reduction by partial starvation and dehydration—known as "making weight."

A major criticism of amateur wrestling is the practice of "making weight." Ribisl and Herbert (24) stated that it is common for participants to lose 10-12 pounds within a one-week period in order to qualify for lower weight classes.
The Committee on Medical Aspects of Sports of the American Medical Association (25) reported that, allegedly, some wrestling coaches

1. Required growing boys to attain and maintain for the season certified weights considerably below their optimum weights; and also

2. Advised boys to lose weight suddenly by crash diets and/or "drying out" (dehydration) to retain eligibility at such certified weights.

The actual process of making weight may begin several days before competition. Studies (25, 26, 27) reported procedures employed include fasting, restriction of fluids, hot boxes, rubberized apparel, induced vomiting, and even diuretics or laxatives. Both the National Foundation of State High School Athletic Associations and the American Medical Association Committee on Medical Aspects of Sports (27) have denounced the practice of "making weight" on both ethical and physiological grounds.

According to Tcheng and Tipton (28) most wrestlers are not "fat" before the season starts. Sinning (29) reports that the average body fat content of these wrestlers was found to be less than 8 percent. Tcheng and Tipton (28) concluded that 9 percent body fat is the lowest acceptable amount of body fat.

Landwer (30) stated that on the basis of the Tcheng-Tipton prediction equation a high correlation between actual and predicted weight was found for Nebraska state high school wrestling tournament qualifiers, with a higher corre-
lation for heavier (135-185 pounds) weight classes than for the lighter weight (98-132 pounds) classes. The wrestlers competing in the 98-132 pound weight classes may be losing substantially more weight than their competitors in the other weight classes and, hence, were below their predicted ideal minimum weight. He concludes that "more likely than not, these last few pounds of weight loss are accomplished by dehydration."

The effects of dehydration on physical performance have been widely documented. Elfenbaum (31) reports increased heart rate and core temperature with a 6.63 percent weight loss secondary to dehydration, but strength was not generally affected. Morehouse and Rasch (14) reported that the first symptom of dehydration is fatigue. There is also an increase in resting pulse rate, rectal temperature, and ventilation rate, and a reduction in circulation plasma. Ryan and Allman (8) stated that as the body becomes dehydrated, highly concentrated urine must be voided. There is the distinct possibility of developing calculi or concretions in the kidney, uremia may also develop, and nephritis and/or nephrosis may ensue. Ribisl and Herbert (24) concluded that a 5 percent weight loss within 48 hours due to dehydration is sufficient to significantly reduce the physical working capacity. According to the American Medical Association (25), the impairment may not be significant, especially in a brief match, but under tournament conditions,
where energy reserves become more significant, premature fatigue from any cause sacrifices the wrestler's talents when they count most. Maganzani (32) stated the deficits of dehydration cannot be repaired within the several hours prior to a match after the wrestler weighs in. According to the American Association of Health, Physical Education, and Recreation (33), the tendency in some sports was for coaches to say nothing about nutrition. They felt that the coach is missing an excellent opportunity to educate when he fails to give sound nutritional advice about dietary requirements for athletes, especially when they are motivated to improve their performance during the athletic season.

A national study of secondary coaches in recommending diets for athletes done by Horwood (1) in 1964, revealed many facts about coaches' attitudes toward nutrition. His conclusions were: (1) Coaches with less coaching experience were more restrictive in their diet prescriptions; (2) coaches who had majored in physical education in college were more lenient with regard to dietary prescriptions than those with other academic preparations; (3) coaches generally recommended that athletes include in their diet the following foods: beans, beef, bread, butter, cabbage, cheese, eggs, fish, fowl, fruit, fruit juices, gelatin, honey, ice cream, milk, potatoes, tea, vitamins, and wheat germ. Foods contraindicated were: candy, coffee, fried foods, pastries, and carbonated beverages; (4) the concern for
weight control was especially prevalent among wrestling coaches; (5) coaches from small schools or rural areas were generally more restrictive than coaches from larger schools or urban areas; (6) coaches gave athletic experience and personal judgment as their most important sources of nutrition information. Literature, nutrition courses, and professionals (doctors, nutritionists) were not given as important sources.

