2007

Nutrition knowledge, attitudes, and practices of high school coaches: implications for nutrition education

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by

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A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Diet and Exercise

Program of Study Committee:
Ruth Litchfield, Major Professor
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Iowa State University
Ames, Iowa
2007

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ABSTRACT

A survey was used to examine high school coaches' nutrition confidence in their knowledge, knowledge, attitudes, and practices. Subjects' (N=1056) responses were evaluated by years of experience, gender of sport coach, and sport classification (weight-related vs. non-weight related). Overall, coaches' knowledge about sports nutrition was suboptimal; the mean knowledge score was 68.8%. Coaches with more experience had more knowledge ($P<0.05$). Coaches of boy sports displayed more confidence in their knowledge ($P<0.01$), better attitudes ($P<0.05$), but poorer practices ($P<0.01$) than coaches of girl sports. Finally, coaches of weight-related sports displayed more confidence in their knowledge ($P<0.01$), greater knowledge ($P<0.01$), and better attitudes ($P<0.01$), but poorer practices ($P<0.01$) than coaches of non-weight-related sports. Interestingly, nutrition knowledge was not associated with nutrition practices, indicating a need for nutrition education that incorporates higher levels of learning to improve nutrition practices.

A nutrition education intervention, 'Eat to Compete,' was developed to fill gaps in nutrition knowledge regarding fluids/dehydration, training diets, and dietary supplements. Pre-and post-questionnaires were used to evaluate changes in nutrition knowledge and program effectiveness. Nutrition knowledge improved with all three programs ($P<0.01$), with greater improvements with the 'fluids' and 'training diets' presentations and with school staff compared to athletes. Although nutrition knowledge improved immediately following nutrition education, long term changes in nutrition knowledge, attitudes, and practices are still unknown. A multi-dimensional approach to nutrition education is needed to improve nutrition cognition, not merely knowledge. Nutrition education that incorporates higher levels of learning, such as application, synthesis, and evaluation will encourage positive nutrition practices. Lastly, nutrition education should address information pertinent and specific to the intended audience and should ultimately lead to behavior change.

CHAPTER 1. INTRODUCTION

The high level of competition existing in high school athletics has prompted both athletes and coaches to become keenly interested in various strategies that may intensify training, thus enhance performance. One area of particular interest to athletes and coaches is nutrition. The American Dietetic Association (ADA), Dietitians of Canada, and the American College of Sports Medicine (ACSM) assert in their position statement that physical activity, athletic performance, and recovery from exercise are enhanced by optimal nutrition (ADA, 2000).

Appropriate nutrition practices are essential for optimal athletic performance. Nutrition practices can help promote the physiological and biochemical adaptations that are necessary to sustain consistent intensive training (Maughan, 2002). Overall health, body weight and composition, substrate availability during exercise, recovery time after exercise, and athletic performance are each affected by an athlete's nutrient intake (ADA 2000). Exercise increases both fluid and nutrient requirements; thus, inadequate nutrition intake can impair performance.

Coaches and Nutrition

Coaches play an important role in providing nutrition information to their athletes. Athletes often view coaches as knowledgeable about nutrition and look to them for advice; however, coaches may not be adequately prepared to provide accurate information about nutrition (Smith Rockwell, Nickols-Richardson, & Thye, 2001; Sossin, Gizis, Marquart, & Sobal, 1997; Griffin & Harris, 1996; Graves, Farthing, Smith, & Turchi, 1991; Corley, Demarest-Litchford, & Bazzarre, 1990; Warren, Stitt, & Bonner, 1985; Parr, Porter, & Hodgson, 1984; Langford-Bedgood & Tuck, 1983; Wolf, Wirth, & Lohman, 1979). Several studies of coaches' knowledge, attitudes, and practices regarding nutrition, have documented the need for increased nutrition education (Smith-Rockwell et al., 2001; Sossin et al., 1997; Graves et al., 1991; Corley et al., 1990; Parr et al., 1984; Langford-Bedgood et al., 1983; Wolf et al., 1979).

Athletes and Nutrition

Athletes are also in need of nutrition education; they tend to be vulnerable to nutrition misinformation due to their strong desire to gain a competitive edge (Pratt &

Walberg, 1988). Lack of nutrition knowledge can lead to questionable dietary practices/behaviors, which can result in adverse effects on an athlete's health and performance. Female athletes, especially those involved in sports that emphasize body size, are at even greater risk due to weight management issues, in addition to physical performance (Sherman & Thompson, 2004; Otis, Drinkwater, Johnson, Loucks, & Wilmore, 1997). In fact, a large percentage (15-25%) of female athletes show signs of disordered eating (Beals & Hill, 2006; Nichols, Rauh, Lawson, Ji, & Barkai, 2006; Westberg, Flakoll, Reddy, & Litchfield, unpublished data).

The increasing use of dietary supplements among high school athletes also indicates a need for nutrition education. According to a survey administered to a sample of Iowa high school athletes (N=4025), those reporting nutrition supplement use increased from 24% in 1998-1999 to 96% in 2003-2004 (Iowa High School Athletic Association, 2004). This four-fold increase is a significant problem, considering nutrition supplements are unregulated, often ineffective, and costly.

Athletes' desire for accurate and implemental nutrition information presents an increasing challenge and responsibility for educators, including coaches (Potter and Wood, 1991). However, understanding athletes' knowledge, attitudes, and practices towards nutrition, along with factors that influence their nutrition practices, increases the effectiveness of nutrition education.

Nutrition Education

Nutrition education has been documented to have a positive effect on cognitive outcomes, such as nutrition knowledge, food-related skills, behavioral expectations, and self-efficacy (Contento, Manning, & Shannon, 1992). Yet, although nutrition education increases athletes' knowledge, it does not always lead to behavioral change (Chapman, Toma, Tuverson, & Jacob, 1997; Story & Resnick, 1986; Douglas & Douglas, 1984). This is in part due to the lack of instructional materials related to nutrition and the lack of research focusing on effective educational methods (Potter & Wood, 1991); particularly in the area of educational materials for sports nutrition.

Nutrition education not only needs to provide information and guidance to coaches and athletes about appropriate nutrition behaviors, but also needs to promote

positive attitudes and behaviors, recognizing the role nutrition has on performance. This approach would make it more likely that athletes apply their knowledge and understanding of nutrition into practice (Nichols, Jonnalagadda, Rosenbloom, & Trinkaus, 2005).

Conclusion

Previous research suggests a need for increased nutrition education for both coaches and athletes. With the advancements in nutrition and exercise physiology, the effect of nutrition on sports performance has become more apparent. Coaches have a unique opportunity to inform their athletes about nutrition; however, coaches often lack the knowledge to provide appropriate nutrition education to their athletes. The objectives of this research were to:

Research objectives

1. Examine high school coaches' nutrition knowledge, attitudes, and practices as they relate to weight loss/weight gain, fluids/dehydration, pre- and post-competition meals, training diets, and nutrition supplements.
2. Develop and evaluate educational materials for high school coaches and athletes to improve their knowledge, attitudes, and practices in areas of interest and knowledge deficiency (identified by objective #1).
3. Evaluate nutrition education programs provided.

Thesis Organization

This thesis includes an introduction, a review of literature, methods, and two manuscripts, followed by a conclusion and references for the first three chapters.

CHAPTER 2. LITERATURE REVIEW

NUTRITION IN HIGH SCHOOL ATHLETICS

Nutrition is a significant component of the adolescent athlete's training regimen. Nutrient demands are high during adolescence related to the rate of growth at this stage of life [Sam (Society of Adolescent Medicine) Position Statement, 1999]. Athletes have additional requirements in order to meet the demands of training. High school athletes often experience peer pressure, concerns about physical appearance, and a strong desire to excel in sports, all of which can affect their nutritional intake (ADA, 1996; Steen, 2000). Nutritional deficiencies, including inadequate energy or nutrient intake, can affect growth and development, performance, and possibly lead to injuries (Petrie, Stover, & Horswill, 2004).

There are several barriers that can compromise meeting the increased energy and nutrient needs of adolescent athletes. Environmental barriers c include: lack of time, inconvenience and expense of eating properly, and lack of a sense of urgency (Story & Resnick, 1986), along with hunger and food cravings, food appeal, amount of time to eat, convenience/food availability, parental influence, media, cost, and perceived benefits (Neumark-Sztainer, Story, Perry, & Casey, 1999). Athletes may also face additional environmental barriers such as time constraints, travel, and sport-specific eating-related attitudes (Croll, Neumark-Sztainer, Story, Wall, Perry, & Harnack, 2006). For example, athletes in aesthetic sports (gymnastics, dance, and figure skating) traditionally place more emphasis on weight or appearance and may compromise food and fluid intake to look thin and theoretically perform better (Croll et al, 2006; Golden, 2002; Benardot, 1996).

Hydration

One specific area of nutritional concern is hydration. Compared with adults, children often experience greater heat stress when exercising in hot environments because they are less efficient thermoregulaters (Allen & Overbaugh, 1994; Dyment, 1991; Squire, 1990). Children have a greater ratio of surface area to body mass; thus, they tend to absorb environmental heat more readily than do adults (Anderson, 2000**;** Unnithan and Goulopoulou, 2004). In addition, increased sweat production in order to

young athletes sweat in order to control their rise in core body temperature, which may cause fluid loss and many times a loss of sodium, iron, and calcium (ADA, 2000; Maughan, 2002).

Fluid balance is especially important for athletes because it can affect performance. A 1% to 2% decrease in body weight from exercise-induced sweating is enough to decrease performance and endurance (Wilk, Yuxiu, & Bar-Or, 2002; Casa, Armstrong, Hillman, Montain, Reiff, Rich, Roberts, & Stone, 2000). A 3% decrease in body weight due to dehydration further disturbs physiological function and increases the athletes' risk of developing a heat illness; athletes can easily become dehydrated at these levels within just an hour of exercise (Casa et al., 2000).

Heat stress increases the likelihood of fluid imbalance and dehydration, especially if fluid intake is not adequate, which can lead to heat disorders. Not only do heat disorders contribute to occasional mortality in athletes, if extreme enough, they can also lead to death. In fact, heat illness is the third leading cause of death among U.S. high school athletes (Coris, Ramirez, and Van Durme, 2004). Voluntary hydration by most athletes during exercise replaces less than one-half of their body fluid losses (Noakes, 1993). The level of voluntary dehydration during exercise is not related to the duration and/or intensity of the activity (Noakes, 1993). Thus, it is imperative that athletes be aware of the amount and type of fluids necessary to support their level performance.

Dehydration is easily prevented with appropriate fluid and electrolyte ingestion. Fluid intake before, during, and after exercise has been shown to reduce the risk of dehydration, hyperthermia, increased heart rate, and cardiac strain (Montain, 1993). Adequate fluid intake can also help maintain blood flow and improve physical performance. To maintain fluid balance, the amount of fluid athletes are advised to ingest before, during, and after exercise should closely match sweating rate. Based on several studies, it is recommended that athletes ingest 400-600 ml (14 to 24 fl oz) of water of a sports drink 2-3 hours before a sports event, 200-300 ml (7-10 fl oz) 10-20 minutes before exercise, and 150-350 ml (6-12 fl oz) every 15-20 minutes (ADA, 2000). Post-exercise hydration should aim at replacing all fluid loss that occurred during exercise. Athletes should drink 450-675 mL (16-24 fl oz) of fluid for every pound (0.5

kg) of body weight lost during exercise (ADA, 2000). The temperature and taste of fluids influences fluid intake; voluntary hydration can be increased by the ingestion of cool, sweet fluids (Noakes, 1993). Hydration is clearly an integral component of nutrition education for athletes.

Energy

Athletes have increased energy and macronutrient requirements. It is important to meet energy and macronutrient needs, especially carbohydrate and protein, in order to maintain body weight, replenish glycogen stores, and build and repair of tissue (ADA, 2000). To meet the nutrient needs of physical activity and health, the athlete's training diet should provide at least 55% to 60% of total energy from carbohydrate, 12% to 15% from protein, and 20% to 25% from fat (ADA, 2000).

Meeting energy needs should be the first and foremost nutrition priority for athletes. Athletes' energy needs vary based on the type and duration of activity being performed. The recommendation is to add the estimated energy expenditure from exercise to the energy requirement for normal daily activity (ADA, 2000). Inadequate energy intake can lead to a loss of muscle mass, menstrual dysfunction, loss or failure to gain bone density, and increased risk of fatigue, injury, and illness (ADA, 2000). Since energy balance is essential for the maintenance of lean tissue mass, immune and reproductive functions, as well as optimal athletic performance, meeting energy needs is the top priority of athletes.

Macronutrients

Athletes have unique macronutrient needs related to the intensity and duration of the exercise, the gender of the athlete, and the athletes' nutritional status prior to exercise (ADA, 2000). Although minimal research has been performed on protein and carbohydrate needs of children and adolescents, these macronutrient requirements are likely greater due to increased physical activity (Institute of Medicine, 2000).

Carbohydrate

Carbohydrate is an important substrate for high-intensity training; as the intensity of physical activity increases, so does the body's reliance on carbohydrate as a fuel (Petrie et al., 2004). In order to maintain blood-glucose levels during exercise and replenish

muscle glycogen, it is recommended that carbohydrate intake of athletes be 6-10 g/kg body weight per day (ADA, 2000). The exact amount depends upon the athletes' total energy expenditure, type of exercise, sex, and environmental conditions (ADA, 2000).

Protein

Heavy training increases protein requirements; however, protein needs in young athletes are almost always met through normal dietary intake of protein (Petrie et al., 2004). The RDA for protein for adolescents is 0.85 g/kg/day (Institute of Medicine, 2005). It is recommended that adolescent athletes consume slightly more protein (1.2-2.0 g/kg/day) (Jenkins & Reaburn, 2000); however, some sports may require more. Protein recommendations for adult male endurance athletes (i.e. long distance runners and cyclists) are 1.2-1.4 g/kg body weight per day (ADA, 2000; Meredith, Zackin, Frontera, & Evans, 1989); and those for adult male strength-trained athletes (i.e. experienced male bodybuilders and weight trainers) are even higher at 1.6-1.7 g/kg body weight per day (ADA, 2000; Tarnopolsky, Atkinson, MacDougall, Chesley, Phillips & Schwarcz, 1986). However, data on the requirements for young athletes and female athletes is not available (Petrie et al., 2004; ADA, 2000).

Protein needs can easily be satisfied by diet alone and do not require supplementation (ADA, 2000; Maughan, 2002). In most cases, athletes unconsciously increase their food intake for energy and consequently meet their protein needs. In fact, assessment of protein intake in young athletes suggests that athletes typically consume 1.0-2.2 g/kg of body weight (Petrie et al., 2004). A study on adolescent soccer players and non-athletes reported that the average protein intake for soccer players was 1.68 g/kg/day. Although the recommended protein intake of 0.8–1.0 g/kg body mass/day may be insufficient for young athletes, athletes typically consume enough protein to maintain nitrogen balance (Boisseau, Le Creff, Loyens, & Poortmans, 2002).

Protein intake beyond the recommendation is not necessary because there is a limit on protein synthesis (ADA, 2000). If protein intake is too high, it can produce extra urea, increase the risk of dehydration, and cause calcium loss (Millward & Jackson, 2004).

Fat

Dietary fat provides the essential fatty acids and fat-soluble vitamins, as well as adequate energy for weight maintenance (ADA, 2000). The recommended intake for athletes is 20-25% of energy. Restricting fat intake below 15% of energy provides no performance or health benefit (ADA, 2000).

Micronutrients

Micronutrients play an important role in energy production, hemoglobin synthesis, bone health, immune function, and antioxidant activity (ADA, 2000). Exercise may increase the need for vitamin and minerals for several reasons: (1) exercise uses many metabolic pathways that require micronutrients; (2) exercise increases the turnover of micronutrients; and (3) micronutrients help repair and maintain lean tissue mass in athletes (ADA, 2000).

Most athletes can meet their needs by consuming a high energy intake and balanced diet; however, athletes involved in aesthetic sports are particularly at risk for suboptimal micronutrient intake related to restricted caloric intake. Calcium, iron, and zinc are of particular concern (Croll et al., 2006; & Ziegler, Sharp, Hughes, Evans, & Khoo, 2002). High energy output coupled with low energy intake may result in suboptimal calcium and iron status and menstrual dysfunction, which can ultimately lead to impaired bone health (Drinkwater, Nilson, Chesnut, Bremner, Shainholtz, & Southworth, 1984).

Iron

Iron intake is marginal or inadequate in many females who engage in regular physical activity (Weaver & Rajaram, 1993; Beard & Tobin, 2000). Rowland and colleagues (1987) reported that iron deficiency increased from 3% to 17% of male cross-country runners and from 40% to 45% of female cross-country runners during the competitive season. Other studies report that iron depletion occurs in 30% to 50% of female athletes (Rosenbloom, Jonnalagadda, & Skinner, 2002; Croll et al., 2006).

Adolescents have significant iron requirements related to the expansion of the total blood volume, an increase in lean body mass, and the onset of menses in young females (Beard & Tobin, 2000). Additional concerns for athletes include increased

physiologic needs to promote muscle tissue growth, marginal energy intake, inadequate iron intake, and exercise-related iron loss (Clarkson, 1991; ADA, 1996). Not only does frequent exercise augment muscle mass and blood volume, causing increased iron uptake, it also may impair iron absorption and increase iron losses in sweat, feces, and urine due to intravascular hemolysis and frequent microtrauma and microbleedings (Clarkson & Haymes, 1995; Malczewska, Raczynski, & Stupnicki, 2000).

The RDA for iron for adolescent boys and girls is 12 and 15 mg/day, respectively (Institute of Medicine, 2000). Data on iron intake of adolescents suggests that adolescent girls' iron intake is inadequate as their intakes average as little as 10–11 mg/day (Weaver & Rajaram, 1992;).

Iron deficiency can affect health and physical performance (Beard & Tobin, 2000; Clarkson & Haymes, 1995). Iron deficiency can influence performance related to the role of iron in hemoglobin transporting oxygen to muscle cells (Beard & Tobin, 2000). In addition, low iron concentration in skeletal muscle tissue has been shown to decrease endurance performance, related to the role of iron-dependent oxidative enzymes (Willis, Brooks, Henderson, & Dallman, 1987).

Calcium and Vitamin D

Intake of calcium and vitamin D is inadequate for many athletes, particularly adolescent athletes (ADA, 1996; Bernadot, 1996). The adequate intake (AI) for calcium is greatest during adolescence and early adulthood (Institute of Medicine, 1997). Calcium intake is critical from childhood to adulthood in order to achieve peak bone mass and minimize the risk of osteoporosis (Wolman, Clark, McNally, Harries, & Reeve, 1992; Matovic, Fontana, Tominac, Goel, & Chestnut, 1990). Inadequate calcium intake during training and competition is associated with increased risk of low bone mass and consequently stress fractures (Croll et al, 2001; Nattiv & Armsey, 1997; Sanborn, Horea, Siemers, and Dieringer, 2000). Factors that parallel low calcium intake, such as low energy, protein, and vitamin D intake, may also be contributing to poor bone health (Bryant, Cadogan, & Weaver, 1999).

HIGH SCHOOL ATHLETES

Adolescents are at risk for inadequate nutrient intake because of common misconceptions, negative attitudes, and poor nutrition practices. Adolescent boys and girls often become preoccupied with their weight, body size, and appearance. In addition, athletes have a desire for a competitive advantage. Athletes often use nutrition and exercise to control their weight and/or enhance their performance; however, they do not always use legitimate information to guide their practices. Misconceptions and misinformation can not only impair performance, but can also lead to long term health problems.

Nutrition Knowledge

Acquiring nutrition knowledge is a cumulative process. Lack of practical knowledge and poor understanding of nutrition principles are factors that prevent sound nutrition practices by athletes (Burke, 1995). Several studies indicate that athletes are, in fact, lacking adequate nutrition knowledge (Wiita, Stombaugh, & Buch, 1995; Wiita & Stombaugh, 1996; Perron, 1985; Cupisti, D'Alessandro, Castrogiovanni, Barale, & Morelli, 2002; Brook & Tepper, 1997). Additionally, those with misinformation may make nutrition choices that negatively affect their performance (Rosenbloom et al., 2002)

Weight loss/weight gain

Common factors adolescent athletes identify as motivation to enhance their knowledge and application of sound nutrition include weight control and level of performance (Chapman et al., 1997). Some athletes want to be thinner (i.e. gymnastics, track, and wrestling), believing that it will improve their performance (Cotugna, Vickery, & McBee, 2005; Brook & Tepper, 1997); while some want to gain weight (i.e. football). However, athletes lack appropriate knowledge about food, nutrition, and dieting. More than half (54%) and a third of college athletes (35%) incorrectly believed that a reducing diet should not contain bread or potatoes (Wiita et al., 1995).

Fluids/hydration

High school athletes have misconceptions about fluids. Overall, collegiate athletes seem to be more knowledgeable about appropriate hydration practices. A survey of high school and college runners found that 57% of the high school runners reported

that fluids should *not* be consumed during competition, whereas only 11% of college athletes believed so (Witta, 1995). Most college athletes also knew that dehydration decreased performance, fluids should be replaced before, during, and after exercise, and thirst was not a good indicator of fluid needs (Rosenbloom et al., 2002; Nichols, 2005). Yet, there was a large degree of uncertainty pertaining to sports drink consumption; over half (68%) of collegiate athletes believed sports drinks were superior to water because they restore glycogen in muscles. On the other hand, 53% correctly identified that a sports drink should be consumed during or after exercise lasting longer than an hour (Nichols et al., 2005).

Collegiate athletes also knew that salt tablets do not prevent dehydration (81%); dehydration decreases athletic performance (91%); athletes should drink water during practice (98%); monitoring urine color is a way to judge dehydration (94%); excessive sweating, thirst, and cramping are signs of dehydration (88); and more than 2 alcoholic drinks the day before competition can lead to dehydration (90%) (Nichols et al., 2005). Another study of collegiate cross-country runners reported that hydration was one of only three subscales where athletes scored greater than 70% (Zawila, Steib, & Hoogenboom, 2003).

Training diets

High school athletes have more misconceptions regarding nutrition than college athletes (Wiita et al., 1995). A significantly greater number of high school athletes believe food may not provide enough nutrients and that vitamin supplements are necessary for good health (Wiita, et al., 1995). High school athletes are also more likely to incorrectly agree that carbohydrate rich foods provide few nutrients, other than calories (Wiita et al., 1995).

Both high school and college athletes are also unsure about the function of protein. Many athletes believe protein is the primary source of energy for muscle (Wiita, 1995; Wiita & Stombaugh, 1996; Rosenbloom et al., 2002). Wiita & Stombaugh (1996) evaluated change in nutrition knowledge over a three year span found that over half of adolescent female runners who believed protein was the primary source of energy initially, continued to believe so three years later. Rosenbloom and colleagues (2002)

reported similar findings; only 37% of college athletes disagreed that protein is the main energy source for the muscle, while 16% were unsure with this statement.

Another misconception among athletes is that increased protein intake is necessary to increase muscle mass (Wiita et al., 1995; Wiita & Stombaugh, 1996; Cupisti et al., 2002). In Wiita's studies (1995 and 1996), approximately half (55% and 50%) of the female athletes (college and high school) believed that increasing protein in the diet was necessary to increase muscle mass in the body. More recently, Cupisti and colleagues (2002) reported that 40% of female athletes believed that eating large amounts of meat increased muscle size. Finally, athletes are not knowledgeable about the role of quality protein (Perron & Endres, 1985, Cupisti et al., 2002).