Cho (2) in a study of nutritional knowledge of physical education majors revealed that physical education students considered high school and college courses, parents, and coaches as their primary sources of nutrition knowledge.

Gonino (34), in a study of weight control methods in high school interscholastic wrestling, found that over 60 percent of programs studied did not require a physician's approval for their weight reduction programs. The coaches favored using a diet in addition to physical exercise to control weight, but were divided on the questions of the effect of excessive weight loss (over 5 percent of normal weight) on strength, agility, and stamina, and also the effect of crash diets on the athlete's health.

Novich and Taylor (35) believe that the coach must demonstrate as much interest in diet as in the conditioning program. To maintain highest degree of health and well-
being, and to obtain maximum physical performance from his athletes, coaches must understand and disseminate knowledge in the following:¹

1. Physiology of the gastrointestinal tract and preparation of foods for absorption and assimilation into body tissues and energy;

2. Knowledge of the foods that are best utilized for growth, tissue repair, maintenance and energy;

3. Understanding of the body fluids and electrolyte balance; and

4. Caloric requirements for different events.

CHAPTER III

METHOD

Design of the Study

The purpose of this study was to evaluate the nutritional knowledge of a stratified random sample of high school wrestling coaches in Ohio. The coaches were divided into two basic groups: those who had majored in physical education or health, and those who had majored in other areas. They were further classified according to school size and number of years of coaching.

A mailed questionnaire was utilized to collect the data because it permitted contact with a large number of subjects. The anonymous nature of the questionnaire did not permit follow-up of non-respondents.

Instrument Used

A two-part instrument was designed. Part I was designed from an inventory of items supplied from an instrument used by Cho (2) in a test of physical education majors at Kansas State University, and (2) questions suggested by graduate physical education majors at Ohio State University. A Likert scale format rather than a true-false format was used in order to discourage guessing. The final questionnaire
consisted of 15 questions from Dr. Cho's instrument, and 15 questions suggested by the graduate physical education students. The principles covered in the test items were directed to the following areas: general nutrition, protein, vitamins and minerals, weight loss, fluid and electrolytes, carbohydrates, and body composition and physiology.

Part II of the questionnaire was developed on the basis of the study by Horwood (1) at Michigan State University, who reported coaches' attitudes about nutrition were affected by years of coaching, size of high school, area of the country, and sport coached.

The items were validated by a review panel consisting of a dietitian-educator, a physician, exercise physiologist, and a wrestling coach. A pilot study of the questionnaire was conducted to (1) insure clarity of the questions, and (2) to eliminate ambiguity in the questions. Participants in the pilot study were graduate students enrolled in physical education at Ohio State University and senior medical dietetics students from the coordinated undergraduate program at Ohio State.

The Sample

The Ohio High School Athletic Association maintains records on high school wrestling programs throughout the state of Ohio. Because the high schools in Ohio are divided into three classifications (AAA, AA, and A) based on the number of boys in the high school, a stratified
random sampling was used. This was an attempt to maintain a representative sample of the entire population. There are currently 574 wrestling programs in the state (255 AAA, 213 AA, 106A), with at least one coach per school. It was estimated that if 40 percent of this population were surveyed, there would be a response rate of 40-50 percent.

The sample was selected in the following manner: (1) a 1976-77 list of all high school wrestling programs was obtained from the Ohio High School Athletic Association; (2) 250 of the 574 wrestling programs were selected (111 Class AAA, 93 Class AA, and 46 Class A); (3) each Class A wrestling program was assigned a number beginning with one, and number consecutively; (4) the process was repeated with the Class AA and Class AAA programs; (5) a table of random numbers was then used to select the sample.

Each of the subjects selected for the sample was mailed a questionnaire. A cover letter written by Chris Ford, assistant professor and head wrestling coach at Ohio State University, was included with the questionnaire. A self-addressed stamped envelope was provided for return of the completed questionnaire.