Dietary supplements

Knowledge regarding supplement use among athletes also reveals a number of misconceptions. Studies have reported more than half of college and high school athletes believed that it is important for athletes to take dietary supplements (Wiita & Stombaugh, 1996; Sobal & Marquart, 1994). Interestingly, this belief increased from 55 to 73% among the same group of athletes when they were surveyed again three years later (Wiita & Stombaugh, 1996). Most athletes reported that vitamin and mineral supplements increase energy (Rosenbloom et al., 2002; Jonnalagadda & Rosenbloom, 2001; Jacobsen & Aldana, 1992; Burns, Schiller, Merrick, & Wolf, 2004) and have a moderate impact on the healing process (Burns et al., 2004). Reasons collegiate athletes reported taking supplements include: muscle building, increased energy, disease prevention, supplement an inadequate diet, and recommendation by family members, coaches, athletic trainers, and dietitians (Krumbach, Ellis, & Driskell, 1999). On the other hand, high school athletes' reported that healthy growth was the most important reason for supplement use, followed by treating illness and sports performance (Sobal & Marquart, 1994). In addition, there were significant gender differences in the reasoning for taking supplements; boys rated muscle development and sports performance as more important than girls (Sobal & Marquart, 1994).

Nutrition Attitudes

Knowledge, alone, is not enough to ensure good nutrition practices; attitudes also affect behavior. College athletes (Werblow, Fox, & Henneman, 1978) and high school athletes (Perron & Endres, 1985) generally have positive attitudes toward nutrition and performance. Nutrition knowledge and attitudes are positively and significantly correlated, indicating that more nutrition knowledge usually results in more positive attitudes toward nutrition (Perron & Endres, 1985).

Conversely, nutrition attitudes were not found to be good predictors of dietary practices (Perron & Endres, 1985). For example, most (88%) of high school athletes reported eating nutritious food as enjoyable, yet most of the foods they ate were low-nutrient, energy-rich sources (Perron & Endres, 1985). Additionally, although most athletes believe nutrition can influence performance (Perron & Endres, 1985), many feel they lack the knowledge to assist them in making proper food choices (Shoaf, 1986).

Nutrition Practices

Although individuals perceive information, they only internalize and operationalize what is perceived as important to them (Updegrove, 1991). Therefore, it is important for athletes to understand the importance of nutritional practices as the effects of poor nutrition practices can be detrimental to their performance and health. Nutrition practices of high school athletes have been examined by a number of studies.

Weight loss/weight gain

Many coaches and athletes believe optimal performance is only possible when athletes reach a low body weight (Griffin et al., 1996; Davis, 1992; Harris & Grecco, 1990). This belief can encourage athletes to adopt detrimental weight-loss practices (Griffin et al., 1996; Davis, 1992; Smolak, Murnen, & Ruble, 2000), such as crash dieting, diet pills, diuretics, enemas, excessive exercise, fasting, fluid restriction, laxatives, sauna use, spitting, sweating, and vomiting (Griffin et al., 1996). These weight loss methods are often more prevalent in female than male athletes and in athletes in sport where leanness is considered important (Griffin et al., 1996; Smolak et al., 2000). In fact, a large percentage (15-20%) of female athletes show signs of disordered eating (Beals & Hill, 2006; Nichols et al., 2006)

Eating disorders have become a topic of interest and concern, especially among athletes. Athletes often feel pressure about their weight, and their weight loss/weight gain practices are often be influenced by others (Heffner, Ogles, Gold, Marden, & Johnson, 2003). Female athletes are exposed to psychological pressures from society and the athletic world (Sungot-Borgen & Torstveit, 2004), and are particularly susceptible to weight management issues. They are often unhappy with their weight (Wiita & Stombaugh, 1996; Perron & Endres, 1985), and many (41%) feel pressure about their weight (Wiita & Stombaugh, 1996). The majority of adolescent female athletes (70%) reported they haved asked for advice concerning diet and health, and 55% reported receiving it, most commonly from the coach (Wiita & Stombaugh, 1996).

Fluids/dehydration

Inappropriate hydration practices are not only a problem for high school athletes; but collegiate athletes as well. Many recommendations by the National Athletic Trainers' Association (NATA) and the American College of Sports Medicine (ACSM) are not being followed by either group of athletes. Approximately half (43% and 55%) of adolescent female runners believed that athletes should not drink water during practice, but rather rinse their mouth or suck on ice cubes (Wiita & Stombaugh, 1996). Among collegiate athletes, 33% reported not using sports drinks, and only 59% reported drinking 7-10 ounces of fluid 10-20 minutes before competition (Nichols et al., 2005). In the same study, the majority (86%) did not weigh themselves before and after practice in order to determine how much fluid to replenish. Overall collegiate athletes had adequate knowledge on fluid replacement, but did not know the specific amounts of fluids that should be consumed and did not practice the knowledge they reported (Nichols et al., 2005).

Training diets

Despite suboptimal nutrition practices, adolescent athletes have more positive nutrition behaviors than non-athletes (Croll et al., 2001). Athletes were more likely to eat breakfast on a daily basis (Croll et al., 2001); more likely to not add salt to their food; and more likely to consume dairy products and items from the fruit and vegetable group on a daily basis (Baumert, Henderson, & Thompson, 1998). These studies suggest a positive

association between participation in sports and better nutrient intake for both males and females.

Despite a better nutrient profile than non-athletes, the majority of athletes still do not meet specific nutrient recommendations, in particular, calcium and iron. Perron and Endres (1985) reported that 70% of adolescents did not meet the RDAs for energy, calcium, and iron. More recently, Croll and colleagues (2001) reported that adolescent athletes were deficient in calcium intake. However, the participants in this study had mean iron intakes of 14.5 mg, which nearly meets the current DRI (Dietary Reference Intake) of 15 mg. This is an improvement over past reports where mean iron intakes of 11 mg did not meet the RDA (Recommended Daily Allowance), which was 18 mg (Perron & Endres, 1985).

Dietary supplements

Dietary supplement use is prevalent among high school athletes. An exhaustive review of the literature on dietary supplement use among athletes (Sobal & Marquart, 1994) reported the overall prevalence rate of nutrition supplement intake by athletes as 46% (Sobal & Marquart, 1994). Elite athletes used supplements more frequently than college or high school athletes (Parr et al., 1984). Athletes appear to use supplements more than the general population, with some taking doses at a high enough amounts that may lead to nutritional problems (Sobal & Marquart, 1994). The leading reasons for using supplements included: healthy growth (48%), preventing and treating illness (44% and 37%), sports performance (31%), tiredness/fatigue (28%), and muscle development (28%) (Sobal & Marquart, 1994).

There appears to be an increasing inclination toward supplement use among high school athletes. Prevalence of supplement among high school athletes increased four-fold from 24% in 1998-1999 to 96% in 2003-2004 (Iowa High School Association, 2004). Most athletes supplement with sports drinks (93-95%) and vitamin supplements (36-39%); however, boys are more likely to supplement with weight gain products, protein products, energy enhancing products, and creatine than girls (Iowa High School Association, 2004).

Supplement use may be related to inappropriate dietary practices. Poor eating habits combined with dietary supplement use is common in athletes, especially those attempting to lose weight (Parr et al., 1984). For example, wrestlers were more likely to use supplements and take them more regularly compared to other sports; they often restrict food intake and believe that vitamin/mineral supplements provide the necessary nutrients they lack due to inadequate food consumption (Sobal & Marquart, 1994).

Conversely, other athletes report taking supplements to gain weight or muscle mass (Swirzinski, latin, Berg, & Grandjean, 2000). For example, a survey of high school football players reported 90% of the players take creatine (94%) for weight gain weight or muscle building (Swirzinski et al., 2000). Ultimately, whether their intentions are to gain weight or lose weight, athletes tend to justify poor eating practices by taking supplements.

Athletes also supplement protein, particularly male athletes. Parr and colleagues (1984) reported that 19% of the college and high school athletes used protein supplements. High school athletes (10%) appeared more likely to supplement their diet with protein than college athletes (6%) (Parr et al, 1984). The prevalence of protein supplementation among high school athletes may have increased; recently, 37% of male and 11% of female high school athletes reported using protein supplements (Iowa High School Association, 2004). Energy enhancing supplements, such as ginseng, energy gels, co-enzyme Q-10, and red bull are also commonly taken by male high school athletes (30%) and female high school athletes (17%) (Iowa High School Association, 2004).

Approximately 36-40% of high school athletes use vitamin supplements (Douglas & Douglas, 1984; Sobal & Marquart, 1994; Swirzinski et al., 2000). The most common type of supplement taken is multivitamins (54%) and vitamin C (49%) (Parr et al, 1984); however, more recent studies report lower multivitamin (19%-39**%**) and Vitamin C use (25%) (Sobal et al, 1994; Iowa High School Association, 2004).

Mineral supplements are also used among athletes. Approximately 13% of the high school and college athletes take mineral supplements, where iron is the most prevalent supplement (32%) being used (Parr et al, 1984), and significantly more by girls (16%) than boys (8%) (Sobal & Marquart, 1994).

SOURCES OF NUTRITION INFORMATION FOR HIGH SCHOOL ATHLETES

Athletes are constantly inundated with information regarding nutrition by the media, parents, peers, and coaches; however these sources are not always adequate. One study reported that approximately 10% of athletes had been on training diet that was prescribed to them by an unreliable source (Schmalz, 1993). It is essential that the source from which athletes receive nutrition information is available and accurate.

Parents

One source of nutrition information for adolescents is parents. Many athletes rank parents as their top source of nutrition information (Iowa High School Association, 2004; Cupisiti et al., 2002; Shoaf, 1986; Douglas & Douglas, 1984; Parr et al, 1984). Parents have a significant impact on their child's dietary and exercise behaviors. They can be an important source of nutrition information by being role models and by providing accurate nutrition information to their children.

Schools

During infancy and early childhood the home is typically the key environment for children to learn and develop food preferences and eating habits; however, as they grow and attend school, teachers, peers and others at school become more important. Adolescence is a period of increasing independence and youth are more apt to making their own food choices, instead of relying on their parents (Perez-Rodrigo & Aranceta, 2001). The school not only provides nutrition education, but also an environment that can promote positive eating behaviors (DeFriese, Crossland, MacPhail-Wilcox, & Sowers, 1990).

Coaches

Coaches are authority figures who may take on multiple roles in their relationships with athletes (Heffner et al., 2003). Athletes frequently rank them as a primary source of nutrition information (Sossin et al, 1997; Wiita & Stombaugh, 1996). Coaches have an opportunity to promote good nutrition practices through discussions and meetings, written guidelines for training meals, display posters, inviting sports nutritionists to speak, or even providing good examples of snacks/meals to the team (Wiita et al., 1995). Coaches are also role models when eating together as a team (Witta

et al., 1995). Although athletes do not always recognize coaches as their top source of nutrition information, coaches can provide their athletes with proper nutrition information and positive attitudes and practices toward good nutrition.

HIGH SCHOOL COACHES

Many coaches are held in high regard by their athletes. They are often the most available resource for athletes; thus, have a unique opportunity to positively influence their athletes' nutrition behaviors. Yet, coaches are not always fully prepared to provide accurate nutrition information because of their own knowledge, attitudes, and/or practices.

Nutrition Knowledge

Coaches have a responsibility to understand basic nutrition principles and practices and then convey them to their athletes. Yet, studies that have examined nutrition knowledge of coaches indicate that most coaches are not always accurate sources of nutrition information (Langford-Bedgood & Tuck, 1983, Corley et al., 1990, Smith-Rockwell et al., 2001, and Graves et al., 1991).

Weight loss/weight gain

High school coaches lack knowledge about nutrition needs specific to adolescents and weight control methods. Many high school coaches believe that optimal performance is possible only when athletes reach very low body weight (Griffin & Harris, 1996; Sossin et al., 1997). They are also unsure about caloric intake for weight loss by adolescent athletes (Langford-Bedgood et al., 1983). If coaches are unable to provide proper knowledge and planning skills to their athletes to begin safe weight loss programs, athletes may and frequently do turn to pathogenic weight-loss methods, such as excessive exercise (Harris & Grecco, 1990) that require little expertise or planning (Griffin & Harris, 1996). Nutrition plays a critical role in the success and long-term health of adolescent athletes; thus, it is essential that coaches have a clear understanding of nutritional needs and recommendations for their adolescent athletes.

Fluids/dehydration

High school coaches also lack accurate knowledge about proper hydration techniques; they may be aware of symptoms of dehydration, but are not knowledgeable

about the guidelines and recommendations for fluid consumption (Sossin et al., 1997; Langford-Bedgood et al., 1983). For example, approximately one-third high school coaches (23-37%) believe that thirst is an appropriate indicator of fluid needs (Langford-Bedgood et al., 1983; Sossin et al., 1997), and only half (52%) can identify the appropriate fluid replacement for weight lost during activity (Sossin et al., 1997). High school coaches need to know how to prevent dehydration in order to prevent illness and enhance their athletes' performance.

Collegiate coaches may be more knowledgeable about hydration. Most Division I coaches (70% or more) agreed that fluids should be available to athletes before, during, and after practice and competition, and that thirst is not the best indicator of fluid needs (Nichols et al., 2005; Smith-Rockwell et al., 2001). Division I coaches also identified that dehydration decreases athletic performance (Corley et al., 1990). Athletic trainers are also more knowledgeable about fluids and hydration than high school coaches (Graves et al., 1991).

Training diets

Coaches lack general nutrition knowledge concerning athletes' training diets. Surveys indicate that both college and high school coaches are not knowledgeable about macronutrients (Langford-Bedgood et al., 1983; Graves et al., 1991; and Corley et al, 1990). Coaches are uncertain about the percentage of protein, carbohydrate, and fat that should be included in a balanced diet (Langford-Bedgood et al., 1983; Corley et al., 1990) and are unaware that carbohydrates and protein provide the same amount of energy per weight (Corley et al., 1990). The research suggests sub-optimal nutrition knowledge of both high school and college coaches.

Dietary supplements

High school coaches lack appropriate knowledge about dietary supplements as well. Coaches scored significantly lower than athletic trainers on knowledge questions related to dietary supplements (Graves et al., 1991). In another study, coaches scored lowest on the subtopic 'nutrition supplementation,' where 66% agreed that supplementation with protein helps increase muscle mass, and 68% agreed that supplementation with salt tablets is necessary to combat sweating (Langford-Bedgood et

al., 1983). A more recent study suggests improved understanding, as only 33% of high school wrestling coaches reported protein and amino acid supplementation as an acceptable way to increase muscle mass (Sossin et al., 1997). However, 40% of the same coaches believed vitamins and minerals could provide energy to improve performance (Sossin et al., 1997).

College coaches appear knowledgeable about dietary supplementation. They scored the highest on the nutrition supplements topic compared to macronutrients, micronutrients, and weight control (Smith Rockwell et al., 2001) and were knowledgeable about the types of athletes who benefit from creatine supplementation and research related to creatine. However, despite adequate knowledge regarding specific supplements, college coaches were least knowledgeable about micronutrients (even though 40% were recommending vitamin and mineral supplementation) (Smith-Rockwell et al., 2001). Like athletes, coaches are constantly presented with an abundance of information regarding supplements, some of which is inaccurate; therefore, it is necessary that reliable sources of information about supplements are available to coaches.

Nutrition Attitudes

Misconceptions and lack of nutrition knowledge are often reflected in high school coaches' attitudes. Of particular interest are coaches' attitudes towards eating and weight control. Coaches are not only aware of inappropriate practices, behaviors, and misconceptions that can trigger an eating disorder, but also recognize that their own attitudes can influence their athletes' nutrition attitudes and practices (Griffin & Harris, 1996).

Coaches believe appropriate body weight is important for optimal performance in their sports (Smith-Rockwell et al., 2001; and Griffin et al., 1996; Heffner et al., 2003). Many coaches report they use appearance to determine the ideal body weight for individual athletes (Warren et al., 1985; Griffin et al., 1996); however, they often underestimate the optimal weight of athletes when using appearance alone (Housh, Johnson, & Housh, 1991). This practice also encourages the belief that appearance is the most important goal for the athlete (Davis, 1992; Harris & Grecco, 1990). Over-emphasizing weight management can convey negative messages to athletes and can cause

them to become pre-occupied with their weight, which can spiral into disordered eating and weight management issues.

Nutrition Practices

Not only do coaches have a responsibility to know and understand appropriate nutrition information, but they also need to know how to effectively convey nutrition practices to their athletes. Unfortunately, studies indicate that high school and college coaches do not always serve as accurate sources of nutrition information (Warren et al., 1985; Langford-Bedgood & Tuck, 1983), which underscores the need for nutrition education for coaches.

Weight loss/weight gain

Although coaches may not directly encourage athletes to engage in potentially harmful eating practices, coaches who place more emphasis on decreasing body weight for the purpose of performance enhancement may indirectly encourage unhealthful weight-control behaviors (Leon, 1991; Taub & Blinde, 1992; Thompson & Sherman, 1993). Results suggest that many coaches report supervising weight loss and weight gain of their athletes (Heffner et al., 2003; Corley et al., 1990, and Warren et al., 1985). The majority of coaches (60%) recommends decreased calories and/or increased exercise as methods to lose weight (Heffner et al., 2003; Warren et al., 1985; Smith-Rockwell et al., 2001); however, there is controversy over which method is more common. This is an improvement because in 1979, Wolf et al. reported that many collegiate coaches of female teams (39%) and male teams (26%) prescribed diets for individual weight loss or gain. More recently, most coaches (55-80%) agreed that the most effective way to lose weight is by restricting calories (Sossin et al., 1997; Warren et al., 1985; Corely et al., 1990), as opposed to promoting fad diets. Interestingly, most high school wrestling coaches (80%) consider exercise as the most important factor in promoting weight loss (Sossin et al., 1997).

Discussing weight management with athletes can be a sensitive topic, given the fact that even the slightest suggestion from an influential coach that an athletes' body weight or composition are too high may motivate the athlete to engage in unhealthy weight control behaviors (Chopak & Taylor-Nicholson, 1991; Rosen & Hough, 1988).

Therefore, it is critical that coaches are knowledgeable about proper weight loss practices and are capable of effectively providing information about weight loss practices without increasing the probability that their athletes will develop disordered eating behaviors and attitudes.

Fluids/de/hydration

Fluid recommendations by coaches are important for their athletes' performance. Earlier research suggested that 57% of high school coaches reported limiting the amount of fluids consumed by their athletes during practice and competition (Warren et al., 1985); however, more recent result indicate that most college coaches (88-94%) recommend and/or provide water as a measure to prevent fluid loss during practices and competition (Smith-Rockwell et al., 2001; Corley et al., 1990). Although coaches have positive fluid recommendations, they are less likely to monitor hydration status of their athletes. Only 31% of coaches report they monitored dehydration among their athletes, most commonly by weight records (Corley et al., 1990).

Adequate fluid intake is critical to replace fluid loss and prevent dehydration during exercise. The National Athletic Trainers' Association (NATA) recommends that coaches and athletic trainers establish a hydration protocol for their athletes that considers rehydration strategies, such as an athlete's sweat rate, type of exercise, intensity and duration of exercise, environmental factors, acclimatization state, timing of rehydration, and fluid preference (Casa et al., 2000).

Coaches also need to monitor fluid losses and hydration status after exercise, especially in hot, humid weather. This can be done by several different methods, including measurements of urine volume, urine color, and body weight before and after exercise (Casa et al., 2000). Research indicates that most high school and college coaches do not weigh their athletes before and after practice during warm weather (Warren et al., 1985; Corley et al., 1990).

Table 1 displays the recommended fluid amounts before, during, and after exercise by the National Athletic Association (NATA). These values approximate the likely sweat and urine losses in order to maintain hydration at less than 2% body weight reduction (Casa et al., 2000).

Recommended Fluid Intake for Athletes

Timing	**Amount**
2-3 hours before exercise	500-600 ml (17-20 fl oz)
10-20 minutes before exercise	200-300 (7-10 fl oz)
Every 10-20 minutes during exercise	200-300 (7-10 fl oz)
Within 2 hours after exercise	(correct fluid losses)

National Athletic Trainer's Association (NATA), 2000

Training diets

Coaches appear to practice more appropriate nutrition behaviors when it comes to foods and general training diet principles. Collegiate coaches correctly recommend restricting high fat foods before practice and competition (Warren et al., 1985; Corley et al., 1990); however these coaches also report that a desirable diet consists of 10% fat (Corley et al., 1990), which is too low. High school and college coaches were able to correctly identify the timing of the pre-game meal (Warren et al., 1985; Langford-Bedgood et al., 1983; Corley et al., 1990).

Dietary supplements

Coaches frequently recommend supplements (Smith-Rockwell et al., 2001; Warren et al., 1985), for weight loss or gain, increased energy, and/or pain relief. A survey of Division I collegiate coaches and athletic trainers, reported that 79% recommended supplements, including vitamins/minerals, protein, carbohydrates, creatine monohydrate, and/or sports bars, and 94% provided some type of supplement (Smith-Rockwell et al., 2001). This study also reported that only 40% of Division I coaches/athletic trainers recommended vitamins/minerals supplements, while only 8% provided these to their athletes.

Approximately 40% of high school coaches (Warren et al., 1985) and 34% of college coaches (Smith-Rockwell et al., 2001) recommend protein supplements. In addition, many college coaches/athletic trainers (34%) are providing protein supplements (Smith-Rockwell et al., 2001) primarily to promote weight gain (Warren et al., 1985).

Another popularly recommended supplement is creatine. Some coaches (26%) not only recommend creatine supplements, but also provide creatine supplements to their

athletes (Smith-Rockwell et al., 2001). Like most consumers, coaches believe that supplements are harmless and effective; however, dietary supplements are not tested nor screened by the FDA for efficacy and safety, and many contain contaminants and/or illegal ingredients not shown on the bottle. There is some evidence to support a beneficial effect of supplements on performance (i.e. creatine, caffeine, and bicarbonate); however, the risk of a positive drug test and contaminants outweigh the performance benefits in most cases (Maughan, King, & Lea, 2004).

NUTRITION EDUCATION

Given the lack of knowledge, prevalence of misconceptions, and marginal nutritional practices of athletes, it is apparent that nutrition education programs based on research and scientific principles are needed. There is a lack of research examining the effectiveness of nutrition education provided to coaches and high school athletes. The effectiveness of nutrition education is based on how well the recipients receive, understand, and use the nutrition information provided to them. An important outcome of nutrition education should be the attainment of a variety of cognitive and affective skills that help individuals become nutritionally literate consumers (Contento et al., 1992); thus, the ultimate goal of nutrition education is to promote positive behavior change (Potter & Wood, 1991). Many studies suggest, but have not demonstrated, that an increase in knowledge will influence coaches' and athletes' attitudes and dietary behaviors (Nichols et al., 2005; Alexson & Brinberg, 1992; Collison et al., 1996; Parr, Porter & Hodgson).

Coaches

Coaches are not completely confident with their nutrition knowledge, and realize the need for additional education. Most coaches (87%) report that they would benefit from addition nutrition education (Sossin, et al., 1997). Wrestling coaches, in particular, believe they understand the basic foundation of training diet guidelines, but feel they would benefit from more education about vitamin and mineral supplements and caloric requirements (Sossin et al., 1997). There needs to be more nutrition education programs provided to coaches. As the research indicates, coaches lack nutrition knowledge (Langford-Bedgood, 1983; Corley, 1990; Smith-Rockwell, 2001; Graves, 1991); yet,

athletes view them as primary source of nutrition knowledge (Wiita & Stombaugh, 1996; Sossin, 1997). Coaches have the potential to be valuable sources of nutrition knowledge for athletes. They can provide written guidelines for training, display posters, give presentations, and serve as role models.

Very little research has been done on the effectiveness of nutrition education for coaches; however adult figures (e.g., parents, coaches, teachers) can play an important role in educating athletes. Despite the impact of adults in the lives of children and adolescents, few published studies have targeted these groups in prevention programs (unpublished dissertation Whisenhunt, 2002). One study that explored coaches' concerns regarding eating disorders found that less than half of the coaches (45%) had ever attended an educational program about eating disorders (Turk, Prentice, Chappell, Edgar, & Shields, 1999). Due to the lack of education for coaches regarding eating disorders, a study was put forth to examine the effectiveness of an intervention targeting coaches on knowledge, attitudes, and behaviors associated with eating disorders and body image disturbances among coaches and athletes (unpublished dissertation Whisenhunt, 2002). It was reported that coaches in the experimental group demonstrated significant increases in knowledge and more positive behaviors compared to their baseline knowledge level and compared to control coaches (Whisenhunt, unpulished data). Although these studies examined eating disorder education, it provides implications for additional nutrition education programs available for coaches.

This lack of nutrition education available for high school coaches is a problem and research suggests that they are inadequately prepared to provide nutrition guidance (Graves et al., 1991). Nutrition education is associated with greater knowledge and utilization of more resources for current nutrition information (Graves et al., 1991), which can be accomplished through special workshops that focus on the interrelationships of nutrition and physical performance (Corley et al., 1990). Coaches also need to be instructed on appropriate delivery of nutrition education messages to their athletes. This can be achieved by requiring coaches to participate in sports nutrition workshops, presentations, and nutrition courses provided by nutrition professionals. A multidisciplinary approach has been shown to be effective in treating and preventing

eating disorders; however, the degree to which it is practiced with athletes has not received much empirical attention (Heffner et al., 2003). Nutrition professionals, particularly sports nutritionists, are a valuable resource for increasing nutritional knowledge and promoting more positive attitudes and behaviors among athletes. With increased nutrition education, coaches can also be a valuable resource to their athletes.

Athletes

Most coaches (94%) acknowledge that athletes would benefit from additional nutrition education (Sossin et al., 1997). Knowledge about the physiology of exercise has led to an increased appreciation of the role of nutrition in athletic performance (Burke, 1989). Yet, even as the science and knowledge of sports nutrition improves, most individuals respond emotionally, rather than rationally, when they think about eating patterns and weight management (McCann, 2004). Athletes are no exception; in fact, the stress of sports and competition can create additional emotional challenges. Thus, an increase in nutrition knowledge through education and intervention may help athletes reach peak performance for competition while encouraging nutrition behaviors that will promote lifelong health.

Most nutrition education research has been on nutrition education programs for elite, collegiate, and adult athletes; generally, they indicate that nutrition interventions increase knowledge and promote more positive attitudes regarding the importance of sound nutrition, but do not always lead to changes in dietary intake (Potter & Wood, 1991; Collision et al., 1996; Chapman et al., 1997; Abood, Black, & Birnbaum, 2004). Potter and Wood (1991) examined the effectiveness of sports nutrition education given to collegiate athletes. Half the athletes received the instruction in a group setting, while the other half received it in a self-instruction setting. Results indicated that both groups of athletes gained nutrition knowledge after attending the instructional programs; however, the group who participated in the self-instruction program had significantly higher post-test scores than those participating in the group-instruction (Potter & Wood, 1991). The characteristics of the self-instruction that contributed to its greater effectiveness were not determined.

Another nutrition education program assessed nutrition knowledge, attitudes, and dietary intakes of female college athletes and non-athletes before and after receiving nutrition education (Collision, Kuczmarski, and Vickery, 1996). The athletes and non-athletes attending the nutrition education intervention had a significant increase in nutrition knowledge and more positive attitudes toward nutrition (Collision et al., 1996). The post-test results indicated that 63% of the athletes and 73% of the non-athletes correctly answered all knowledge test questions that were previously answered incorrectly (Collision et al., 1996). In addition to increased knowledge, the athletes also demonstrated significantly ($p<0.0005$) more positive attitudes toward nutrition (Collision et al, 1996). This study clearly demonstrates that nutrition education can increase knowledge and enhance attitudes of female college athletes.

One study examined the effectiveness of nutrition education provided to adolescent athletes. This study examined the effectiveness of a sports nutrition education program on changing nutrition behaviors of female high school varsity softball teams (Chapman et al, 1997). Those who received the education significantly increased their nutrition knowledge by an average of 17.9 points while those who did not receive nutrition education had an average decrease in knowledge by 1.8 points. However, neither group improved nutrition practices to achieve optimal distribution of calories (Chapman et al, 1997).

Lastly, upon completion of a nutrition education intervention, which consisted of eight 1-hour educational sessions, college athletes experienced a significant increase in nutrition knowledge and self-efficacy to make dietary changes (Abood et al., 2004). Changes in dietary behavior were not significant, but were more favorable in the experimental group. Research on nutrient intake and sport-specific sport participation has been conducted primarily with elite, collegiate, or adult athletes, with limited research documenting the increased nutrient requirements of adolescents (Croll et al., 2001). Research is needed to determine whether the nutrient recommendations applied to adult athletes will have the same affect and positive benefits for adolescent athletes, without impairing growth and development or performance (Petrie et al, 2004).

It is also important to examine the eating behaviors of youth participating in sports and determine whether they are meeting nutrient and energy requirements. Identification of nutrient deficiencies and topics adolescent athletes are least knowledgeable about are necessary to develop interventions to increase knowledge and ultimately promote more positive attitudes and behaviors.

Effective Nutrition Education

There are several gaps in research concerning nutrition education for high school coaches and athletes. Nutrition education programs not only need to fill the knowledge gaps, but also need to focus on eliciting change in food/nutrient intake (Casazza & Ciccazzo, 2006). It is important that information is relevant and applicable to those receiving the nutrition education. Effective nutrition education programs need to consider the setting, delivery method, and evaluation.

Setting

There are several different settings in which nutrition education can take place. One is schools. Schools can be an effective and efficient place to reach a large segment of the population, including youth, coaches, families and community members (Perez-Rodrigo & Aranceta, 2001). The ADA states that schools and the community are responsible for providing all students with access to high-quality foods and school-based nutrition services as a fundamental part of the total education program (ADA, 2006). Food choices at school are influenced by the environment, including the types of foods available in the school, nutrition information, nutrition education in the classroom, and nutrition promotions for families (ADA, 2006).

Delivery method

The delivery method of nutrition education programs is also important to consider. Some have found that college athletes receiving nutrition education, independently, had significantly greater increases in post-test scores than those who received it in a group setting; however, both groups made significant increases in sports nutrition knowledge, indicating that both methods of instruction were effective (Potter & Wood, 1991). The benefit of using self-instruction materials is that individuals can use the modules on their own time or professionals can use them in a group setting (Potter &

Wood, 1991). Primary care providers (83%) preferred one-page printed handouts to home videos and interactive computer programs for nutrition and wellness education material (Kenner, Taylor, Dunn, Gruchow & Kolasa, 1999).

Evaluation

Evaluation to assess the effectiveness and efficiency of interventions is a key element of successful nutrition education programs. Evaluation of school-based nutrition education programs supports the use of theories, including the Social Cognitive Theory and the Stages of Change model (Perez-Rodrigo and Aranceta, 2001). Outcome evaluations have shown increased knowledge after several different school-based nutrition education programs, including GIMME 5 (Nicklas, Johnson, Farris, Rice, Lyon, & Shi, 1998), High 5 (Reynolds, Franklin, Leviton, Malory, Harrington, Yaroch, Pearson, Jester, 2000), and CATCH (Raizman, Montgomery, Osganian, Ebzery, Evans, Nicklas, Zive, Hann, Snyder, & Clesi, 1994). Positive changes in dietary behaviors and physical activity have also taken place following school-based nutrition education programs (Perez-Rodrigo & Aranceta, 2001).

SUMMARY

Sports nutrition is becoming increasingly appealing with the advances in ergogenic aid for athletes. With this increase in interest, coaches and athletes are seeking more information; however, studies indicate they are still lacking fundamental knowledge. They also have attitudes and behaviors that may affect their nutrient levels. Poor dietary intake can affect both the health and performance. High school athletes are of particular concern because they are at a critical growth and developmental stage in their life.

Nutrition education can provide both coaches and athletes with appropriate knowledge to help change their attitudes and behaviors. It is important to consider the areas in which they are lacking knowledge and also the best techniques to provide nutrition education. There is great need for more nutrition education for high school coaches. An increase in nutrition education for high school coaches will ideally lead to positive impacts on the athletes' health and performance.

The purpose of this study is to: 1) examine high school coaches' and athletic directors' nutrition knowledge, attitudes, and practices as they relate to weight loss/weight gain, fluids/dehydration, pre- and post-competition meals, training diets, and nutrition supplements; 2) develop educational programs for high school coaches and athletes to improve their knowledge, attitudes, and practices in areas of interest and knowledge deficiency (fluids/hydration, nutritional supplements, and pre-and post-competition meals), as evidenced by a analysis of the survey results; and 3) evaluate nutrition education programs provided.

CHAPTER 3. METHODS

Subjects

Subjects for this study were all high school head coaches for boys and girls athletic programs in the state of Iowa. The mailing lists for the coaches were provided by the Iowa Boy's High School Athletic Association and Iowa Girl's High School Athletic Union. Athletic directors were contacted via an e-mail list serve to encourage their coaches to complete the survey. All procedures were reviewed and approved by the Institutional Review Board at Iowa State University (Appendix A) and all subjects signed an informed consent form (Appendix B). A total of 5,251 addresses of high school head coaches were provided. Of the 5,251 coaches, 47% (N= 2,478) represented coaches of girls' sports and 53% (N= 2,773) represented coaches of boys' sports. The composition of the sample included:

- 395 boys' basketball coaches,
- 392 girls' basketball coaches,
- 392 girls' volleyball coaches,
- 390 girls' softball coaches,
- 385 boys' baseball coaches,
- 379 boys' track coaches,
- 367 girls' track coaches,
- 365 boys' golf coaches,
- 363 boys' football coaches,
- 331 girls' golf coaches,
- 309 girls' cross-country coaches,
- 308 boys' cross-country coaches,
- 298 boys' wrestling coaches,
- 125 boys' soccer coaches,
- 119 girls' tennis coaches,
- 118 girls' soccer coaches,
- 109 boys' tennis coaches,
- 60 girls' swimming coaches, and

- 46 boys' swimming coaches.

Procedures

Part I: Initial Survey of High School Coaches

A cover letter (Appendix C), informed consent, 43-question survey (Appendix D), and a stamped and addressed envelope were sent to all potential subjects. The survey was developed using questions, verbatim and adapted, from existing surveys. Questions from existing surveys were adapted for each subscale: confidence in knowledge (Sossin et al., 1997), knowledge (Sossin et al., 1997; Nichols et al., 2005; Corley et al., 1990; Smith-Rockwell et al., 2001), attitudes (Graves et al., 1991; Langford Bedgood & Tuck, 1983; Smith Rockwell et al., 2001), and practices (Corely et al., 1990; Graves et al., 1991; Langford Bedgood & Tuck, 1983; Smith Rockwell et al., 2001). Three questions surveyed descriptive information including: 1) sport(s) coached, 2) years of coaching experience, and 3) age group coached (junior or senior high; some coaches may coach both junior and senior high level). The second section of the survey examined coaches' confidence in nutrition knowledge and their ability to assist their athletes in five specific content areas: (1) weight loss/weight gain, (2) fluids/dehydration, (3) pre- and post-competition meals, (4) training diets, and (5) dietary supplements. The third section of survey consisted of seven statements assessing coaches' attitudes toward nutrition and 23 statements assessing knowledge about nutrition. A 5-point Likert scale where 1= strongly agree and 5= strongly disagree was used for the second and third sections of the survey. The fourth section of the survey examined coaches' nutrition practices using a 3-point Likert scale where 1 = always, 2 = sometimes, and 3 = never. 'Always' was defined as once a week during the season and 'sometimes' was defined as 3-5 times during the season. Finally, coaches identified where teams eat at on road trips and sources of information they and their athletes most used for nutrition information, as well as the coaches' preferred media to receive nutrition education.

Part II: 'Eat to Compete'

Intervention Development

Survey results were used to identify topics of interest and/or concern and the coaches preferred media sources for additional information. Topics of interest and/or

concern included fluids/dehydration, training diets, and dietary supplements. The coaches preferred to receive nutrition information through videos (21%), speakers/presentations (19%), and local workshops/training (18%). 'Eat to Compete,' an Iowa State University Extension program was developed as a three-part program to address each of the nutrition topics identified by the coaches (fluids/hydration, training diets, and dietary supplements).

Each topic program included a video, power point presentation, and an experiential learning activity to incorporate each of the preferred forms of media by the coaches. Each of the programs was designed so that it could be adapted from 20 to 75 minutes. A presentation outline was prepared for each program to ensure that presenters used a similar format (Appendix E). The following format was used for each of the program topics.

1) Opening activity – A short introduction about the topic/programs was provided by the presenter.
2) DVD video segment – *Winning Sports Nutrition 2000*, from University of Arizona was used to introduce each presentation topic. Clips from the video used included 'Fluids,' 'Supplements,' and 'Meal Ideas.'
3) Power point presentation – 15 minute power point presentation provided an overview of the topic, implications for athletic performance, and recommendations for athletes.
4) Experiential learning – an activity provided an opportunity to apply the information to everyday/real-life situations. For example, the *Training Diets* activity was a comparison of food items from fast food restaurants and comparisons of common meals eaten at home/school.
5) Handout – a handout of the presentation topic was provided to the attendees with information from presentation, along with additional facts.
6) Question and Answer – time was allotted for attendees to ask the presenter additional questions about the topic.
7) Evaluation – attendees were asked to complete an evaluation form.

Intervention Delivery

The 'Eat to Compete' programs were marketed to all Iowa high school coaches, athletic directors, and Area Education Agencies. In addition, each Area Education Agency received the *Winning Sports Nutrition 2000* video to include in the lending library for teachers, coaches, and athletic directors in order to stimulate interest in the program. Iowa State University Extension and Nutrition Health Field Specialists (NHFS) (N=13) promoted the program through existing extension networks and local school districts. The Iowa Boys and Iowa Girls Athletic Associations promoted the programs to all of the state's athletic directors with a letter and flier.

Eleven programs were delivered to athletes, coaches, school staff, and parents representing 17 Iowa high schools and 1 community-wide event. The programs provided included: four 'Training Diets,' three 'Fluids,' one 'Dietary Supplements,' and three were a combination of all three topics.

Intervention Evaluation

Pre- and post-evaluations (Appendix F) were developed for each presentation topic based on sample presentation evaluations (University of Washington, 2003). Five questions for each presentation were developed to assess key points addressed in the presentation. A five-point Likert scale where 1 = strongly agree and 5 = strongly disagree was used to examine their knowledge before and after the presentation by asking the same five questions both before and after the presentation. Post-evaluations included an additional five questions to assess effectiveness and delivery of the presentation. A total of 378 participated and 679 evaluations were completed, including pre- and post-evaluations.

Part III: Follow-up Survey

The same 43-question survey was sent to head coaches in the communities in which an 'Eat to Compete' presentation took place. The coaches were contacted by mail with a cover letter (Appendix G), informed consent (Appendix H), and survey (Appendix D). They were asked to complete the survey and return it approximately two weeks later. They were also sent a reminder postcard 3 weeks after the initial deadline, allowing them an additional two weeks to complete the survey.

Data Analysis

Part I: Initial Survey of High School Coaches

Likert scale responses for confidence, knowledge, attitude, and practices were scored such that higher scores reflected greater confidence and knowledge, and more positive attitudes and practices. Scores were converted to percent correct response scores to facilitate comparisons between each of the subscales. Analysis was performed on confidence, knowledge, attitude, and practices by years of experience, gender of sport coached, and sport classification. Sports were classified as weight-related and non-weight related for comparison purposes. Non-weight-related sports included baseball/softball, basketball, golf, soccer, volleyball, and football (Croll et al., 2006; Sungot-Borgen, 1993; Griffin & Harris, 1996). However, for this study, football was grouped in the weight-related sports because a larger body mass is emphasized (Labre, 2002; Johnson, Powers, & Dick, 1999; Parkes & Read, 1997; Thompson & Sherman, 1999). Other weight-related sports included sports emphasizing a lean body mass for performance and/or appearance (cheerleading, cross-country, swimming, track, and wrestling) (Croll, et al., 2006; Sungot-Borgen, 1993; Thompson & Sherman, 1999; Griffin & Harris, 1996)

Part II: 'Eat to Compete'

Likert scale responses for pre-knowledge, post-knowledge, and post-evaluation were scored such that higher scores reflected greater knowledge and more effective program delivery. Overall knowledge and program effectiveness was examined using the means of the five knowledge responses and the evaluation responses. Percent of correct/positive was calculated by summing knowledge and evaluation responses and dividing by the maximum score (25).

Part III: Follow-Up Survey

Confidence, knowledge, attitude, and practices were compared to the initial survey. Analysis by years of experience, gender sport coached, and sport classification was also performed.

Statistical Analysis

All statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS, version 15.0) software (SPSS, Inc.; Chicago, IL). Descriptive statistics (frequencies, percentiles, means, and standard deviations) were performed on all data. Independent-Samples T Test and Chi-Square were used to compare responses of (1) girl/boy coaches, (2) weight related/non-weight related sports, (3) pre-and post-evaluation results and (4) follow-up survey and initial survey results. One way analysis of variance (ANOVA) with Tukey's post hoc analysis was used for multiple comparisons, such as years of coaching experience and program evaluation by program topic (fluids/dehydration, training diets, and nutrition supplements) and audience (school staff, athletes, and combination). Pearson's correlation and stepwise linear regression were also performed on the initial survey. All statistical analyses were conducted at $P < 0.05$ level of significance.

CHAPTER 4. NUTRITION KNOWLEDGE, ATTITUDES, AND PRACTICES OF HIGH SCHOOL COACHES

A paper submitted to International Journal of Sport Nutrition and Exercise Metabolism

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Abstract

Adolescent athletes view coaches as a knowledgeable and reliable source of nutrition information; however, high school coaches may not be adequately prepared to provide sound nutrition information. Few studies have examined specific factors that may influence coaches' knowledge, attitudes, and practices. The objective of this study was to examine head high school coaches' nutrition knowledge, attitudes, and practices by gender of sport coached, weight-related and non-weight-related sport, and years of experience. Participants (N = 1056) completed a 43-question survey assessing confidence, knowledge, attitudes, and practices. Overall, coaches' confidence in their nutrition knowledge was marginal (75.6%); in fact, their knowledge score was suboptimal (68.8%). They were least confident in their knowledge about dietary supplements (63.0%) and training diets (72.3%), and least knowledgeable about fluids/dehydration (64.0%) and training diets (66.9%). Coaches of boy sports were more confident in their knowledge (+4.5%; $P<0.01$), but reported poorer practices (-1.7%; $P<0.01$) than coaches of girl sports. Coaches of weight-related sports reported more confidence in their knowledge (+8.0%; $P<0.01$), greater knowledge (+2.0%; $P<0.01$), and more positive attitudes (+3.4%; $P<0.01$), but poorer practices (-1.4%; $P<0.01$) than coaches of non-weight-related sports. Results of this study suggest that nutrition education for high school coaches be tailored according to the gender of the sport coached and sport classification (weight-related vs. non-weight related). Additionally, nutrition education should focus on improving nutrition cognition by incorporating higher levels of learning, such as comprehension, application, and evaluation. A multidimensional approach to conveying nutrition information will help facilitate improving nutrition behaviors.

Key Words: athletes, weight-related, education

High school coaches are role models for their athletes. As such, they have a unique responsibility to know and practice sound health principles, including nutrition. They have the potential to be a vital resource to identify problematic health behaviors and convey health messages to their athletes. Athletes view coaches as a knowledgeable and reliable source of nutrition information (Sossin, Gizis, Marquart, & Sobal, 1997; Wiita & Stombaugh, 1996); however, coaches may not be adequately prepared to provide sound nutrition information (Smith Rockwell, Nickols-Richardson, & Thye, 2001; Sossin, Gizis, Marquart, & Sobal, 1997; Graves, Farthing, Smith, & Turchi, 1991; Langford-Bedgood & Tuck, 1983). Lack of nutrition knowledge among coaches and athletes can lead to questionable dietary practices, resulting in adverse effects on performance and health (Nichols, Jonnalagadda, Rosenbloom, & Trinkaus, 2005).

Factors that have been related to collegiate coaches' nutrition knowledge include gender of sport coached and years of experience (Smith-Rockwell et al., 2001). Collegiate coaches of sports with a greater emphasis on weight such as gymnastics (Heffner, Ogles, Gold, Marsden, & Johnson, 2003) and wrestling (Smith Rockwell et al., 2001; Sossin et al, 1997), have been shown to have poorer attitudes and practices regarding eating and weight management. Ultimately, coaches need positive attitudes and practices to role model appropriate nutrition behaviors, in addition to accurate knowledge.

Research indicates a need for ongoing nutrition education for coaches (Langford Bedgood & Tuck, 1983; Graves et al., 1991; Griffen & Harris. 1996; Sossin et al., 1997). Research among high school coaches suggests a deficit in nutrition knowledge including weight control (Sossin et al, 1997; Griffin & Harris, 1996), fluids and hydration, pre-event meal, and nutrition supplementation (Graves et al., 1991; Langford Bedgood & Tuck, 1983) This deficit in knowledge influences attitudes and practices (Graves et al., 1991). However, the relationship between nutrition knowledge, attitudes, and practices of high school coaches by years of experience, gender of sport coached, and type of sport coached was not examined.

Fortunately, high school coaches are eager to learn more about key issues such as training diets, safe weight loss methods, pre-competition meals, and fluids and

dehydration (Sossin et al., 1997). Increasing high school coaches' knowledge may improve attitudes and practices (Nichols et al., 2005; Cupisiti, Alessandro, Castrogiovanni, Barale, & Morelli, 2002) and ultimately the performance and health of their athletes. The purpose of this study was to: (1) examine confidence, knowledge, attitudes, and practices of high school coaches on various nutrition topics (weight loss/weight gain, fluids/dehydration, pre-and post-competition meals, training diets, and nutrition supplements); and (2) explore coaches' confidence, knowledge, attitudes, and practices by years of experience, gender of sport coached, and sport classification (weight-related and non-weight-related).

Methods

The coaches who participated in this study were high school head coaches for boys and girls athletic programs in the state of Iowa. All head high school coaches in Iowa during the time of the study were eligible to participate in the study (N=5,251). Of the 5,251 coaches, 47% (N= 2,478) represented coaches of girls' sports and 53% (N= 2,773) represented coaches of boys' sports. All protocols were approved by the Institutional Review Board at Iowa State University, and all participants signed an informed consent form.

Survey

A 43-question survey was developed using questions, verbatim and adapted, from existing surveys administered to high school and collegiate coaches, trainers, and athletes (Smith-Rockewell et al., 2001; Sossin et al., 1997; Graves et al., 1991; Corely et al, 1990; Langford Bedgood & Tuck, 1983). Part I of the survey included three demographic questions: (1) sport(s) coached; (2) years of coaching experience; and (3) age group coached (junior or senior high school). The remainder of the survey included subsets of questions, which were scored to create subscales of coaches' confidence with nutrition knowledge (N=5), nutrition knowledge (N=22), general attitudes toward nutrition (N=8), and nutrition practices recommended to athletes (N=10). Coaches' confidence and nutrition knowledge was explored in five content areas: (1) weight loss/weight gain; (2) fluids/dehydration; (3) pre- and post-competition meals; (4) training diets; and (5)

nutrition supplements. Nutrition practices were explored in the areas of weight loss/weight gain, fluids/dehydration, and dietary supplements.

Responses to questions regarding confidence, knowledge, and attitudes were scored using a 5-point Likert scale (1= strongly agree, 2= agree, 3= neither agree/disagree, 4= disagree, and 5= strongly disagree). Nutrition practices were scored on a 3-point Likert scale (1 = always, 2 = sometimes, and 3 = never). 'Always' was defined as once a week during the season and 'sometimes' was defined as 3-5 times during the season. Examples of survey questions appear in Table 1. Internal consistency was analyzed for all 4 subscales of the survey and the Cronbach's alpha level for confidence, knowledge, attitudes, and practices were 0.87, 0.56, 0.40, and 0.73, respectively.