Analysis of Data

The nature of the data to be collected and the nature of the hypotheses to be tested were determinants of the type of statistical procedures that were utilized. The data from
the returned, completed questionnaires was coded and recorded on IBM punched cards. The Ohio State University Computer Center IBM Processing System was employed to analyze the data. The coaches were asked to rate each item on a continuum of 1 through 5, ranging from "strongly agree," which reflected their knowledge of the accuracy of the statement; "agree"; "no opinion"; "disagree"; and "strongly disagree," which reflected their knowledge of the inaccuracy of the statement. One hundred questionnaires were statistically analyzed; seven additional questionnaires were later returned by the coaches. The breakdown of the 100 questionnaires were as follows: 49 Class AAA (44.1 percent of the original number), 35 Class AA (37.6 percent of the original number), and 16 Class A (34.8 percent of the original number).

The scores on this portion of the questionnaire were determined as follows:

If the statement was judged by the review panel as TRUE, the score was assigned as follows:

<table>
<thead>
<tr>
<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
<th>SD</th>
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<tr>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
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If the statement was judged FALSE, the score was assigned as follows:

<table>
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<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
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<td>+1</td>
<td>+2</td>
<td>+3</td>
<td>+4</td>
<td>+5</td>
</tr>
</tbody>
</table>
The Kuder-Richardson method of item analysis was used to test reliability of the attitudinal portion of the questionnaire. This is a method of estimating the reliability of test scores from a single administration of a single form of a test. It provides a measure of internal consistency. The Kuder-Richardson method takes into account the consistency of testing procedures and consistency of results over different samples of items, but does not consider the constancy of subjects' characteristics. The estimated reliability was computed to be .58.

Factorial analysis of variance was a method of testing the significance of mean differences between more than two groups in a single test. The scores were combined and subsequently partitioned for comparison and analysis in such a way as to permit specification of the relative importance of the component scores.
CHAPTER IV
FINDINGS

The purpose of this chapter is to report the findings related to the question: Are there any significant differences in the scores on the test of nutrition knowledge by the coaches who had majored in physical education or health when compared with the coaches who had not; and are there any significant differences in the scores of the coaches when grouped according to school size, or number of years of coaching?

The returned questionnaires were coded, and analyzed by the Ohio State University Division of Computing Services. The total score was computed on 100 questionnaires. This represents 40 percent of the total population surveyed. The average score of the coaches was calculated to be 108.79 ± 7.82.

Three one-way analyses of variance were performed to determine if educational background, size of school, or number of years of coaching experience had any effect on the score achieved by the coach.

The only variable which significantly affected the coaches' scores was the educational background. The wrestling coaches who listed physical education or health as their major...
areas of study scored significantly higher ($F_{1,98}, p < 0.05$) than those who had majored in other areas (Table 1). School size (Table 2 and years of coaching experience (Table 3) did not significantly affect the scores achieved by the coaches.

**TABLE 1**

Result of Analysis of Variance by Educational Background

<table>
<thead>
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<th>Description</th>
<th>No. in Group</th>
<th>Mean Score</th>
<th>Stand. Deviation</th>
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<td>Group #1</td>
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<td>Physical education or health major</td>
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<td>$\pm 7.68$</td>
</tr>
<tr>
<td>Group #2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All other majors</td>
<td>57</td>
<td>107.42</td>
<td>$\pm 7.70$</td>
</tr>
</tbody>
</table>

**TABLE 2**

Results of Analysis of Variance by School Size

<table>
<thead>
<tr>
<th>School Size</th>
<th>Number</th>
<th>Mean Score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class AAA</td>
<td>49</td>
<td>109.24</td>
<td>$\pm 7.62$</td>
</tr>
<tr>
<td>Class AA</td>
<td>35</td>
<td>108.97</td>
<td>$\pm 7.87$</td>
</tr>
<tr>
<td>Class A</td>
<td>16</td>
<td>107.00</td>
<td>$\pm 8.54$</td>
</tr>
</tbody>
</table>
TABLE 3