Survey Administration

Mailing lists for the coaches were provided by the Iowa High School Athletic Association and Iowa Girl's High School Athletic Union. Coaches were mailed an informed consent, survey, self-addressed stamped envelope, and web address where the survey could be completed online.

Data Analysis

Sports were classified as weight-related or non-weight related for the purposes of this study. Non-weight-related sports included baseball/softball, basketball, golf, soccer, and volleyball (Croll et al., 2006; Sungot-Borgen, 1993; Griffin & Harris, 1996). For this study, football was grouped with weight-related sports because of the emphasis on larger body mass (Labre, 2002; Johnson, Powers, & Dick, 1999; Thompson & Sherman, 1999). Other weight-related sports included sports emphasizing lean body mass for performance and/or appearance including cheerleading, cross-country, swimming, track, and wrestling (Croll, Neumark-Sztainer, Story, Wall, Perry, & Harnack, 2006; Sungot-Borgen, 1993; Thompson & Sherman, 1999; Griffin & Harris, 1996).

All statistical analyses (descriptive statistics, independent sample t-tests, Pearson correlation coefficients, one-way ANOVA) were conducted using SPSS, version 15.0 for Windows (Chicago, IL). Likert scale responses for confidence, knowledge, attitude, and practices were scored such that higher scores reflected greater confidence and knowledge,

and more positive attitudes and practices. Scores were converted to percentages to facilitate comparisons between each of the subscales.

Independent samples t-tests were used to compare survey responses by coaches of boy sports versus coaches of girl sports and coaches of weight-related versus coaches of non-weight-related sports. One way analysis of variance (ANOVA) with Tukey's post hoc analysis was used to examine responses based on years of coaching experience. All statistical analyses were at $P < 0.05$ level for significance.

Results

A total of 1,057 returned the survey, indicating a 20% response rate. However, the total number of sports represented by the survey indicated a 36% rate when compared to the number of head coaching positions sent the survey. Demographic information of respondents appears in Table 2. Demographics of respondents was similar to the population with the exception of football, which represented a greater proportion of the sample (11%) than the total population (7.5%). Almost half of the coaches (43.6%) had 15-20 years of experience and about one-fourth of them coached junior high sports (23.1%) in addition to coaching high school sports. Coaches of weight-related sports (34.4%) represented a slightly smaller proportion of the sample than coaches of non-weight-related sports (43.1%).

Confidence

Coaches were fairly confident in their nutrition knowledge; the mean confidence score was 75.6%. Responses indicated they were most confident in their knowledge regarding fluids/dehydration, weight loss/weight gain, and pre- and post-competition meals; a minimum of 75% of the coaches agreed or strongly agreed that they were confident in their knowledge about these topics. Coaches were least confident about training diets and nutrition supplements; only 60.0% and 41.0 % agreed or strongly agreed that they were confident in their knowledge about training diets and nutrition supplements, respectively.

No significant differences were observed in confidence based on years of experience; however, significant differences were observed between gender of sport coach and sport classification (weight-related versus non-weight-related) (Figure 1). Coaches of boy sports were more confident in their nutrition knowledge in every topic

(weight loss/weight gain, fluids/dehydration, pre-and post-competition meals, training diets, and nutrition supplements) ($P < 0.01$) than coaches of girl sports (data not shown). Coaches of weight-related sports were also more confident in knowledge in every topic ($P < 0.01$) than non-weight affiliated sports (data not shown). Of the weight-related sports, wrestling coaches tended to be more confident in their knowledge. In particular, they tended to be more confident in weight loss/weight gain, pre-and post-competition meals, training diets, and nutrition supplements than other coaches ($P<0.05$; data not shown).

Knowledge

The mean knowledge score among the coaches was 68.8%; they were most knowledgeable about weight loss/weight gain, where the mean knowledge score was 80.6%. They were less confident about fluids/dehydration, pre- and post-competition meals, training diets, and nutrition supplements, with mean knowledge scores ranging from 64.0-68.5%.

Coaches with more experience tended to have greater overall knowledge than those with less years of experience (Figure 2); overall knowledge among coaches with 15-20 years of experience was significantly greater ($P<0.05$) than coaches with 5-10 years of experience. This was particularly evident in knowledge related to pre-and post-competition meals ($P < 0.01$) (data not shown). There was no difference in overall knowledge by gender of sport coach; however, coaches of girls sports were more knowledgeable about weight loss/weight gain, whereas coaches of boys sports were more knowledgeable about fluids/dehydration ($P<0.01$; data not shown). Coaches of weight-related sports had greater knowledge ($P<0.01$) than coaches of non-weight-related sports (Figure 2); this was true for every topic ($P <0.01$) but weight loss/weight gain (data not shown).

Attitudes

Coaches' attitudes were fairly positive, reflected by a mean score of 71.3%. Most agreed or strongly agreed (82.7%) they should advise athletes about nutrition, but they were not confident they influenced their athletes' food choices (53.7% agreed or strongly agreed) (data not shown).

There were no differences in attitudes by years of experience (Figure 3); however, there were differences in some individual items. Interestingly, coaches with *less* experience (0-5 years) were more likely to agree ($P<0.05$) that athletes are knowledgeable about nutrition; whereas, coaches with *more* experience (15-20 years) were more likely to agree ($P<0.05$) that athletes are interested in nutrition and its effect on performance (data not shown). Coaches with more years of experience were also more likely to agree ($P<0.05$) that appropriate body weight and composition are important for optimal athletic performance (data not shown).

There was a difference in attitudes by gender of sport coached; coaches of boys sports had a more positive attitudes ($P<0.05$) than coaches of girls sports (Figure 2). Specifically, coaches of boy sports were more likely to agree ($P<0.05$) that coaches should advise athletes about their diets, high school athletes are interested in nutrition and its effect on performance, and appropriate body weight and composition are important for optimal athletic performance. Coaches' of weight-related sports had more positive attitudes ($P<0.01$) than non-weight-related sports; they responded more favorably ($P<0.05$) to more than half of the attitudes items.

Practices

Most coaches (93.1%) reported they sometimes or always discuss nutrition with their athletes (data not shown). The mean practice score was 86.1%, reflecting more positive practices by the coaches (data not shown). The most common recommendations included weight loss/weight gain (42.9% sometimes or always recommend), multivitamin/mineral supplements (36.4%), and individual nutrition supplements (31.5%) (data not shown).

Coaches with less coaching experience (0-5 years) had the highest practice score (Figure 4), which was significantly higher ($P<0.05$) than coaches with 10-15 years of experience. Coaches of girls sports had more positive practices than coaches of boy sports ($P < 0.01$) (Figure 4). Although coaches of boy sports were more likely to discuss nutrition with their athletes, they were more likely to recommend sometimes questionable multivitamin/mineral supplements, protein supplements, and creatine ($P<0.01$). Coaches of non-weight-related sports had more positive practices than those of weight-related sports ($P < 0.01$) (Figure 4). They were more likely not to recommend weight

loss/weight gain (P<0.01), protein supplements (P<0.01), creatine (P<0.01), and individual supplements (P<0.01).

Pearson correlation analyses revealed significant (P<0.01) positive correlations between confidence, knowledge, and attitudes, but a significant (p<0.01) correlation between confidence and practices and not correlation between knowledge and practices (Table 3). Simple linear analysis was used to examine variables that might predict coaches' nutrition practices. Sport classification (weight-related/non-weight-related), gender of sport coach, and attitudes score were significant predictors, but did not produce a meaningful model.

Discussion

Overall, high school coaches' knowledge score of 68.8% is inadequate. They were slightly more confident in their knowledge with an overall confidence score of 75.5%. Interestingly, coaches were most confident in their knowledge regarding fluids/dehydration (85.5%) yet, scored lowest on fluids/dehydration knowledge subscale (64.0%). They were unsure about appropriate fluid replacement guidelines, which is consistent with previous reports (Sossin, et al., 1997). Specifically, 30.7% of the coaches believed that thirst is an adequate indicator of fluid and 45.1% strongly disagreed, disagreed, or neither agreed/disagreed that 2-3 cups of fluid is required to replace one pound of weight loss.

Fluid misconceptions have also been previously reported in high school athletes; 32.4% believed thirst is the best indicator of dehydration and 68.3% believed sports drinks were better than water (Nichols et al., 2005). Results of this study suggest that athletes' perceived benefit of sports drinks *over* water may be a reflection of coaches' practices; the majority (76.9%) of coaches in this study always or sometimes recommended sports drinks to their athletes. Thus, fluid misinformation and misconceptions continue to be a problem among high school coaches and athletes, and can lead to questionable life-threatening practices.

Coaches' confidence, knowledge, and practices scores related to weight loss/weight gain were very similar (79.0%, 80.6%, and 83.4%, respectively). Despite coaches recognizing that eating disorders are a concern among athletes (83.0%), the

majority (90.3%) believed appropriate body weight and composition are important for optimal athletic performance. In addition, almost half (42.9%) always or sometimes recommend weight loss or weight gain to their athletes. Emphasis on weight management and negative messages regarding weight status could cause some athletes to become pre-occupied with their weight, which can spiral into disordered eating.

Coaches were more confident with their knowledge about pre-and post-competition meals (77.9%) and training diets (72.3%) than their knowledge scores reflected (68.5% and 66.9%, respectively). They recognized the importance of meals consumed several days before competition and the timing of the pre-event meal; however, they were unsure about specific nutrient recommendations. Whether this knowledge translated to positive practices related to the pre-event meal was not examined by this study; however, previous research suggests that high school coaches have undesirable practices pertaining to the pre-event meal (Graves et al., 1991).

Nutrition supplements was a topic where coaches were neither confident (63.0%) nor knowledgeable (68.5%); however, appeared to have positive practices (82.1%). Although 17% of coaches agreed or strongly agreed that protein/amino acid supplementation was needed to increase muscle mass, this misconception has improved significantly considering 66.0% of coaches had this belief 20 years ago (Langford Bedgood & Tuck. 1983) and 30% just 10 years ago (Sossin et al., 1997). The majority (86.3%) of coaches in this study reported never recommending protein supplements to their athletes. Over half the coaches (70.9%) were either unsure or agreed that vitamin/mineral supplements provide energy and improve performance. This misconception may explain why 63.6% of coaches reported recommending vitamin/mineral supplements to their athletes.

Few studies have examined differences in confidence, knowledge, attitudes, and practices between coaches working with different gender athletes. Smith-Rockwell and colleagues (2001) reported that coaches of female college athletes may be more knowledgeable than those of male college athletes. The present study found no difference in knowledge between coaches of high school boy and girl sports. However, coaches of boy sports had more confidence in their knowledge ($P<0.01$) and more

positive attitudes (P<0.05), but less desirable practices than coaches of girl sports (P<0.05). In particular, coaches of boy sports were more confident in their knowledge regarding weight loss/weight gain, yet had less weight loss/weight gain knowledge and were more likely to recommend weight loss/weight gain compared to coaches of girl sports (P<0.01). They were also more confident in their knowledge regarding nutrition supplements and more likely to recommend protein supplements, sports drinks, and creatine than coaches of girl sports (P<0.01).

The most significant and meaningful differences were seen between coaches of weight-related sports and non-weight-related sports. Coaches of weight-related sports (track, cross-country, wrestling, football, cheerleading, and swimming) had more positive scores related to confidence, knowledge, and attitudes, but less desirable practices than coaches of non-weight-related sports (P<0.01). Not surprisingly, coaches of weight-related sports were more confident in their weight loss/weight gain knowledge and more likely to recommend weight loss or weight gain to their athletes (P <0.01). Yet coaches of weight-related sports did not have greater weight loss/weight gain knowledge when compared to coaches of non-weight-related sports. Wrestling coaches were most likely to recommend weight loss/weight gain to their athletes when compared to other coaches of weight-related boy sports (P<0.05).

Recently, research reported a strong positive relationship between weight-related sport participation and unhealthful weight-control behaviors in adolescent males (Vertalino, Eisonberg, Story, & Beumark-Sztainer, 2007). Results of the current research suggest that these unhealthful weight control behaviors may be the result of less desirable practices among coaches of boy sports, particularly weight-related sports. Coaches of weight-related sports were also more were more likely to agree that appropriate weight body weight and composition were important for optimal performance (P <0.01). Previous studies have reported many coaches and athletes believe optimal performance is only possible at a low body weight (Davis, 1992; Harris & Grecco, 1990). Adolescent athletes tend to be more concerned about appearance and immediate performance and less concerned with long term health consequences (Wiita & Stombaugh, 1996); thus, preoccupation with weight status in this age group can have profound implications. In

fact, athletes in weight-related sports have been shown to be at risk for eating disorders (Ziegler, Sharp, Hughes, Evans, & Khoo, 2003; Smith-Rockwell et al, 2001). Although adolescent female athletes are more likely to partake in disordered eating behaviors than non-athletes (Sherwood, Neumark-Sztainer, Story, Beurhring, & Resnick, 2002), this likelihood is even greater in adolescent male athletes, particularly those in weight-related sports (Vertalino et al., 2007). Thus, it is critical that coaches of adolescent athletes, particularly of weight-related sports, have the proper knowledge and practices regarding weight loss/weight gain.

With a suboptimal knowledge score of 68.8%, coaches are not knowledgeable about sports nutrition for their athletes. Although their knowledge was positively correlated to confidence and attitudes, low Pearson r-values indicate that the associations are weak and not generlizable. The relationship between nutrition knowledge and nutrition behavior has been extensively studied. Results suggest that nutrition knowledge may not be related to behavioral change (Collision, Kuczmarski, & Vickery, 1996; Potter & Wood, 1991; Contento, Manning, & Shannon, 1992; Chapman et al, 1997); however, more recently nutrition knowledge and attitudes were positively correlated with behavior in collegiate athletes (Nichols et al., 2005). Thus, the relationship between nutrition knowledge and behavior remains controversial. It is possible that the disassociation between knowledge and behavior may be due to a lack of instructional materials related to nutrition and a lack of research focusing on effective educational methods (Potter & Wood, 1991). It may also be due to an inadequate conceptualization and measurement of knowledge or dietary behavior (Axelson & Brinberg, 1992). Nutrition knowledge is often measured as one dimension; however, based on Bloom's taxonomy, knowledge is only one level of learning (Bloom, Englehart, Hill, & Krathwohl, 1956). Other factors contribute to cognition including comprehension, application, analysis, synthesis, and evaluation. In order to achieve a higher level of learning and increased competence, more emphasis should be placed on a multi-dimensional approach to education rather than just knowledge improvement.

There are limitations to the present study. The attitudes and knowledge subscales ofthe survey had unacceptable reliability (Cronbach's alpha <0.60) (De Vellis, 1991).

Low Cronbach's alpha of the attitudes subscale could be explained by the limited number of items forming the scale (Hattie, 1985). Low Cronbach's alpha in the knowledge subscale could be explained by the items variability; the knowledge subscale questions assessed a wider variety of topics regarding sports nutrition. Therefore, the heterogeneity of the knowledge subscale may lead to a low Cronbach's coefficient. Additionally, the practices subscale was scored using a 3-point Likert scale making the range smaller than the 5-point Likert scale used in the other subscales, confidence, knowledge, and attitudes. This likely artificially inflated the practices scores; thus, they appear larger, especially when compared to the confidence, knowledge, and attitudes scores.

There were also limitations in the sample. Coaches in this study represent those from one Midwest state and participation in the survey represented only 36% of the population, which prevents generalizing the conclusions. Yet, the population was fairly representative of the states' head high school coach population, with the exception of football coaches, which made up a greater proportion of the sample population. The gender of the coach was not assessed, and there may be differences by gender of coach in addition to the gender of the sport coached. Finally, the sample had a large number of coaches with extensive coaching experience (43.6% having 15-20 years of experience), and it is unknown if this is representative of coaches in the state or nationwide.

Despite these limitations, this study verifies continued need for nutrition education among high school coaches. Not only are they not confident in their knowledge about nutrition, but their knowledge score of 68.8% is inadequate. This study also suggests that nutrition education needs of high school coaches varies by gender of sport coached and weight-related/non-weight related sport. These differences may necessitate tailoring nutrition education programs to these audiences. Knowledge, alone, does not translate into practices. Other dimensions of cognition, including comprehension, application, analysis, synthesis, and evaluation are necessary to achieve a higher level of learning and competence, in order to encourage behavior change. Nutrition education needs to provide nutrition information and guidance to coaches through higher levels of learning, utilizing multiple dimensions of cognition. This will

help promote positive attitudes and encourage positive behaviors, recognizing the role nutrition has on performance.

In conclusion, high school coaches do not have adequate and/or appropriate knowledge about sports nutrition for their athletes; given that a knowledge score of 68.8% is suboptimal. However, nutrition knowledge was not associated with practices. This has implications for nutrition education for high school coaches, in that, along with improving knowledge, nutrition education needs to focus on improving all levels of cognition, including comprehension, application, analysis, synthesis, and evaluation, in order to better ensure behavior change. Nutrition education also needs to be tailored to the gender of the sport coached and especially to their sport classification. Coaches of boy sports and/or weight-related sports appear to have more confidence in their knowledge, more knowledge, better attitudes, but poorer practices. Therefore, nutrition education for those coaches needs to incorporate higher levels of cognition to help promote positive behavior change. Ultimately, improved nutrition cognition, better attitudes and practices will allow coaches to better educate their athletes about the benefits of nutrition for health and performance.

Table 1 Sample Confidence, Knowledge, Attitude, and Practice Statements

Statement	
Topic #1: Weight loss/weight gain	
Confidence:	I am confident with my nutrition knowledge and am able to assist my athletes with questions/concerns about: weight loss/weight gain. Strongly Agree / Agree / Neither Agree/ Disagree / Disagree / Strongly Disagree
Knowledge:	A five pound weight loss or gain per week is an appropriate loss or gain. Strongly Agree / Agree / Neither Agree/ Disagree / Disagree / Strongly Disagree
Practice:	I recommend to my athletes: weight loss/weight gain. Always (Once a week) / Sometimes (3-5 times a season) / Never
Topic #2: Fluids/dehydration	
Confidence:	I am confident in my nutrition knowledge and am able to assist my athletes with questions/concerns about: fluids/dehydration. Strongly Agree / Agree / Neither Agree/ Disagree / Disagree / Strongly Disagree
Knowledge:	To replace fluid loss, it is best to drink 2-3 cups of fluid for every pound of weight lost. Strongly Agree / Agree / Neither Agree/ Disagree / Disagree / Strongly Disagree
Practice:	I recommend to my athletes: sports drinks. Always (Once a week) / Sometimes (3-5 times a season) / Never

Table 2 Demographic Characteristics of Study Participants

Years of Experience	**No**	**%**
0-5 Years	172	16.3
5-10 Years	226	21.4
10-15 Years	176	16.7
15-20 Years	461	43.6
Total	**1035**	
Grade Level[a]	**No**	**%**
Junior High	244	23.1
High School	1026	97.1
Total	**1057**	
Sport classification[b]		
Weight-related	364	34.4
Non-weight-related	456	43.1
Total	**820**	
Gender[c]		
Girls	353	33.4
Boys	420	39.7
Total	773	

[a]Coaches were allowed to select both grade levels.

[b]Weight-related sports included cheerleading, cross-country, football, swimming, track, and wrestling. Non-weight-affiliated sports included baseball/softball, basketball, golf, soccer, and volleyball. Coaches of both weight-related sport and non-weight-related sport were not included in sport classification analyses.

[c]Coaches who coached both genders were not included in gender of sport analyses.

Figure 1, Seminara, top

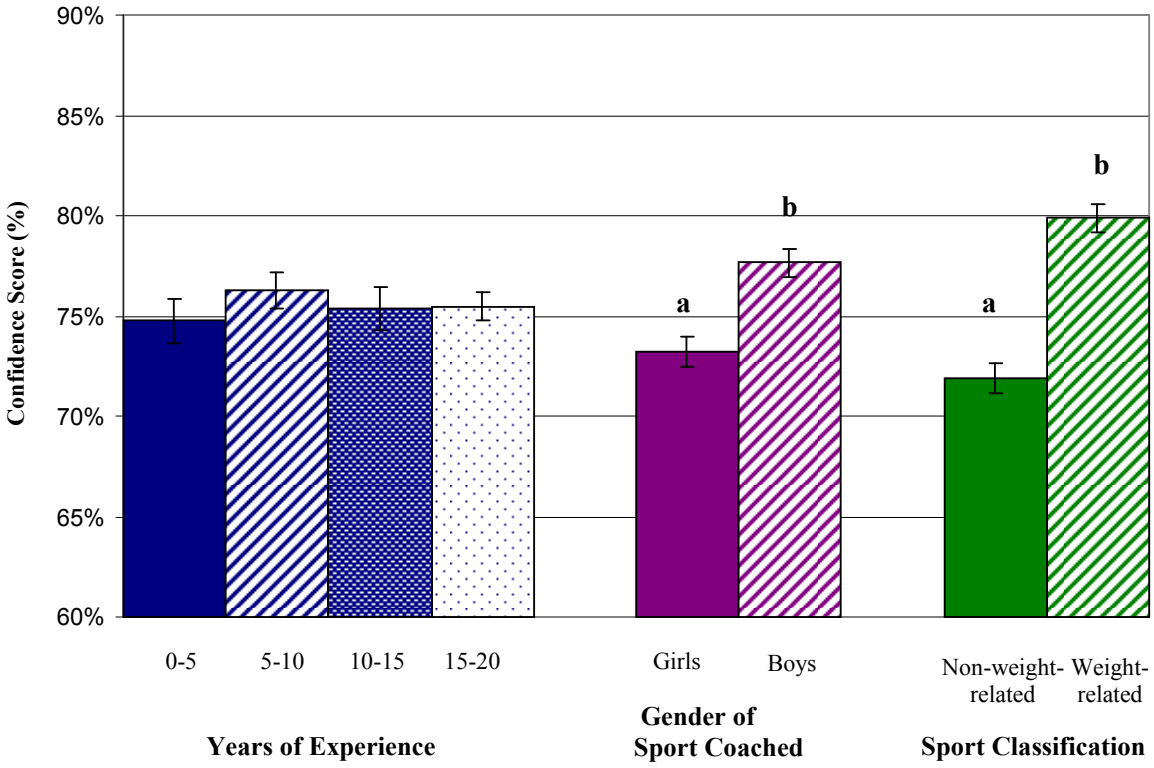

Figure 1- Mean ± SE Confidence Score (%).

Variables with different letters indicate significant difference at a p-value of $P<0.01$.