Results of Analysis of Variance by Number of Years of Coaching Experience

<table>
<thead>
<tr>
<th>Years of Coaching</th>
<th>Number</th>
<th>Mean Score</th>
<th>Stand. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>17</td>
<td>104.82</td>
<td>±6.48</td>
</tr>
<tr>
<td>4-7</td>
<td>38</td>
<td>108.50</td>
<td>±8.19</td>
</tr>
<tr>
<td>8-11</td>
<td>23</td>
<td>110.87</td>
<td>±7.07</td>
</tr>
<tr>
<td>12-15</td>
<td>15</td>
<td>110.33</td>
<td>±8.47</td>
</tr>
<tr>
<td>Over 15</td>
<td>7</td>
<td>109.86</td>
<td>±7.94</td>
</tr>
</tbody>
</table>

The pilot study of the questionnaire was conducted using 29 graduate students in physical education and 19 senior medical dietetics students, all enrolled at Ohio State University. Mean scores were as follows:

Graduate Physical Education Students - 107.3
Senior Medical Dietetics Students - 110.4

The senior medical dietetics students scored significantly higher ($t_{46}=5.53, \ p<0.001$) than the graduate physical education students. It must be remembered, however, that the graduate physical education students had contributed to the test pool. In addition, the purpose of the pilot study was to develop the instrument rather than to test a hypothesis.
CHAPTER V
DISCUSSION AND CONCLUSIONS

This study was conducted to evaluate the nutrition knowledge of Ohio high school wrestling coaches, and to determine what, if any, effect the selected variables had on the scores achieved by the coaches.

Specifically, the hypotheses tested were:

1. There is no significant difference between the mean scores of those subjects who majored in physical education or health, and those who did not.

2. There is no significant difference between the mean test scores when coaches are grouped according to number of years of coaching, or school size.

The first hypothesis was rejected. Those coaches who listed either physical education or health as part of their educational preparation scored significantly higher (p < .005) than those who did not. There was one uncontrolled variable which may have affected this result. This variable was related to item #33 on the instrument. The original intent was for the coaches to give their undergraduate major, however the coaches were not specifically instructed to do so. Many of the coaches listed two or three majors, presumably including their graduate major as well as their undergraduate major. It was decided that if the coach had listed more

28
than one major, and if physical education or health was one of those, they were classified as a physical education major.

The other research hypotheses were not rejected. School size (Class AAA, Class AA, or Class A) did not significantly affect his total score on the questionnaire. It seems reasonable that the larger schools might hire a wrestling coach for only that purpose but in smaller, or rural schools, the coach might have other teaching responsibilities completely unrelated to his duties as a wrestling coach. This study failed to prove this variable to be of significance. It also seems logical that coaches with more coaching experience would know more about nutrition because of practical experience than those coaches with little or no experience. However, in this study, years of coaching experience did not prove to be a factor which significantly affect the coaches' scores.

The questions contained in the instrument can be grouped into several basic areas. These areas and the questions related to them are as follows:

General nutrition - 1, 4, 7, 12, 30
Protein - 2, 5, 8, 13, 16
Vitamins, minerals - 3, 6, 9, 20, 21
Weight loss - 17, 22, 27, 28
Fluid, electrolytes - 10, 19, 25, 26
Carbohydrates - 14, 23

Body composition, physiology - 15, 18, 24, 29

Each question was analyzed for specific number of each of the responses given by the coaches. Although the majority of coaches did answer the question within the correct range, there were several results of interest.

In the category of general nutrition, coaches made the greatest number of errors. Question #1 related to the amount of calories required as the only difference in diets for athletes versus non-athletes. Mayer and Bullen (13) feel that the first nutritional requirement in athletic performance is the caloric cost of the type of activity considered, and that if the calories are adequate, the other required nutrients will also be present in sufficient quantities. But the results of the coaches (18 percent disagreed with the statement) seem to indicate that coaches feel there are added requirements over and above the caloric cost of the activities.

Question #4 concerned the value of milk to the diet. Forty-seven of the 100 coaches agreed or strongly agreed with the statement that milk was a perfect food (containing all essential nutrients) while 39 coaches felt that it did lack some of these nutrients. Analysis of Question #12 revealed that the coaches were almost equally divided on the merits of a lacto-ovo-vegetarian diet. Thirty-four of the coaches agreed with the statement, indicating that this
type of diet could supply all needed nutrients, while 24
gave no opinion, and 31 disagreed with the statement. The
results of Question #4 and #12 seem to indicate that the
coaches are lacking the basic knowledge of nutrient quality
of foods and the contribution of nutrients by foods.

Question #16 concerned the use of protein as an energy
source. Forty-two percent of the coaches felt that protein
was not a source of energy while 52 percent believed that
it could be utilized in this manner.

Although coaches were quite knowledgeable in matters
related to vitamins and minerals, there were a few questionn
which deserve special attention. Question #20 concerned
the contribution of minerals to water balance. Sixty-eight
percent agreed with the statement that minerals have an
important role in water balance, but 32 percent were undecided
as to the actual role of minerals to this body function.

Question #21 dealt with the use of salt tablets. Although
this is not a recommended practice, 24 percent of the
coaches felt that salt tablets should be taken before a "hard
work-out." Even though the percentage of error on both
Questions #20 and #21 may not seem significant, this is
an extremely critical matter when related to the health of
the athlete. However, 60-75 percent of the coaches did
respond to the question of fluid and electrolyte balance in
the correct manner. These questions included the use of
diurectics and exercising in rubber suits to reduce body
weight, both of which are exceedingly dangerous practices. The response to Question #17, related to exercising in rubber suits to reduce body weight, is of definite concern. Although 82 percent of the coaches felt that exercising in rubber suits was not a recommended method of losing weight, 13 percent felt that it was.

Question #11 dealt with the merits of carbohydrate loading for a wrestler. Since wrestling matches rarely last more than 10-15 minutes, carbohydrate loading does not benefit the wrestler(36). Carbohydrate loading only becomes a factor in activities lasting more than 30 minutes. Eighty-six percent of the coaches were aware of this fact.

Finally, the group of questions related to body composition and the digestive process were answered correctly by most of the coaches. Question #24 related to normal rate of body fat for a high school boy and Question #29 related to the contribution (by percentage of fat to body weight). However, in both Question #24 and #29, 28 and 40 percent, respectively, of the coaches did not give an opinion. This seems to represent insufficient information as to the desirable body composition of the athlete. Since the coach is usually the person who decides in which weight classification the athlete will participate, it is essential that the coach understand these concepts so that he prescribes a weight at which the athlete may compete safely.
The questionnaire addressed those areas which were felt to be areas of concern to the wrestling coach. Because these areas are of critical importance to the health and development of a high school athlete, coaches should be knowledgeable in these matters so that they may disseminate knowledge to the athletes for whom they are responsible. Since all coaches attend rules interpretation meetings and clinics annually, portions of these meetings could be devoted to continuing education specific to the central role of nutrition to the metabolic process and their physiological implications for athletic competition.

Of the 250 questionnaires which were mailed to the selected sample, 107 were returned, which represented 43 percent of the original sample. The response rate was disappointing in view of the fact that the study was endorsed by both Chris Ford, OSU wrestling coach, and the Ohio State Athletic Department. This raises at least one question. Were those coaches who responded more interested and probably more knowledgeable in nutrition than their counterparts who did not return the questionnaire? Although this was not one of the original purposes of the study, it should be noted that many of the coaches requested sources on nutrition information which they could pass along to their athletes.
Limitations

This study was limited in three ways. The questionnaire was evaluated by a panel to determine the appropriateness and accuracy of information. It was assumed that the instrument had face validity but not internal validity.

A second limitation that was recognized was the method which was used to survey the coaches. Mailed questionnaires typically have low response rates. Although the actual response rate in this survey was 43 percent, it was not as great as hoped. The cover letter by Mr. Ford, and also the provision of a return envelope, were attempts to increase the response rate.

The third limitation relates to the population being studied. Because the sample was drawn from only wrestling coaches in the state of Ohio, the results of the study can only reflect the nutrition knowledge of these coaches at this time.

Recommendations for Further Study

This study was conducted using wrestling coaches as subjects because it was felt that the nutritional implications of wrestling (specifically, weight control and fluid and electrolyte balance) are extremely critical subjects. Athletic competition of any sort imposes additional physiological needs on the competitor, and studies should be conducted to determine the knowledge base of coaches in
other sports. The study might also be expanded to other areas of the country.