Figure 2, Seminara, top

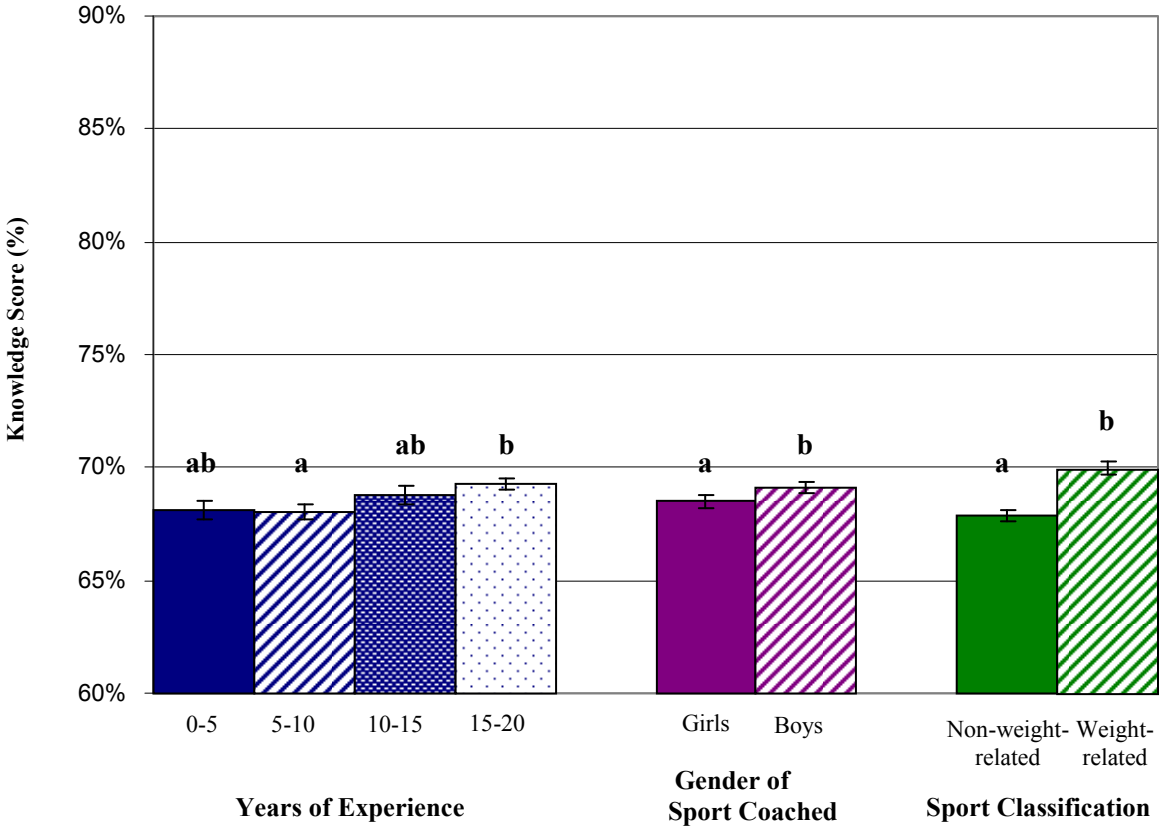

Figure 2- Mean ± SE Knowledge Score (%).

Variables with different letters indicate significant difference at a p-value of $P<0.05$.

Figure 3, Seminara, top

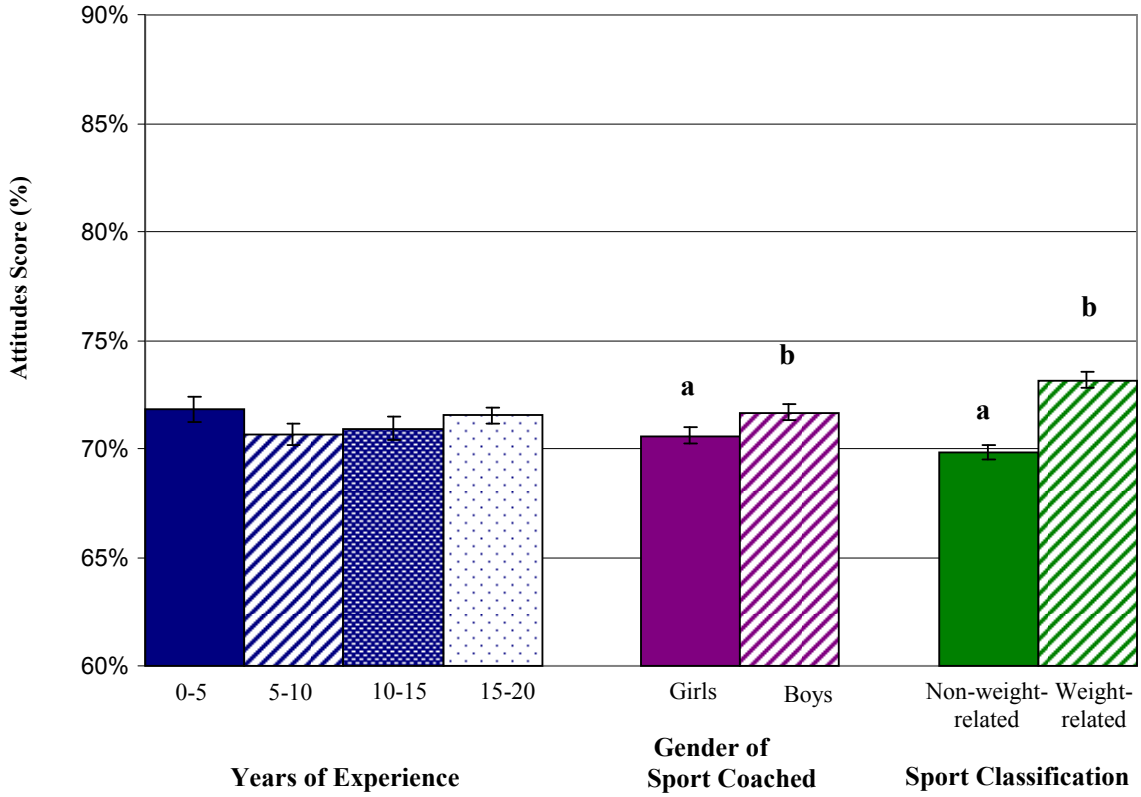

Figure 3- Mean ± SE Attitudes Score (%).

Variables with different letters indicate significant difference at a p-value of $P<0.05$.

Figure 4, Seminara, top

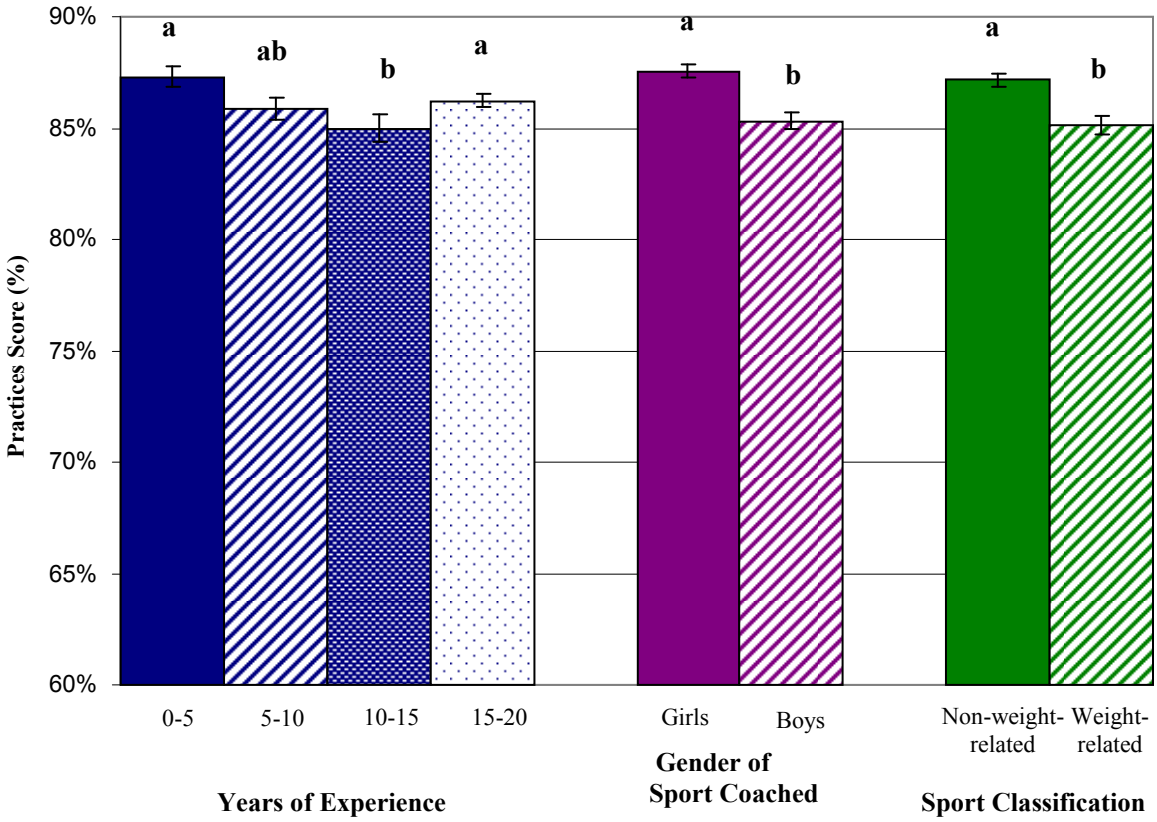

Figure 4- Mean ± SE Practices Score (%).

Variables with different letters indicate significant difference at a p-value of $P<0.05$.

Table 3 Pearson Correlation Coefficients Between Confidence, Knowledge, Attitude, and Practice Scores of High School Coaches

	Confidence score	Knowledge score	Attitude score	Practice score
Confidence score	1.00	0.27**	0.28**	-0.15**
Knowledge score		1.00	0.17**	0.27
Attitude scores			1.00	-0.08*
Practice score				1.00

**P < 0.01

*P < 0.05

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CHAPTER 5. EVALUATION OF A NUTRITION EDUCATION INTERVENTION FOR HIGH SCHOOL COACHES AND ATHLETES

A paper submitted to Journal of Nutrition Education and Behavior

ABSTRACT

Objective: To evaluate three sports nutrition education programs provided to high school coaches and athletes.

Design: A pretest-posttest design with program participants, follow-up survey with communities receiving nutrition education.

Participants: High school coaches and athletes in Iowa.

Intervention: Nutrition education program including interactive/cooperative learning strategies.

Main Outcome Measures: Difference between pre- and post- nutrition knowledge. Dependent variables were nutrition knowledge; independent variables were audience and program topic.

Analyses: Independent samples t-tests were used to compare pre- and post-tests and coaches surveys; one way analysis of variance (ANOVA) to examine evaluations by program topic and audience.

Results: Nutrition knowledge significantly improved immediately following nutrition education ($P<0.01$), with greater improvements with the 'Fluids' and 'Training Diets' (14% and 16% increase in knowledge, respectively) compared do the 'Dietary Supplements' program (11%). They were also evaluated more positively (87%) compared to the 'Dietary Supplements' program (73%). School staff (91%) evaluated programs more positively than combination audiences (85%).

Conclusions and Implications: Nutrition education increased nutrition knowledge; yet impact on attitudes and practices are unknown. Perceived effectiveness of nutrition education was influenced by program topic and audience composition. In order to achieve a higher level of learning and increased competence, more emphasis should be placed on a multi-dimensional approach to education, including application, synthesis, and evaluation, rather than just knowledge improvement.

KEY WORDS: nutrition education, high school coaches and athletes

INTRODUCTION

Nutrition is a significant component of the adolescent athlete's training regimen. Nutrient demands are high during adolescence related to the rate of growth at this stage of life (Society of Adolescent Medicine Position Statement, 1999]. Athletes have additional needs due to the demands of training. Yet, coaches and athletes often lack adequate nutrition knowledge (Smith Rockwell, Nickols-Richardson, & Thye, 2001; Sossin, Gizis, Marquart, & Sobal, 1997; Graves, Farthing, Smith, & Turchi, 1991; Langford-Bedgood & Tuck, 1983). This lack of information and misconceptions can result in marginal nutritional practices among athletes, which often influence health and performance.

Fortunately, high school coaches realize they lack adequate nutrition knowledge, and most (82-87%) report they would benefit from additional nutrition education (Sossin, et al., 1997; Seminara & Litchfield, unpublished data). Nutrition education for coaches and athletes, needs to not only improve nutrition knowledge, but also promote positive attitudes and behaviors. Understanding the role of nutrition on health and performance in sport(s) can make coaches more effective educators and role models and for their athletes.

Effectiveness of nutrition education is dependent on how well recipients receive, understand, and use information provided. Important outcomes of nutrition education include a variety of cognitive and affective skills, such as nutrition knowledge, food-related skills, behavioral expectations, and self-efficacy (Contento et al., 1992). Bloom's taxonomy describes cognition as multi-dimensional learning typology in which knowledge is the lowest level of learning. Higher levels of learning including application, analysis, synthesis, and evaluation help increase competence (Bloom, Englehart, Hill, Krathwohl, 1956). Ultimately, the goal of nutrition education is to promote positive behavior change (Potter & Wood, 1991). Previous studies suggested, but have not demonstrated, that increased knowledge will influence both high school and collegiate coaches' and athletes' attitudes and dietary behaviors (Nichols, Jonnalagadda, Rosenbloom, & Trinkaus, 2005; Alexson & Brinberg, 1992; Collision et al., 1996; Parr,

Porter & Hodgson). There is a lack of research examining the effectiveness of nutrition education provided to high school coaches and athletes.

The present study was conducted to evaluate sports nutrition education programs provided to coaches, athletes, parents and community members in a Midwestern state Iowa. The purpose was to: (1) examine change in nutrition knowledge regarding training diets, fluids/dehydration, and/or dietary supplements, and (2) examine program evaluation by program topic and audience.

METHODS

Intervention Development

A survey of all head high school coaches in the state (Seminara & Litchfield, unpublished data) was used to identify topics of interest and/or concern and preferred media for delivery of educational programs. This survey identified fluids/dehydration, training diets, and dietary supplements as topics where coaches displayed the least amount of knowledge or were least confident in their knowledge (Seminara, unpublished data). Coaches identified videos (45.6%), speakers/presentations (39.8%), and local workshops (38.2%) as preferred format/media for educational programs.

'Eat to Compete' was a series of sports nutrition programs developed by Iowa State University Extension. Each program incorporated each of the preferred media identified by coaches (video/DVD, power point speaker presentation) and an interactive learning activity. The programs addressed key concepts of each topic, which consisted of: (1) the importance of hydration, fluids recommendations, and types of sports drinks, (2) carbohydrate and protein requirements and food sources and food choices for before and after practice/competition, and (3) claims and risk of popular dietary supplements and how to evaluate a dietary supplement. Experiential learning activities were developed for each program to incorporate higher levels of learning, such as application, synthesis, and evaluation. The activities included: (1) evaluating sports drinks, (2) choosing the better meal at home and at a restaurant for before and after practice/competition, and (3) evaluating dietary supplements labels.

'Eat to Compete' programs were marketed to all Iowa high school coaches, athletic directors, and Area Education Agencies. Iowa State University Extension and

Nutrition and Health Field Specialists (N=13) promoted the program through existing extension networks and local school district contacts. The state Boys and Girls Athletic Associations promoted the programs to all of the state's athletic directors with a letter and flier. Each Area Education Agency received a complimentary DVD on sports nutrition for their lending library available to local school districts to increase interest in the programs.

Participants' knowledge before and after an 'Eat to Compete' program was examined via pre- and post-tests. Part II surveyed head coaches of all sports in communities where programs had been delivered. Survey results were compared to a survey of all head coaches in the state prior to 'Eat to Compete' programs. Pre- and post-tests were developed for each presentation topic (University of Washington, 2003). Knowledge of key points was assessed by five questions on pre- and post-tests using a five-point Likert scale (where 1 = strongly agree and 5 = strongly disagree). Post-tests included an additional five questions to examine delivery and effectiveness and of the presentation. Participants evaluated the interactive learning activities, educational materials, communication by the speaker, and their confidence in knowledge and practices regarding the program topic.

Subjects. A total of fifteen 'Eat to Compete' programs were delivered to 378 participants, who consisted of school staff including coaches, athletes, parents, and other community members. Participants represented 17 schools statewide. Five programs included 'Training Diets', two included 'Fluids', and one 'Dietary Supplements'; three additional programs were a combination of two or more of the topics.

Part II. Follow-up Survey

Study Design. Head coaches' knowledge, attitudes, and practices in communities receiving 'Eat to Compete' programs was examined by survey (Seminara, unpublished data). The survey was previously administered to all head coaches in the state prior to 'Eat to Compete' programs (Seminara, unpublished data).

Participants. Coaches in communities receiving an 'Eat to Compete' program (N=282) were mailed an informed consent, survey, and self-addressed stamped envelope. Of the 282 coaches, 49.6% (N= 140) represented coaches of girls sports and 50.4% (N= 142)

represented coaches of boys' sports. All protocols were approved by the Institutional Review Board at Iowa State University, and all participants signed an informed consent form.

Data Analysis

Statistical analyses were conducted using SPSS, version 15.0 for Windows (Chicago, IL). Likert scale responses were scored such that higher scores reflected greater knowledge and more effective program delivery. Overall knowledge and program effectiveness were examined using the means of the five knowledge responses and the means of five evaluation responses, respectively. Percent correct knowledge responses was calculated by summing knowledge responses and dividing by the maximum score (25). Responses to the knowledge statements on pre-and post evaluations were analyzed and tested for internal consistency using Cronbach's alpha. Cronbach's alpha levels were 0.65, 0.50, and 0.78 for the training diets, fluids/dehydration, and dietary supplements evaluations, respectively.

Independent samples t-tests were used to compare pre- and post-knowledge results; one-way analysis of variance (ANOVA) with Tukey's post hoc analysis was used to examine the effectiveness and delivery of each program ('Fluids,' 'Training Diets,' and 'Dietary Supplements') by audience (coaches, athletes, or combination). All statistical analyses were conducted at $P < 0.05$ level of significance

Independent samples t-tests were used to compare coaches' confidence, knowledge, attitudes, and practices identified from the follow-up survey to the initial survey. Demographics of the coaches including years of experience, gender of sport coached and sport classification were compared via ANOVA and Tukey's post hoc analysis and independent samples t-tests.

RESULTS

Part I. Evaluation of Nutrition Education: 'Eat to Compete'

Fifteen 'Eat to Compete' programs were provided in communities across the state. A total of 676 pre- and post-evaluations were completed, consisting of 263 for the 'Fluids' program, 360 for the 'Training Diets' program, and '53' for the 'Dietary Supplements' program. Summed knowledge scores improved significantly ($P < 0.01$) from pre- to

post-test in each program topic area (fluids/dehydration, training diets, and dietary supplements') (Figure 1). Responses to each of the five knowledge questions in the 'Fluids' and 'Training Diets' programs improved from pre to post-test (P = 0.00); all but two questions in the 'Dietary Supplements' program improved from pre to post-test (P<0.05) (data not shown). Coaches remained unsure whether protein/amino acid supplements are needed to increase muscle mass and whether protein supplements are superior to protein from food. The largest improvement in knowledge from pre- to post-test occurred with the 'Training Diets' program (15.8%), followed by 'Fluids' (14.1%) and 'Dietary Supplements' (11.4%).

Analyses of program effectiveness suggest that 'Fluids' and 'Training Diets' programs were more positively received (P<0.01) than 'Dietary Supplements' (Figure 2). Participants in the 'fluids' and 'Training Diets' program were more likely to agree that the information was communicated clearly and could make informed choices about the topic (P<0.05) than participants in the 'Dietary Supplements' program (Figure 3).

School staff (including coaches) evaluated the programs more positively (P<0.01) than combined audiences (Figure 2). They were more likely to agree that the information was communicated clearly; the activities reinforced their understanding; the handouts were useful; and, they were more confidence in their knowledge than combined audiences (Figure 4).

In addition, there were differences in knowledge by audience noted for the 'Fluids' and 'Dietary supplements' programs. School staff were more likely to answer correctly agree that thirst is an adequate indicator of fluid needs and disagree that replacement of fluids is best obtained from sports drinks (P<0.05) than athletes or a combined audience (including school staff, students, parents, and community members). School staff were also more likely to correctly disagree that protein supplements are superior to protein obtained from food and that all supplements must prove safety and efficacy before they are marketed or sold(P<0.05).

Part II. Follow-Up Survey

Of 282 surveys mailed, 49 (17.4%) were completed; demographic information of respondents appears in Table 4. Composition of respondents was similar to results of the

previous survey (Seminara, unpublished data). Girls track and boys golf, which represented significantly greater proportions (22.5% and 18.8%, respectively) than the original sample (14% and 9%, respectively), while football and girls basketball represented a smaller proportion (11% and 20.4%, respectively) than the original sample (20% and 28%, respectively). Almost half of the coaches (43.8%) had 20 or more years of experience and slightly less than a fourth of them coached junior high sports (20.8%) in addition to coaching high school sports. Coaches of girls' sports (52.4%) represented a slightly smaller proportion of the sample than coaches of boys sports (47.6%).

No differences were found between overall confidence, knowledge, attitudes, and practices between the previous and current survey respondent survey 1 and survey 2 (Figure 4). Respondents to the current survey (those in a community where a program had been delivered) were more knowledgeable ($P<0.05$) 'pancakes, muffins, and puffed cereals are good high carbohydrate choices for the athletes.' No differences were noted in responses to individual confidence or attitude questions; however, respondents to the current survey were *less* likely ($P<0.01$) to recommend weight loss/weight gain (data not shown).

DISCUSSION

Participants of 'Eat to Compete' programs displayed increased knowledge (11-16%) between pre-test and post-test in each of the three topics ($P<0.01$). This is consistent with previous research where coaches provided nutrition education experienced significant increases in knowledge relative to coaches who did not receive education (Whisenhunt, unpublished data). Other studies have also reported significant increases in nutrition knowledge when nutrition education is provided to athletes (Abood, Black, & Birnbaum, 2004; Collision & Kuczmarski, 1996; Potter & Wood, 1991; Chapman, Toma, Tuverson, et al, 1997).

'Fluids/dehydration' and 'Training Diets' programs were evaluated more positively than the 'Dietary Supplements' program. Specifically, participants indicated information was communicated more clearly and they had greater confidence to make informed choices about dietary behaviors related to the program topic ($P<0.05$). The 'Dietary Supplements' program was not evaluated as favorably. There is considerable

misinformation about nutrition supplements making this topic particularly challenging for health professionals (Hetherwick, Morris, Silliman, 2006) let alone consumers such as high school coaches. Previous research suggests coaches are considerably less confident in their knowledge regarding nutrition supplements compared to other topics, including fluids and training diets (Seminara, unpublished data). Although this nutrition education program did not improve coaches' knowledge confidence with nutrition supplements, a limitation to the data is that only one presentation on the topic had been delivered.

Program evaluations also varied by audience; school staff tended to evaluate programs more positively**.** They were more likely to agree that information was communicated clearly and educational materials were useful ($P<0.05$). The target audience for the programs was high school coaches, thus it appears the programs were more effective in reaching this audience. School staff including coaches, likely have more experience and familiarity with the program topics and information, which likely explains some of their greater confidence in knowledge after the program ($P<0.05$).

A follow-up survey of coaches in communities receiving 'Eat to Compete' programs indicated no changes in confidence, knowledge, attitudes, and practices when compared to a previous survey of coaches prior to programs (Figure 4), and no differences among years of experience, gender of sport coach, and sport classification (Figures 5-8). However, the follow-up survey was conducted with all coaches in the community regardless of whether they participated in the program; thus, there is not way to know if the coaches who responded to the follow-up survey also participated in an 'Eat to Compete' program. Finally, the follow-up survey was administered in fall, whereas the previous survey had been administered in the spring. Coaches who were *not* in season were more likely to respond to the survey than those who were in season, thus contributing bias to the survey sample.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Coaches play a crucial role in educating athletes about nutrition; however, often they are not fully prepared provide appropriate and reliable nutrition education to their athletes. Several studies have examined the effectiveness of nutrition education intervention on athletes, but few have explored nutrition education intervention among coaches.

Findings of this study support the need for effective nutrition education interventions to improve knowledge among coaches and athletes with the ultimate goal of changing behaviors.

This study demonstrated significant ($P<0.01$) and meaningful (11-16%) increases in nutrition knowledge as a result of a nutrition education intervention. Whether this increased knowledge results in behavior change has been studied extensively, yet remains controversial. Some research indicates that knowledge, attitudes, and behaviors are interrelated (Axelson, Federline, Brinberg, 1985; Johnson & Johnson, 1985) However, research with coaches and athletes has indicated that increases in nutrition knowledge may not always lead to behavioral change (Collision, Kuczmarski, & Vickery, 1996; Potter & Wood, 1991; Contento, Manning, & Shannon, 1992; Chapman et al, 1997). A more recent study with collegiate athletes suggests that nutrition knowledge and attitudes are correlated with behavior (Nichols et al., 2005). The disassociation between increased knowledge and behavior change may be related to the lack of instructional materials related to nutrition and the lack of research focusing on effective educational methods (Potter & Wood, 1991); particularly in the area of sports nutrition. The nutrition education intervention in this study was unique in that: 1) program topics were identified through a survey of the target audience, 2) program delivery/media used were those identified by the target audience as preferred methods, and 3) experiential learning activities (i.e. sport drink comparisons, carbometer, supplement comparisons) were included for each program topic. These approaches made it more likely that coaches apply their knowledge and understanding of nutrition and put it into practice.

Possible limitations of the study should be considered when interpreting the data and planning for future research. The results of this study are limited to the athletes, coaches, and school staff who chose to participate in 'Eat to Compete' programs. They voluntarily participated and may not necessarily represent the general athletic and coaching population. They may have had more interest in nutrition than those electing not to participate. Secondly, participants in each of the programs ('Fluids,' 'Training Diets,' and 'Dietary Supplements') were not the same population. Therefore, it is difficult to assess difference between the programs without accounting for individual

(within subjects) variability. Finally, confounding factors, such as presenter, location of the program may have influenced responses.

In conclusion, nutrition education does increase nutrition knowledge; however, knowledge alone does not always translate to positive practices. Future research and nutrition interventions need to incorporate higher levels of learning to help develop nutrition cognition and ultimately positive nutrition practices. Additionally, long term changes in nutrition cognition, attitudes, and practices from nutrition interventions are needed to validate the effectiveness and impact of nutrition interventions. Perceived effectiveness of nutrition education in this study appeared to be influenced by program topic and audience; therefore, nutrition interventions need to carefully consider the topic and audience to ensure program success. 'Eat to Compete' may serve as a framework for future research and application of nutrition education.

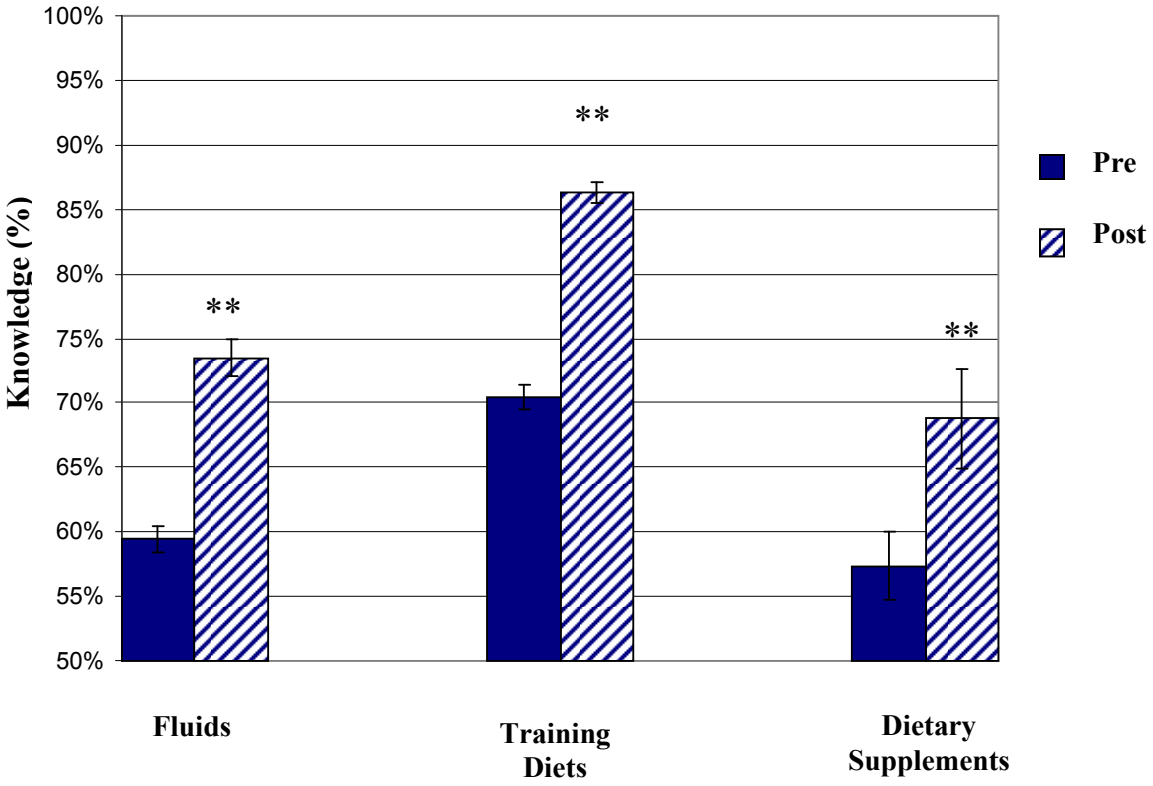

Figure 1. Mean ± SE of knowledge response (% correct), ** p< .001. Percentage calculated by summing knowledge responses (N=5) and dividing by the maximum score (25).

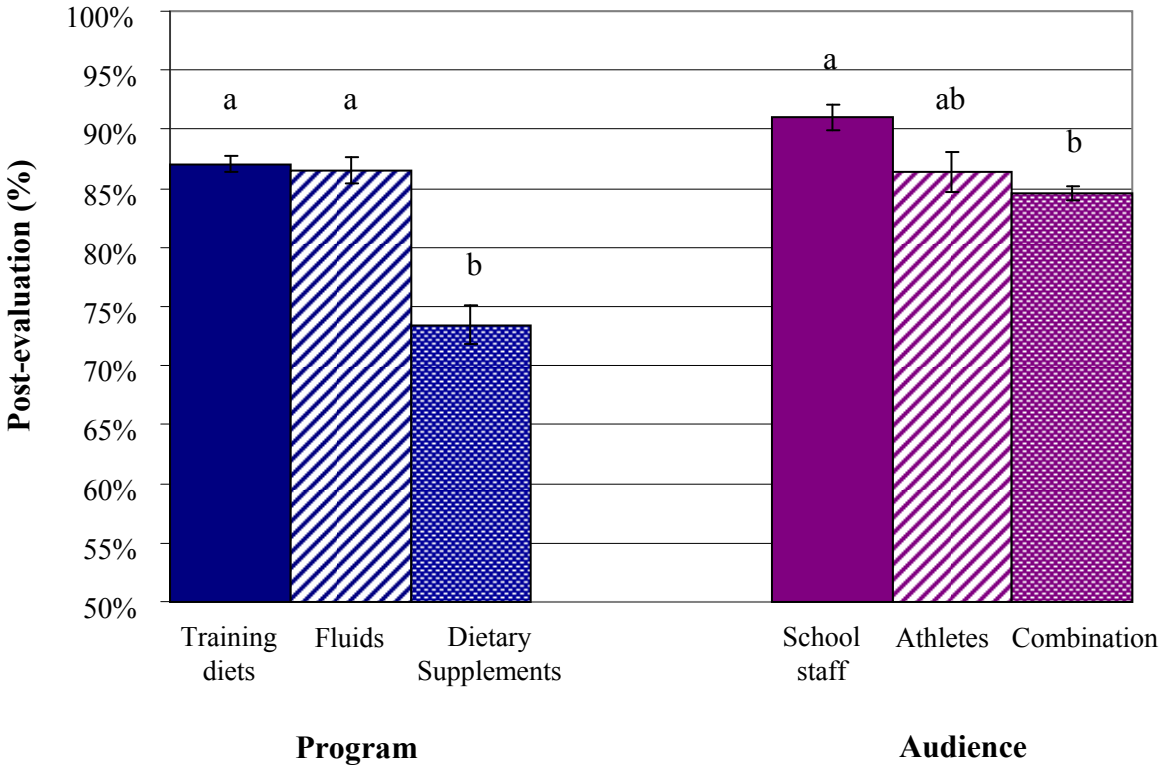

Figure 2. Mean ± SE of post-evaluation responses among programs and audience. All responses coded were such that higher numbers denote more favorable evaluation. Variables with different letters indicate significant difference at a p-value of $P<0.05$.

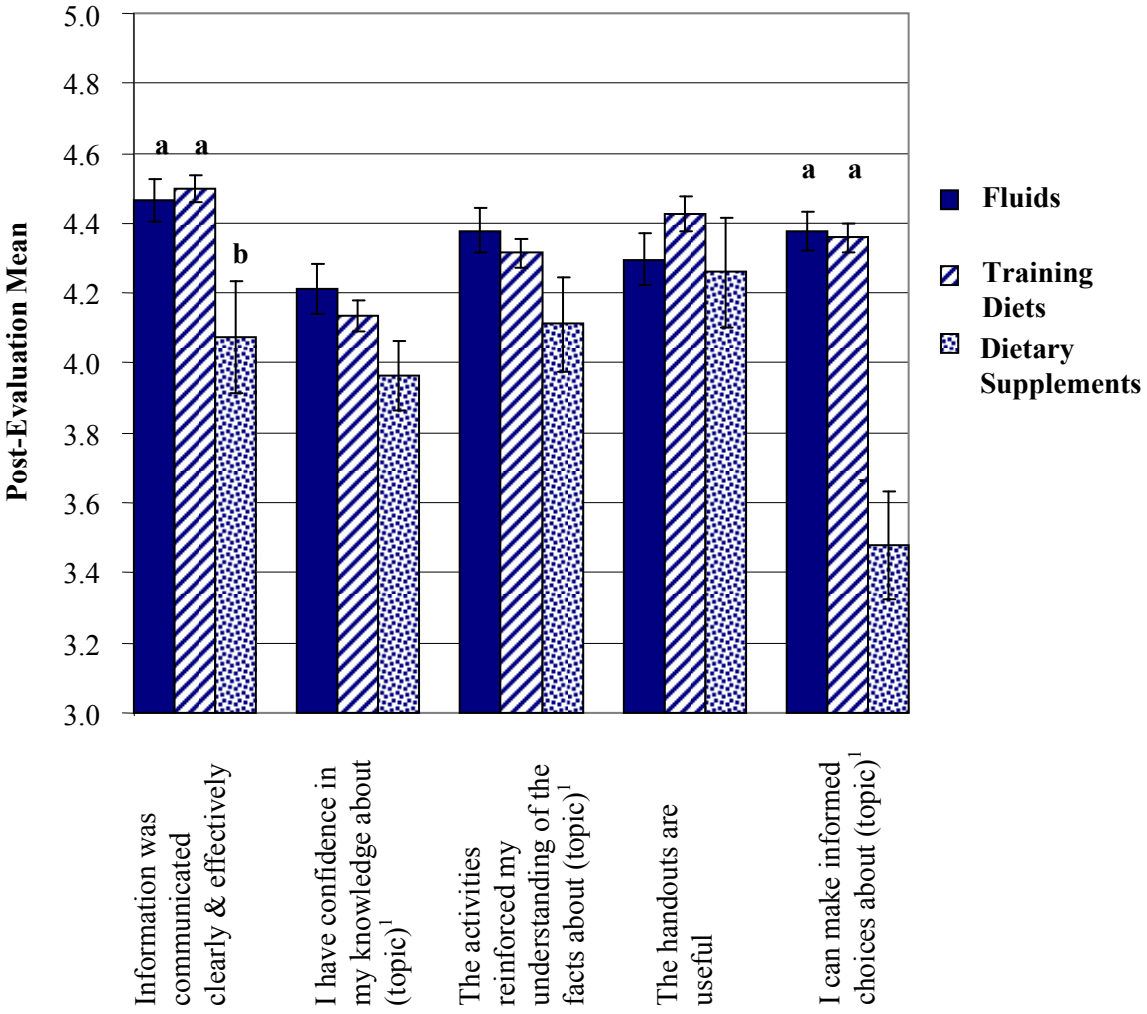

Figure 3. Mean ± SE of individual post-evaluation Likert scale responses among programs. All responses were coded where higher numbers denote more favorable evaluation. Variables with different letters indicate significant difference at a p-value of $P<0.01$.

[1]Topic is dependent on the program: Fluids, Training Diets, or Dietary Supplements

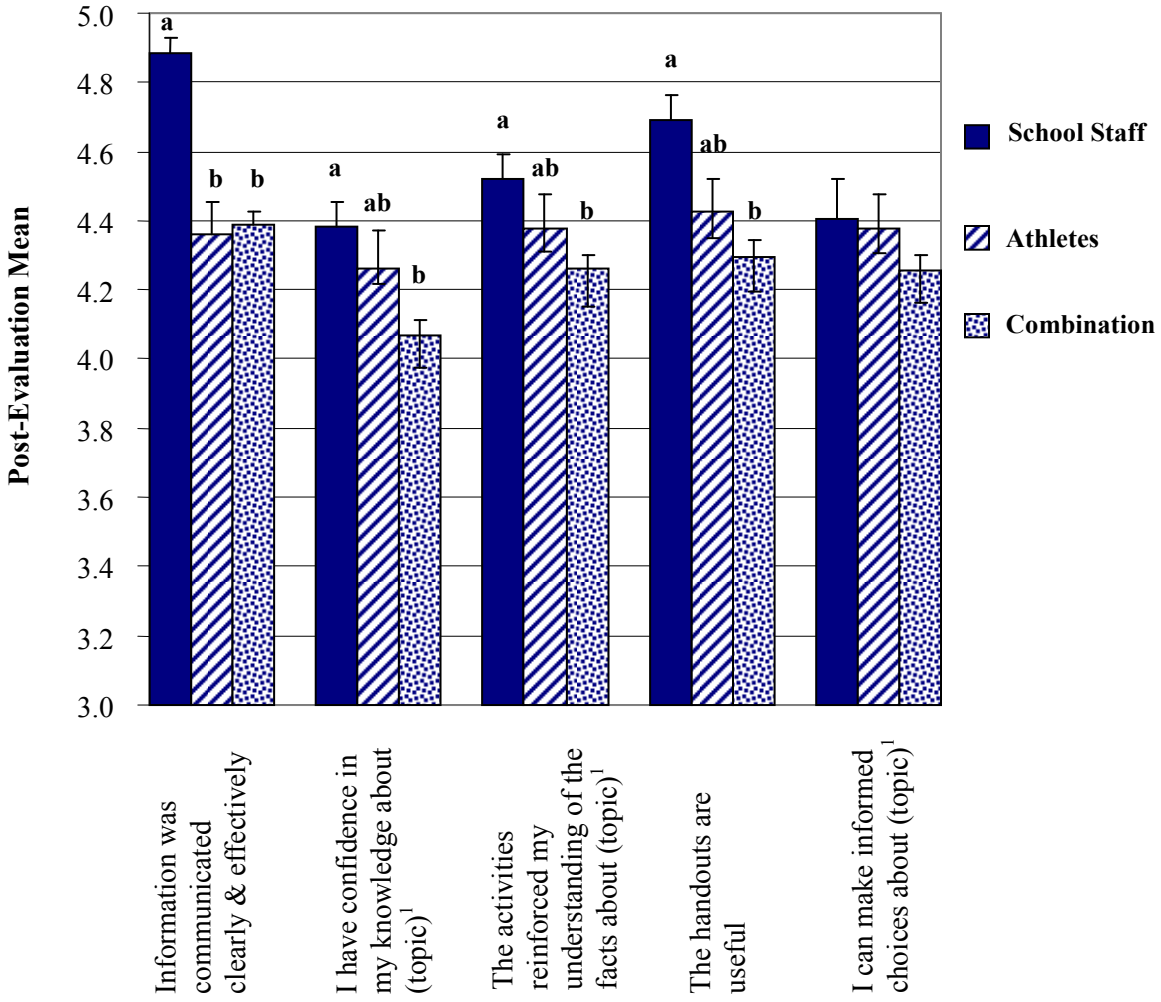

Figure 4. Mean ± SE of individual post-evaluation Likert scale responses among audience type. All responses were coded where higher numbers denote more favorable evaluation. Variables with different letters indicate significant difference at a p-value of $P<0.01$.

[1]Topic is dependent on the program: Fluids, Training Diets, or Dietary Supplements

Table 4- Demographic Characteristics of Coaches

Years of Experience	**No**	**%**
0-5	4	8.3
5-10	9	18.8
10-15	9	18.8
15-20	5	10.4
20+	21	43.8
Total	**48**	
Grade Level[a]	**No**	**%**
Junior High	10	20.8
High School	48	100.0
Total	**48**	
Sport Classification[b]	**No**	**%**
Weight-related	17	43.6
Non-weight-related	22	43.6
Total	**39**	
Gender[c]	**No**	**%**
Girls	19	59.4
Boys	13	40.6
Total	**32**	

[a]Coaches were allowed to select both grade levels.

[b]Weight-related sports included cheerleading, cross-country, football, swimming, track, and wrestling. Non-weight-affiliated sports included baseball/softball, basketball, golf, soccer, and volleyball. Coaches of both weight-related sport and non-weight-related sport were not included in sport classification analyses

[c]Coaches who coached both genders were not included in gender of sport analyses.

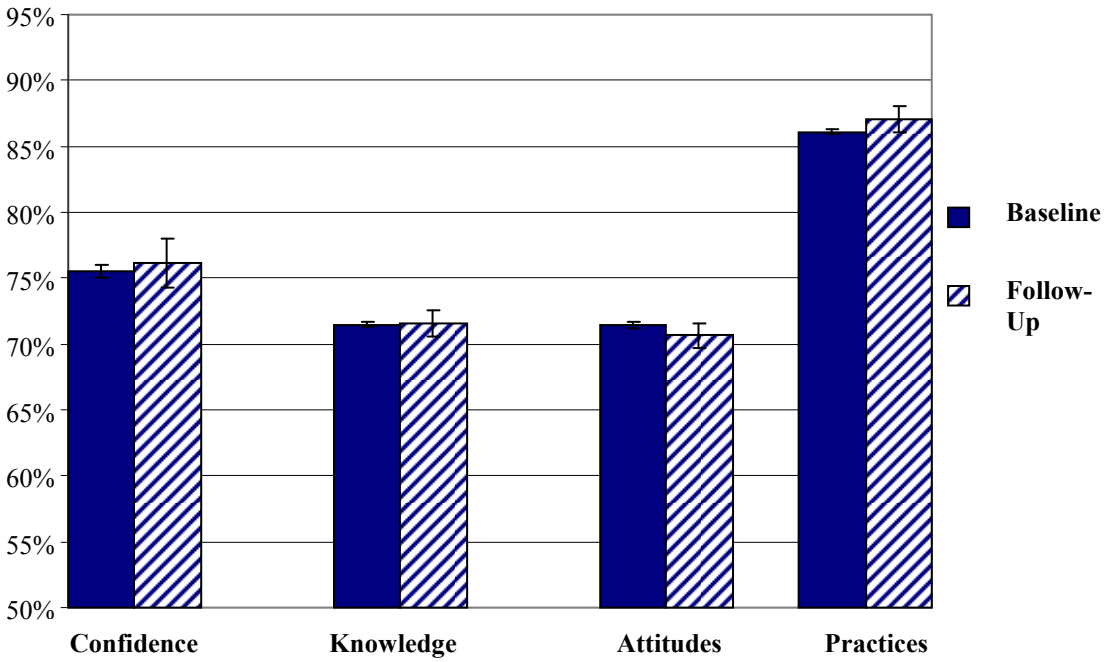

Figure 4. Mean ± SE of confidence, knowledge, attitudes, & practices for the baseline survey and the follow-up survey

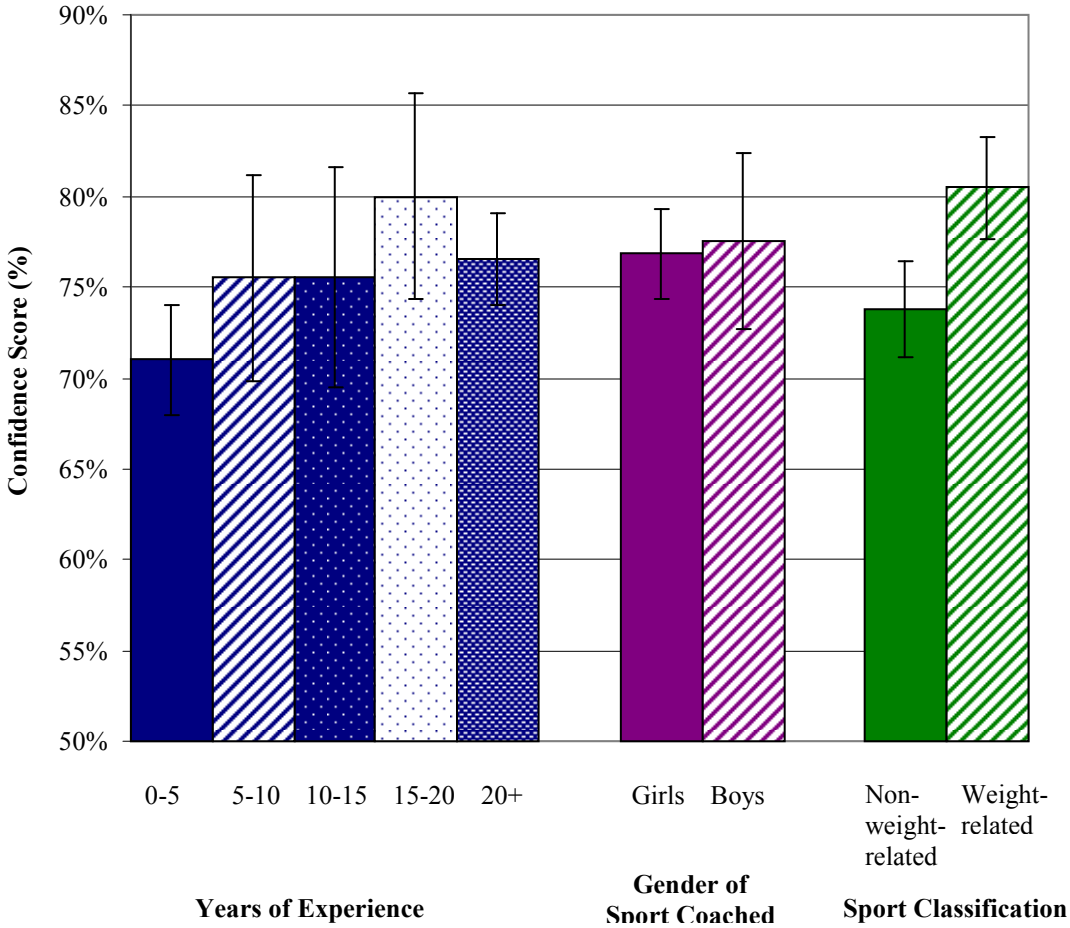

Figure 5. Mean ± SE Confidence Score (%).