Although the coach is in a position from which he can advise his athletes in matters of nutrition, the athlete must be motivated to follow this advice. Some attempt should be made to assess the knowledge base of the athlete and also to determine at what point in his athletic career that athlete would be most receptive to nutrition information.

The questionnaire used in this study still needs further refinement and revision. Special attention must be directed to the jargon of the coaching profession so that the coach understands the nature of the question. Item #33 needs to be revised so that the coaches only list their undergraduate majors or distinguishes undergraduate study from graduate study.


36. Personal communication with Dr. Donald K. Mathews, The Ohio State University.
APPENDIX
January 31, 1977

Dear Coach:

Enclosed is a questionnaire relating to nutrition, dietary habits, and weight loss for the athlete. It is geared to find out your attitudes and practices as a coach in determining weight loss of your wrestlers. As you well know, this is the most controversial issue in the sport of wrestling.

The questionnaire has been devised by Mary Overmyer, a practicing dietitian and Post-graduate student at Ohio State University. Her research in this area will be of great value to our sport as we will be able to advise our athletes properly in dietary procedures.

I sincerely hope that you will take the time to answer the questionnaire and return it. The more research that we have conducted by people of outside professions like Mary's the more proficient we can become in our coaching. Thank you kindly for your cooperation and sincere interest in the betterment of wrestling.

Yours in wrestling

Chris Ford
Head Coach
Ohio State Wrestling

Cf: jd

Enclosure 40
Part I. The purpose of Part One is to determine your attitudes about nutrition. Please circle either A (strongly agree); B (agree); C (no opinion); D (disagree); E (strongly disagree).

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>No Opinion</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>3.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>4.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>5.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>6.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>7.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>8.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>9.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>10.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>11.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>12.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>13.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>Number</td>
<td>Statement</td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>No Opinion</td>
<td>Disagree</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------------------------------------</td>
<td>----------------</td>
<td>-------</td>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>14</td>
<td>Carbohydrates are essential in the diet of the wrestler.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>15</td>
<td>Stomach emptying time can be delayed due to pregame tension.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>16</td>
<td>Protein can be used as an energy source.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>17</td>
<td>Exercising in rubber suits are a recommended method of reducing body weight.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>18</td>
<td>Fats and proteins are slow to digest; therefore they should not be eaten less than 3-4 hours before competing.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>19</td>
<td>Inadequate water intake has the most serious effect on the athlete's performance.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>20</td>
<td>Minerals play an important role in water balance of the body.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>21</td>
<td>It is a good idea to take salt tablets before a hard work.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>22</td>
<td>Not eating anything is the best way to lose weight.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>23</td>
<td>Carbohydrate is the main source of energy during exhaustive exercise.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>24</td>
<td>The normal range of body fat for a high school boy age 16 is 15-17 percent of his total body weight.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>25</td>
<td>Losing 5 percent of total body weight rapidly has little effect on the cardiovascular system.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>26</td>
<td>Water is the principle vehicle in the body for eliminating heat through evaporation of sweat.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>27</td>
<td>The rubberized suit inhibits heat loss through evaporation of sweat.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>28</td>
<td>Chewing gum has a measurable effect on weight loss.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>29</td>
<td>A wrestler should have at least 7 percent of total body weight as fat.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>30</td>
<td>Strength and endurance of a wrestler varies with his nutritional status.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>
Part II. The purpose of Part Two is to identify you, the respondent. Please answer each question as it applies to you.

31. Size of high school where you coach.
   A. Class AAA
   B. Class AA
   C. Class A

32. Number of years you have been coaching.
   A. 0-3 years
   B. 4-7 years
   C. 8-11 years
   D. 12-15 years
   E. over 15 years

33. What was your major in college?
   A. Physical Education
   B. Health
   C. Science (Biology, Chemistry, etc.)
   D. Liberal Arts (English, History, Mathematics)
   E. Business
   F. Other

34. From what institution did you graduate?

35. In what state was this college or university?

36. Do you give written information on dieting and weight control to your wrestlers during preseason training?