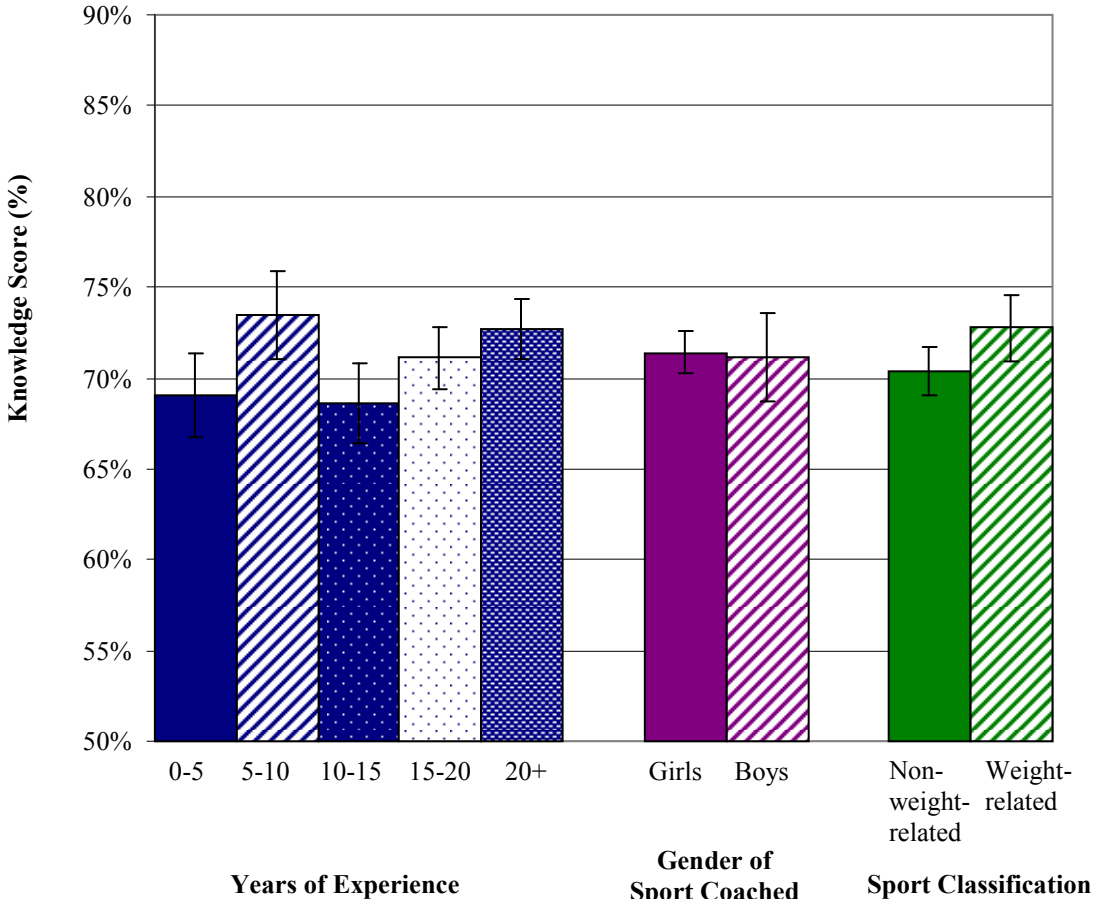

Figure 6. Mean ± SE Knowledge Score (%).

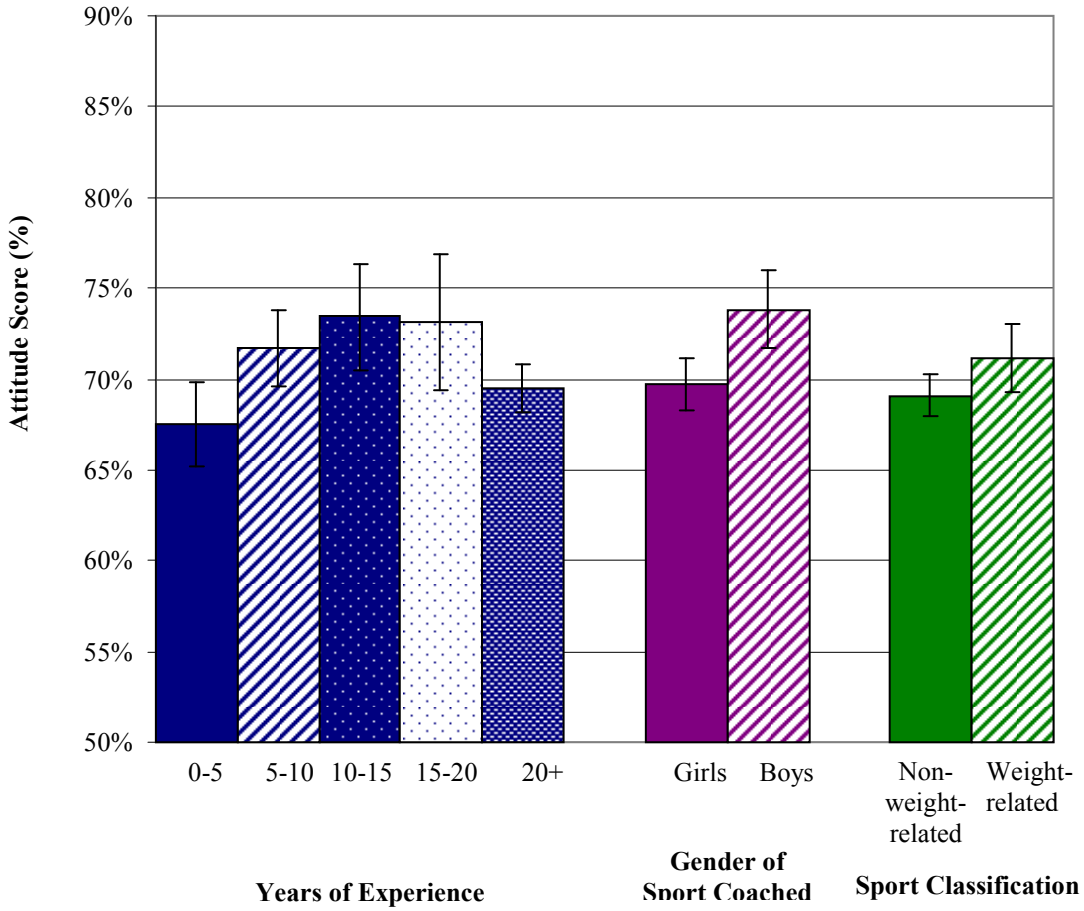

Figure 7. Mean ± SE Attitude Score (%).

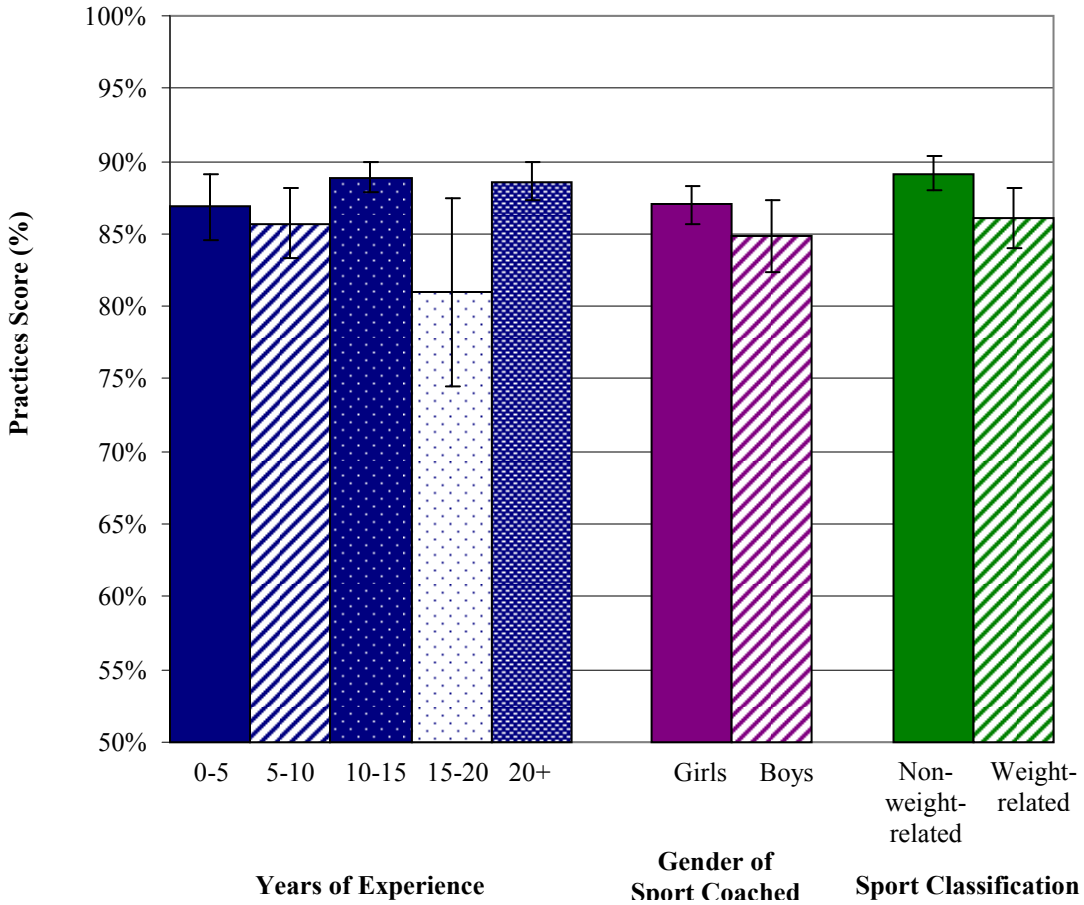

Figure 8. Mean ± SE Practices Score (%).

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CHAPTER 6. GENERAL CONCLUSION

High school coaches' nutrition confidence, knowledge, attitudes, practices differed by years of experience, gender of sport coach, and sport classification. The most significant differences were noted by gender of sport coach and sport classification. Coaches with more experience had more knowledge ($P<0.05$) than those with less experience. Coaches of boy sports displayed more confidence ($P<0.01$), better attitudes ($P<0.05$), but poorer practices ($P<0.01$). Finally, coaches of weight-related sports displayed more confidence, greater knowledge, and better attitudes, but poorer practices ($P<0.01$).

Interestingly, coaches' practices were negatively correlated with confidence and attitude, but no correlation was observed with knowledge. This is consistent with previous research, which suggests that an increase in nutrition knowledge among coaches and athletes does not always lead to behavior change (Collision, Kuczmarski, & Vickery, 1996; Potter & Wood, 1991; Contento, Manning, & Shannon, 1992; Chapman et al, 1997). Thus, nutrition knowledge alone is not sufficient to promote positive changes in behavior.

'Eat to Compete' programs improved nutrition knowledge immediately following program delivery. Knowledge and perceived effectiveness differed by program topic and audience. 'Fluids' and 'Training Ddiets' had greater improvements in knowledge and better overall evaluation by participants than 'dietary supplements.' School staff had greater knowledge improvements and better overall evaluation after program delivery.

Future Considerations

- Long term follow up to see if change in attitude and behavior occurs.
- Nutrition strategies to promote behavior change.
- Sports nutrition education tailored to coaches by gender of sport coach and sport classification.

APPENDIX A. INSTITUTIONAL REVIEW BOARD

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office of Research Assuran
Vice Provost for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

DATE: 10 November 2006

TO: Dr. Ruth Litchfield
1104 HNSB

FROM: Jan Canny, IRB Administrator
Office of Research Assurances

SUBJECT: IRB ID 06-517 **Study Review Date:** 10 November 2006

The Institutional Review Board (IRB) Chair has reviewed the project, "Nutrition Knowledge, Attitudes and Practices among High School Coaches", (IRB ID 06-517) and has declared the study exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) (2). The applicable exemption category is provided below for your information. Please note that you must submit all research involving human participants for review by the IRB. Only the IRB may make the determination of exemption, even if you conduct a study in the future that is exactly like this study.

The IRB determination of exemption means that this project does not need to meet the requirements from the Department of Health and Human Service (DHHS) regulations for the protection of human subjects, unless required by the IRB. We do, however, urge you to protect the rights of your participants in the same ways that you would if the project was required to follow the regulations. This includes providing relevant information about the research to the participants.

Because your project is exempt, you do not need to submit an application for continuing review. However, you must carry out the research as proposed in the IRB application, including obtaining and documenting (signed) informed consent if you have stated in your application that you will do so or if required by the IRB.

Any modification of this research should be submitted to the IRB on a Continuation and/or Modification form, prior to making any changes, to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.

Exempt Category

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

APPENDIX B. INITIAL SURVEY INFORMED CONSENT

Title of Study: Nutrition in High School Athletics

Investigators: Ruth Litchfield - State Nutrition Extension Specialist
Andrea Seminara- Graduate Research Assistant
Kelly Burke – Undergraduate Research Assistant
Lindsey Metcalf- Undergraduate Research Assistant

INTRODUCTION:

The purpose of this study is to collect information on nutrition knowledge, attitudes, and practices among high school coaches and athletic directors. You are being invited to participate in this study so that better nutrition information and resources can be provided to high school coaches and athletic directors.

DESCRIPTION OF PROCEDURE:

If you agree to participate in this study, you will be asked to complete the enclosed survey, which will take approximately 25 minutes. The survey can be completed at your convenience online (http://www.fcs.iastate.edu/fshn/tech/coaches.asp) or on the enclosed hard copy. You are not required to answer any or all questions that may make you feel uncomfortable. You may elect to withdraw from the study at any time without penalty.

If you elect to complete the survey online you will be asked to acknowledge your informed consent with a question at the beginning of the survey. If you elect to complete the enclosed hard copy of the survey, this informed consent and they survey will be returned to the investigators using the enclosed postage-paid envelope.

RISKS:

There are no foreseeable risks at this time from participating in this study.

BENEFITS:

If you decide to participate in this study there will be no direct benefit to you. It is hoped that the information gained in this study will benefit society by providing valuable information about future nutrition programs and/or curriculum development for high school athletes, coaches, and athletic directors.

COSTS AND COMPENSATION

You will not have any costs from participating in this study. You will not be compensated for participating in this study.

PARTICIPANT RIGHTS

Your participation in this study is completely voluntary and you may refuse to participate in the study at any time. If you decide to not participate in the study, it will not result in any penalty or loss of benefits to which you are otherwise entitled.

CONFIDENTIALITY

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available.

To ensure confidentiality to the extent permitted by law, each survey will be identified with a participant code rather than name. The specific study records obtained (surveys) will be kept in a safely locked cabinet and will only be used by Kelly Burke, Lindsey Metcalf and Ruth Litchfield.

QUESTIONS OR PROBLEMS

For questions or further clarification regarding the study please contact Kelly Burke at 515-292-3695, Lindsey Metcalf at 515-268-1826 and/or Ruth Litchfield 515-294-9484. If you have any questions about the rights of research subjects or research-related injury, please contact the Human Subjects Research Office, 2810 Beardshear Hall, (515) 294-4566; austingr@iastate.edu or the Research Compliance Officer, Office of Research Compliance, 2810 Beardshear Hall, (515) 294-3115; dament@iastate.edu.

SUBJECT SIGNATURE

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered.

Subject's Name (printed) _____

_____ _____

(Subject's Signature) (Date)

APPENDIX C. INITIAL SURVEY COVER LETTER

IOWA STATE UNIVERSITY
University Extension

March, 2005

Dear Coach:

Optimal physical performance and health is a goal of high school athletic programs. Key to optimal performance and health, are physical training and nutrition. However, a great deal of myth and misinformation regarding nutrition and physical performance exists. The Iowa High School Athletic Association and the Iowa Girls High School Athletic Union consider good nutrition and health integral to the high school athletic experience.

Enclosed is a survey to examine the nutrition knowledge, attitudes and practices among high school coaches. This information will be used to provide continuing education opportunities and resources for coaches and athletes. By taking 15 minutes of your time, you can provide information that will determine the content and format for future educational opportunities and resources for coaches and athletes.

Please take a moment to review and complete the enclosed informed consent and survey. These can be returned using the self-addressed postage-paid envelope that has been enclosed for your convenience. If you prefer, the survey can be completed online at http://www.fcs.iastate.edu/fshn/tech/coaches.asp . If you have any questions about the rights of research subjects or research-related injury, please contact Ginny Austin Eason, IRB Administrator, (515) 294-4566, austingr@iastate.edu, or Diane Ament, Research Compliance Officer (515) 294-3115, dament@iastate.edu

If you have received multiple copies of this survey related to your multiple coaching responsibilities, only complete one survey. We would appreciate you sharing any extra copies of this survey with any of your fellow coaches.

Thank you for taking the time to share your thoughts and opinions with us. We value your input as we plan educational programs and resources for high school coaches and athletes.

[redacted]

Rick Wulkow
Iowa High School
Athletic Association

Troy Dannen
Iowa Girls High School
Athletic Union

Ruth Litchfield
Iowa State University Extension

APPENDIX D. NUTRITION IN HIGH SCHOOL ATHLETICS SURVEY

ISU IRB # 1 06-517
Exempt Date: 10 November 2006
Initial by: jlc

Nutrition in High School Athletics

Directions: The purpose of this survey is to gain insight into your opinions, knowledge, and practice about nutrition as it relates to students and sports. For each statement below please check the box with your response.

(1.) Which sport(s) do you coach?

Girls:		Boys:	
Basketball	☐	Baseball	☐
Cheerleading	☐	Basketball	☐
Cross Country	☐	Cross Country	☐
Golf	☐	Football	☐
Softball	☐	Golf	☐
Soccer	☐	Soccer	☐
Swimming	☐	Swimming	☐
Track	☐	Track	☐
Volleyball	☐	Wrestling	☐

(2.) How many years of coaching experience do you have?

0 – 5 years	☐
5 – 10 years	☐
10 – 15 years	☐
15 – 20 years	☐
20 + years	☐

(3.) What age group do you coach?

Junior High	☐
High School	☐

	Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Strongly Disagree
(4.) I am confident with my nutrition knowledge and am able to assist my athletes with question/concerns about:					
weight loss/weight gain	☐	☐	☐	☐	☐
fluids/dehydration	☐	☐	☐	☐	☐
pre- and post-competition meals	☐	☐	☐	☐	☐
training diets	☐	☐	☐	☐	☐
nutrition supplements	☐	☐	☐	☐	☐
(5.) I would benefit from additional training/resources on nutrition and training.	☐	☐	☐	☐	☐
(6.) It is difficult to find enough time to give athletes advice on nutrition.	☐	☐	☐	☐	☐
(7.) High school athletes would benefit from a presentation/discussion led by a qualified nutritionist.	☐	☐	☐	☐	☐
(8.) Coaches are not very influential in high school athletes' food choices.	☐	☐	☐	☐	☐

	Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Strongly Disagree
(9.) High school coaches should take an active part in advising athletes about their diets.	☐	☐	☐	☐	☐
(10.) High school athletes are knowledgeable about nutrition.	☐	☐	☐	☐	☐
(11.) Fluids should be offered before, during and after training/competition.	☐	☐	☐	☐	☐
(12.) Eating disorders are not a concern for athletes.	☐	☐	☐	☐	☐
(13.) Protein and/or amino acid supplements are needed to increase muscle mass.	☐	☐	☐	☐	☐
(14.) Appropriate body weight and composition are important for optimal athletic performance.	☐	☐	☐	☐	☐
(15.) To replace fluid loss, it is best to drink 2-3 cups of fluid for every pound of weight lost.	☐	☐	☐	☐	☐
(16.) Athletes should eat carbohydrate and protein within 2 hours after a practice or competition to optimize recovery.	☐	☐	☐	☐	☐
(17.) An iron-rich diet reduces fatigue and improves an athlete's performance.	☐	☐	☐	☐	☐
(18.) Low-fat milk can be used as an effective post-competition beverage.	☐	☐	☐	☐	☐
(19.) Athletes should consume beef and/or other high protein foods in pre-competition meals to improve performance.	☐	☐	☐	☐	☐
(20.) Athletes ages 9-18 should consume at least 3 servings of low-fat dairy each day.	☐	☐	☐	☐	☐
(21.) Cramps, headache, rapid pulse, weakness and fainting are signs of dehydration.	☐	☐	☐	☐	☐
(22.) Pancakes, cereals, and pasta are good high carbohydrate choices for the athlete.	☐	☐	☐	☐	☐
(23.) Protein supplements are superior to protein obtained through food, such as meat and milk, and contribute more to muscle building in athletes.	☐	☐	☐	☐	☐
(24.) Milk should not be consumed before or after competition/practice because it causes cotton mouth.	☐	☐	☐	☐	☐
(25.) The pre-event meal is a far greater importance to the athlete's overall performance than the meals consumed several days prior to competition.	☐	☐	☐	☐	☐
(26.) Replacement of fluids during athletic activities is best obtained from sports drinks.	☐	☐	☐	☐	☐
(27.) A five pound weight loss or gain per week is an appropriate loss or gain.	☐	☐	☐	☐	☐
(28.) Weight loss has no effect on strength or endurance.	☐	☐	☐	☐	☐

	Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Strongly Disagree
(29.) Thirst is an adequate indicator of fluid needs.	☐	☐	☐	☐	☐
(30.) Muscle cramps are a symptom of calcium deficiency.	☐	☐	☐	☐	☐
(31.) Lean beef is the best source of iron.	☐	☐	☐	☐	☐
(32.) The pre-event meal should be eaten 3-4 hours before competition.	☐	☐	☐	☐	☐
(33.) Vitamin/mineral supplements provide energy and improve performance.	☐	☐	☐	☐	☐
(34.) High school athletes are interested in nutrition and its effect on performance.	☐	☐	☐	☐	☐

Directions: In the following questions please indicate how often you recommend the stated practice.

	Always (Once a week during season)	Sometimes (3-5 times during season)	Never
(35.) I discuss nutrition questions/concerns with athletes.	☐	☐	☐
(36.) I recommend to my athletes:			
multi-vitamin/mineral supplements	☐	☐	☐
weight loss/weight gain	☐	☐	☐
protein supplements	☐	☐	☐
sports drinks	☐	☐	☐
caffeine	☐	☐	☐
creatine	☐	☐	☐
salt tablets	☐	☐	☐
individual supplements (i.e. vit. C, iron, calcium)	☐	☐	☐

(37.) During out of town games, the team stops to eat on the way home. If you stop, where is it?

Sit down restaurant	☐
Fast Food (i.e. McDonald's, Burger King, Hardees's)	☐
Sub Shop (i.e. Subway, Blimpies, Quiznos)	☐
Gas Station	☐
Other	☐

(38.) Where do you get most of your nutrition and exercise information?

- Athletic Association/Union ☐
- Athletic Director ☐
- Team Trainer ☐
- School Nurse ☐
- Other Coaches ☐
- Other Teachers ☐
- Internet ☐
- Magazines ☐
- Journals/Professional publications ☐
- Workshops ☐
- Dietitian/Nutritionist ☐

(39.) Where do you believe your athletes get most of their nutrition information?

- Athletic Association/.Union ☐
- School Classes ☐
- Parents ☐
- Coaches ☐
- School Nurse ☐
- Team Trainer ☐
- Dietitian/Nutritionist ☐
- Magazines ☐
- Internet ☐
- Peers ☐
- Other ☐

(40.) What percent of your athletes do you believe use nutritional supplements?

- 0 – 20% ☐
- 21 – 40% ☐
- 41 – 60% ☐
- 61 – 80% ☐
- 81 – 100% ☐

(41.) How would you like to receive more information on exercise and nutrition?

- Videos ☐
- A State workshop/training ☐
- Local workshop/training ☐
- Speakers/Presentations at coaches meetings ☐
- Interactive CD/Website ☐
- Speakers for athletic teams/boosters ☐
- ICN sessions ☐
- Other: ☐

(42.) Where do your athletes get information regarding nutrition supplements?

- Athletic Director ☐
- Team Trainer ☐
- Magazines ☐
- School Nurse ☐
- Doctor ☐
- Coach ☐
- Parents ☐
- Teammates ☐

(43.) What would be the most effective way for coaches to provide information to athletes?

- Videos ☐
- Workshops ☐
- Printed materials (brochures/posters) ☐
- Speakers for team meetings/seminars (i.e. college athlete, qualified nutritionist) ☐
- Seasonal discussion by coach ☐
- Interactive CD/website ☐
- Other: ☐

APPENDIX E. PRESENTATION OUTLINES

eat to compete: Fluids

Presenter outline

OBJECTIVES

Knowledge
- Participants will be able to identify fluid recommendations.

Attitude
- Participants will believe fluid recommendations are not hard to meet.
- Participants will believe they can improve performance with adequate fluid intake.

Skill
- Participants will know the difference between a fluid replacement drink, high carbohydrate/energy drink, or meal replacement drink.
- Participants will be able to estimate the number of ounces of fluids in containers.

Action
- Participants will set goals related to fluid intake.

PROGRAM LENGTH

35 to 75 minutes

PROGRAM COMPONENTS

- Opening activity (10 to 15 minutes)
- Powerpoint presentation (15 minutes)
- Experiential learning activities (10 to 15 minutes each)
  - Identifying fluid volume
  - Evaluating sport drinks, part 1
  - Evaluating sport drinks, part 2
- Questions and answers (5 to 10 minutes or more)
- Wrap up and evaluation (5 minutes)

ITEMS NEEDED

- Laptop computer witih powerpoint and DVD player
- Multimedia projector
- University of Arizona DVD: 'Fluids' from "Winning Sports Nutrition"
- ISU powerpoint presentation: *Eat to Compete: Fluids*
- Set of glasses
- Sample drink bottles
- *Eat to Compete: What you should know about fluids* (PM 1965a)
- *Evaluate this sport drink label* (N 3486d)
- *Sport Drink Comparison Summary* (N 3486e)
- *Eat to Compete—Fluids Evaluation, parts 1 and 2* (N 3486c)

ADDITIONAL EDUCATOR RESOURCES

- *Eat to Compete—Fluids powerpoint script* (N 3486b)

Session Overview

OPENING ACTIVITY (5 to 10 minutes)

- Introduce self and explain that this presentation is a cooperative effort among Iowa State University Extension, Iowa Beef Industry Council, Midwest Dairy Association, Iowa Boys High School Athletic Association and Iowa Girls High School Athletic Union. A survey of high school coaches and athletic directors identified fluids as a topic of interest and need among coaches and athletes.

- Hand out copies of *Eat to Compete—Fluids Evaluation, part 1* (N 3486c-1) and ask participants to answer the questions.

- Introduction – Fluids are the most important nutrient to optimal performance, and unfortunately are the most frequently overlooked in the training regimen of athletes.

- Show 'Fluids' video clip (on DVD).

POWERPOINT PRESENTATION (15 minutes)

- Show ISU powerpoint presentation: Eat to Compete: Fluids
  - Hydration
  - Consequences of dehydration
  - Fluid recommendations
  - Types of sports drinks

IOWA STATE UNIVERSITY
University Extension

N 3486a February 2006

EXPERIENTIAL LEARNING ACTIVITY— IDENTIFYING FLUID VOLUME (10 to 15 minutes)

- ❑ Set of plastic glasses and water bottles
- ❑ *Eat to Compete: What you should know about fluids* (PM 1965a)

- Divide group into small groups of 4 or 5 individuals.
- Show samples of plastic glasses and bottles and ask groups to guess how many ounces are in each:
  - plastic glasses: 6, 11, 16, 30, 32, 44, and 64 ounces
  - water bottles: 16, and 32 ounce
- Share fluid recommendations
  - For ALL individuals: 10 to 15 eight-ounce glasses daily
    NOTE: 20 percent of fluid needs are met by food (i.e., fruits and vegetables are 80 to 90 percent water); the remaining 80 percent needs to come from fluid intake; thus recommended fluid intake is 8 to 12 cups.
    - 1 to 1.5 of the 64-ounce glasses
    - 2 to 3 of the 32-ounce glasses or bottles
    - 4 to 6 of the 16-ounce glasses or bottles
  - For athletes
    - 2 to 3 hours before practice/competition: 17 to 22 ounces
      - Half to two-thirds of one 32-ounce glass or bottle
      - 1 of the 16-ounce glasses or bottles
    - 10 to 15 minutes before practice/competition: 6 to 12 ounces
      - Half of one 16-ounce glasse or bottle
      - 2 of the 6-ounce glasses
    - Every 10 to 15 minutes during practice/competition: 6 to 12 ounces
      - Half of one 16-ounce glass or bottle
      - 2 of the 6-ounce glasses
    - For every pound of body weight lost during practice/competition: 24 ounces (3 cups)
      - Example: 5 pound weight loss =
        - 2 of the 64-ounce glasses
        - 4 of the 32-ounce glasses or bottles
        - 8 of the 16-ounce glasses or bottles
- Hand out copies of *Eat to Compete: What you should know about fluids* (PM 1965a) if not doing sport drink composition activity.

EXPERIENTIAL LEARNING ACTIVITY— EVALUATING SPORT DRINKS, part 1 (10 minutes)

- ❑ *Eat to Compete: What you should know about fluids* (PM 1965a)
- ❑ *Sport Drink Comparison Summary* (N 3486e)

- Discuss the characteristics of the three types of sports drinks: fluid replacement drinks, high carbohydrate drinks, and meal replacement drinks
- Explain the importance of carbohydrate concentration
  - Ideal carbohydrate concentration is 4 to 8 percent
    ... that equals 10 to 19 grams per 8 ounces
  - A 5% concentration leaves the stomach at the same rate as water, minimizing stomach upset

(CONTINUED)

EXPERIENTIAL LEARNING ACTIVITY— EVALUATING SPORT DRINKS, part 1 (continued)

- A 7 to 9% concentration takes slightly longer to leave the stomach, but increases the amount of carbohydrate absorbed by the small intestine

- Recommendation: start with lower concentration and experiment with higher concentrations for individual tolerance

- Hand out copies of *Eat to Compete: What you should know about fluids* (PM 1965a) and ask participants to do the label-reading activity on page 2. (Answer is on the *Sport Drink Comparison Summary*, N 3486e).

EXPERIENTIAL LEARNING ACTIVITY— EVALUATING SPORT DRINKS, part 2 (10 minutes)

❑ *Evaluate this sport drink label* (N 3486d, five sheets)
❑ *Sport Drink Comparison Summary* (N 3486e)

- Divide group into small groups of 4 or 5 individuals.

- Hand out copies of *Evaluate this sport drink label* (N 3486d) and give them time to answer the questions. Discuss answers as a whole group, using *Sport Drink Comparison Summary* (N 3486e) for answers.

QUESTIONS AND ANSWERS (5 to 10 minutes)

WRAP UP AND EVALUATION (5 minutes)

❑ *Eat to Compete—Fluids Evaluation, part 2* (N 3486c-2)

- Remember:
  - Fluid recommendations:
    - 10 to 15 eight-ounce glasses/day for all
    - 17 to 22 ounces 2 to 3 hours before practice/competition
    - 6 to 12 ounces 10 to 15 minutes before practice/competition
    - 6 to 12 ounces every 15 minutes during practice/competition
    - 3 cups for every pound lost during practice/competition

  - Replacing fluids, not carbohydrates or electrolytes, is the primary goal. If consuming a drink that has carbohydrates, the maximum amount of carbohydrates should be 10 to 19 grams per 8 ounces .... for a carbohydrate concentration of 4 to 8 percent.

- Thank participants for coming.

- Hand out evaluation forms.

- FYI: One 8-ounce glass of orange juice replaces the calcium, potassium, and magnesium lost in 3 liters or 7 pounds of sweat. This is more than the amount of sweat likely to be lost during 60 minutes of very vigorous exercise.

Prepared by Karin Westberg, nutrition graduate student; Ruth Litchfield, Ph.D., R.D., L.D., extension nutritionist; and Diane Nelson, communication specialist.

eat to compete: Training Diet *Presenter outline*

OBJECTIVES

Knowledge

- Participants will be able to identify recommended food choices for the training diet.

Attitude

- Participants will believe that carbohydrate is the preferred fuel for performance.
- Participants will believe that the training diet, not pre-competition meal, is important for optimal performance.

Skill

- Participants will know how to choose foods that are high in carbohydrate
- Participants will be able to select foods while traveling that are appropriate for the training diet

Action

- Participants will set goals related to food choices that reflect a high carbohydrate, moderate protein and fat diet

PROGRAM LENGTH

55 to 75 minutes

PROGRAM COMPONENTS

- Opening activity (10 to 15 minutes)
- Powerpoint presentation (15 minutes)
- Experiential learning activities (10 to 15 minutes each)
  - Menu choices before/after practice/competition
  - Restaurant choices before/after practice/competition
- Questions and answers (5 to 10 minutes or more)
- Wrap up and evaluation (5 minutes)

IOWA STATE UNIVERSITY
University Extension

ITEMS NEEDED

- Laptop computer witih powerpoint and DVD player
- Multimedia projector
- University of Arizona DVD: 'Meal Ideas' from "Winning Sports Nutrition"
- ISU powerpoint presentation: *Eat to Compete: Training Diets*
- Food models to use with powerpoint
- *Eat to Compete: What you should know about training diets* (PM 1965c)
- *Carb-o-meter* (N 3472) and computer
- *What should I eat?* (N 3488d)
- *Choosing food on the road* (N 3488e)
- *Eat to Compete—Training Diet Evaluation, parts 1 and 2* (N 3488c)

ADDITIONAL EDUCATOR RESOURCES

- *Eat to Compete—Training Diet powerpoint script* (N 3488b)
- *What should I eat? —Answers* (N 3488da)
- *Choosing food on the road —Answers* (N 3488ea)

Session Overview

OPENING ACTIVITY (10 to 15 minutes)

- Introduce self and explain that this presentation is a cooperative effort among Iowa State University Extension, Iowa Beef Industry Council, Midwest Dairy Association, Iowa Boys High School Athletic Association and Iowa Girls High School Athletic Union. A survey of high school coaches and athletic directors identified training diet (pre/post competition meals) as a topic of interest and need among coaches and athletes.

- Introduction – Fueling and refueling the body are critical components of the athletes training program to ensure they are healthy and able to perform at their best.

- Hand out copies of *Eat to Compete—Training Diet Evaluation, part 1* (N 3488c-1) and ask participants to answer the questions.

- Show 'Meal Ideas' video clip (on DVD).

POWERPOINT PRESENTATION (15 minutes)

- Show ISU powerpoint presentation:
  Eat to Compete: Training Diets
  - Carbohydrates
    - Simple vs. complex
    - Food sources
  - Protein
    - Requirements
    - Food sources
  - Recommended food choices for before and after practice or competition

N 3488a February 2006

EXPERIENTIAL LEARNING ACTIVITY— Carbohydrate choices (10 to 15 minutes)

- ❑ *Carb-o-meter* (N 3472)
- ❑ Computer

- Using the Carb-o-meter, ask individuals or groups to share their typical consumption. Discuss/demonstrate higher carbohydrate choices in the Carb-o-meter.
- Remember target carbohydrate intake:
  2000 calories = 275 grams
  2400 calories = 330 grams
  3200 calories = 440 grams

EXPERIENTIAL LEARNING ACTIVITY— Menu choices before and after practice or competition (10 to 15 minutes)

- ❑ *Eat to Compete: What you should know about training diets* (PM 1965c)
- ❑ *What should I eat?* (N 3488d)
- ❑ *What should I eat? —Answers* (N 3488da)

- Hand out copies of *Eat to Compete: Training Diets* (PM 1965c) and discuss carbohydrates and proteins. Review the macronutrients that are recommended or should be avoided before and after practice or competition.
- Divide group into small groups of 4 or 5 individuals. Hand out copies of *What should I eat?* (N 3488d). Review the instructions and give them time to do the activity.
- Discuss answers with the whole group using *What should I eat? —Answers* (N 3488da) as a reference.

EXPERIENTIAL LEARNING ACTIVITY— Restaurant choices before and after practice or competition (10 to 15 minutes)

- ❑ *Eat to Compete: What you should know about training diets* (PM 1965c)
- ❑ *Choosing food on the road* (N 3488e)
- ❑ *Choosing food on the road —Answers* (N 3488ea)

- If not already done, hand out copies of *Eat to Compete: Training Diets* (PM 1965c) and discuss carbohydrates and proteins. Review the macronutrients that are recommended or should be avoided before and after practice or competition.
- Divide group into small groups of 4 or 5 individuals. Hand out copies of *Choosing food on the road* (N 3488e). Review the instructions and give them time to do the activity.
- Discuss answers with the whole group using *Choosing food on the road —Answers* (N 3488ea) as a reference.

QUESTIONS AND ANSWERS (5 to 10 minutes)

WRAP UP AND EVALUATION (5 minutes)

❑ *Eat to Compete—Training Diets Evaluation, part 2* (N 3488c-2)

- Remember:
  - What the athlete eats throughout training (both in and out of season) is more important than the pregame meal or what is eaten one or two days before the event
  - For optimal performance the athlete's diet needs to be high in carbo hydrate to support the demands of their training regimen.
  - A high carbohydrate, moderate protein/fat diet is just a matter of making appropriate food choices.
- Thank participants for coming.
- Hand out evaluation forms (N 3488c-2).

Prepared by Karin Westberg, nutrition graduate student; Ruth Litchfield, Ph.D., R.D., L.D., extension nutritionist; and Diane Nelson, communication specialist.

eat to compete: Dietary Supplements

Presenter outline

OBJECTIVES

Knowledge

- Participants will be able to list problems with current dietary supplement regulations.
- Participants will be able to identify vitamins and minerals that may require supplementation by athletes.

Attitude

- Participants will believe that dietary supplements can be harmful.
- Participants will believe that dietary supplements are not needed.

Skill

- Participants will be able to evaluate a dietary supplement label.

Action

- Participants will set goals related to improving food intake to meet nutritional needs.

PROGRAM LENGTH

45 to 60 minutes

PROGRAM COMPONENTS

- Opening activity (10 to 15 minutes)
- Powerpoint presentation (15 minutes)
- Experiential learning activities (10 to 15 minutes each)
  - Reading a dietary supplement label
  - Evaluating a dietary supplement label
- Questions and answers (5 to 10 minutes or more)
- Wrap up and evaluation (5 minutes)

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ITEMS NEEDED

- Laptop computer witih powerpoint and DVD player
- Multimedia projector
- University of Arizona DVD: 'Supplements' from "Winning Sports Nutrition"
- ISU powerpoint presentation: *Eat to Compete: Dietary Supplements*
- *Eat to Compete: What you should know about dietary supplements* (PM 1965b)
- *Evaluate this dietary supplement label* (N 3487d; 5 pages)
- *Eat to Compete—Dietary Supplements Evaluation, parts 1 and 2* (N 3487c)

ADDITIONAL EDUCATOR RESOURCES

- *Eat to Compete—Dietary Supplements powerpoint script* (N 3487b)

Session Overview

OPENING ACTIVITY (10 to 15 minutes)

- Introduce self and explain that this presentation is a cooperative effort among Iowa State University Extension, Iowa Beef Industry Council, Midwest Dairy Association, Iowa Boys High School Athletic Association and Iowa Girls High School Athletic Union. A survey of high school coaches and athletic directors identified fluids as a topic of interest and need among coaches and athletes.

- Introduction – Dietary supplements are not needed with a balanced diet, but if they are taken, an individual should become an educated consumer. Dietary supplements on the market are not regulated, could contain illegal substances, could be costly, and could be harmful

- Hand out copies of *Eat to Compete—Dietary Supplements Evaluation, part 1* (N 3487c-1) and ask participants to answer the questions.

- Show 'Supplements' video clip (on DVD).

POWERPOINT PRESENTATION (15 minutes)

- Show ISU powerpoint presentation:
  Eat to Compete: Dietary Supplements
  - Introduction
  - * Definition of dietary supplements
  - Popular dietary supplements
    - Claims
    - Risks
  - How to evaluate a dietary supplement
  - Conclusion

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EXPERIENTIAL LEARNING ACTIVITY— Reading a dietary supplement label (10 to 15 minutes)

❑ *Eat to Compete: What you should know about Dietary Supplements* (PM 1965b)

- Hand out copies of *Eat to Compete: What you should know about Dietary Supplements* (PM 1965b) and review content.
- Ask each participant to look at the back of the publication (PM 1965b). Examine and discuss the components of an appropriately labeled supplement.
- Discuss the list of questions to ask when evaluating a dietary supplement (as listed on back of PM 1965b).

EXPERIENTIAL LEARNING ACTIVITY— Evaluate a dietary supplement label (10 to 15 minutes)

❑ *Evaluate this dietary supplement label* (N 3487d; 5 pages)

- Divide group into 4 or 5 individuals
- Provide each group with one of the activity sheets *Evaluate this dietary supplement label* (N 3487d) and give them time to answer the questions.
- Ask each group to share their product and evaluation with the whole group.

QUESTIONS AND ANSWERS (5 to 10 minutes)

WRAP UP AND EVALUATION (5 minutes)

❑ *Eat to Compete— Dietary Supplements Evaluation, part 2* (N 3487c-2)

- Remember: a well-balanced diet can meet all of the nutritional needs for the athlete. The only two exceptions may be calcium or iron. Calcium supplementation may be needed if the athlete does not tolerate/like milk. Iron supplementation is frequently needed by female athletes to meet the recommended intake and promote optimal performance.
- Dietary supplements do not have to prove safety and efficacy; they could contain illegal supplements, be harmful, and are costly.
- Thank participants for coming.
- Hand out evaluation forms.

Prepared by Karin Westberg, nutrition graduate student; Ruth Litchfield, Ph.D., R.D., L.D., extension nutritionist; and Diane Nelson, communication specialist.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914 in cooperation with the U.S. Department of Agriculture. Jack M. Payne, director, Cooperative Extension Service, Iowa State University of Science and Technology, Ames, Iowa.

APPENDIX F. PRE- AND POST-EVALUATIONS

eat to compete: FLUIDS *Evaluation, part 1*

Please answer the following questions by circling the appropriate number. If you have additional comments, please write them below or on the back. Thanks for taking time to share your thoughts.

	Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Strongly Disagree
1) Thirst is an adequate indicator of fluid needs.	1	2	3	4	5
2) To replace lost fluids, it is best to drink 1 cup of fluid for every 1 pound of weight loss.	1	2	3	4	5
3) Consuming a sports drink is the best way to replace fluids lost during athletic activities.	1	2	3	4	5
5) The appropriate carbohydrate concentration for fluid replacement drinks is 4 to 8 percent.	1	2	3	4	5
6) I have a good understanding of the appropriate amount of fluid to consume before, during, and after practice or competition.	1	2	3	4	5

eat to compete: **FLUIDS** *Evaluation, part 2*

We'd like to know your reactions to the information in this program. Please answer the following questions by circling the appropriate number. If you have additional comments, please write them below or on the back. Thanks for taking time to share your thoughts.

	Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Strongly Disagree
1) The information on fluids was communicated clearly and effectively.	1	2	3	4	5
2) I have confidence in my knowledge about fluids.	1	2	3	4	5
3) The activities reinforced my understanding of the facts about fluids.	1	2	3	4	5
4) The handouts are useful and easy to understand.	1	2	3	4	5
5) I can make informed choices about fluids before, during, and after athletic events.	1	2	3	4	5
6) Thirst is an adequate indicator of fluid needs.	1	2	3	4	5
7) To replace lost fluids, it is best to drink 1 cup of fluid for every 1 pound of weight loss.	1	2	3	4	5
8) Consuming a sports drink is the best way to replace fluids lost during athletic activities.	1	2	3	4	5
9) The appropriate carbohydrate concentration for fluid replacement drinks is 4 to 8 percent.	1	2	3	4	5
10) I have a good understanding of the appropriate amount of fluid to consume before, during, and after competition.	1	2	3	4	5

Prepared by Ruth Litchfield, Ph.D., R.D., L.D., extension nutritionist; Andrea Seminara, nutrition graduate student; and Diane Nelson, communication specialist.

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eat to compete: TRAINING DIET *Evaluation, part 1*

Please answer the following questions by circling the appropriate number. If you have additional co ments, please write them below or on the back. Thanks for taking time to share your thoughts.

	Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Str Di
1) Protein is the main source of fuel for physical activity.	1	2	3	4	5
2) Carbohydrates are mostly obtained from grains, but also can be found in fruits, vegetables, and milk/milk products.	1	2	3	4	5
3) Complex carbohydrates are preferred over simple carbohydrates because they provide additional nutrients, such as B-vitamins and fiber.	1	2	3	4	5
4) Protein consumption increases muscle strength and size.	1	2	3	4	5
5) The pre-event meal should be eaten 3 to 4 hours before competition or practice.	1	2	3	4	5

eat to compete: TRAINING DIET *Evaluation, part 2*

We'd like to know your reactions to the information in this program. Please answer the following questions by circling the appropriate number. If you have additional comments, please write them below or on the back. Thanks for taking time to share your thoughts.

	Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Strongly Disagree
1) The information on training diets was communicated clearly and effectively.	1	2	3	4	5
2) I have confidence in my knowledge about training diets.	1	2	3	4	5
3) The activities reinforced my understanding of the facts about training diets.	1	2	3	4	5
4) The handouts are useful and easy to understand.	1	2	3	4	5
5) I can make informed food choices before and after competitions and practices.	1	2	3	4	5
6) Protein is the main source of fuel for physical activity.	1	2	3	4	5
7) Carbohydrates are mostly obtained from grains, but also can be found in fruits, vegetables, and milk/milk products.	1	2	3	4	5
8) Complex carbohydrates are preferred over simple carbohydrates because they provide additional nutrients, such as B-vitamins and fiber.	1	2	3	4	5
9) Protein consumption increases muscle strength and size.	1	2	3	4	5
10) The pre-event meal should be eaten 3 to 4 hours before competition or practice.	1	2	3	4	5

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eat to compete: **SUPPLEMENTS** *Evaluation, part 1*

Please answer the following questions by circling the appropriate number. If you have additional comments, please write them below or on the back. Thanks for taking time to share your thoughts.

	Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Strongly Disagree
1) Protein and/or amino acid supplements are needed to increase muscle mass.	1	2	3	4	5
2) Protein supplements are superior to protein from food, such as meat and milk, and contribute to muscle building in athletes.	1	2	3	4	5
3) Vitamin/mineral supplements provide energy and improve performance.	1	2	3	4	5
4) All supplements must prove safety and efficacy before they are marketed and/or sold.	1	2	3	4	5
5) Since athletes have greater calorie needs, they need to use supplements to meet these needs.	1	2	3	4	5

Prepared by Ruth Litchfield, Ph.D., R.D., L.D., extension nutritionist; Andrea Seminara, nutrition graduate student; and Diane Nelson, communication specialist.

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eat to compete: **SUPPLEMENTS** *Evaluation, part 2*

We'd like to know your reactions to the information in this program. Please answer the following questions by circling the appropriate number. If you have additional comments, please write them below or on the back. Thanks for taking time to share your thoughts.

	Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Strongly Disagree
1) The information on supplements was communicated clearly and effectively.	1	2	3	4	5
2) I have confidence in my knowledge about supplements.	1	2	3	4	5
3) The activities reinforced my understanding of the facts about supplements.	1	2	3	4	5
4) The handouts are useful and easy to understand.	1	2	3	4	5
5) I can make informed decisions about supplements.	1	2	3	4	5
6) Protein and/or amino acid supplements are needed to increase muscle mass.	1	2	3	4	5
7) Protein supplements are superior to protein from food, such as meat and milk, and contribute to muscle building in athletes.	1	2	3	4	5
8) Vitamin/mineral supplements provide energy and improve performance.	1	2	3	4	5
9) All supplements must prove safety and efficacy before they are marketed and/or sold.	1	2	3	4	5
10) Since athletes have greater calorie needs, they need to use supplements to meet these needs.	1	2	3	4	5

Prepared by Ruth Litchfield, Ph.D., R.D., L.D., extension nutritionist; Andrea Seminara, nutrition graduate student; and Diane Nelson, communication specialist.

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APPENDIX G. FOLLOW-UP SURVEY COVER LETTER

IOWA STATE UNIVERSITY
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December, 2006

Dear Coach:

Optimal physical performance and health is a goal of high school athletic programs. Key to optimal performance and health, are physical training and nutrition. However, a great deal of myth and misinformation regarding nutrition and physical performance exists. Nutrition education can provide coaches and athletes with nutrition and health information integral to the high school athletic experience.

Last spring, a survey was sent to all head high school coaches in the state to examine nutrition knowledge, attitudes and practices of high school coaches. In response to that survey, a nutrition education program, 'Eat to Compete' was developed and delivered by Iowa State University Extension in a number of Iowa communities. Enclosed is a survey to re-examine the nutrition knowledge, attitudes and practices among high school coaches in communities that participated in the nutrition education program. This information will be used to evaluate the impact of nutrition education on coaches' knowledge, attitudes, and practices regarding sports nutrition. By taking 15 minutes of your time, you can provide information that will determine the effectiveness of nutrition education for coaches and athletes.

Please take a moment to review and complete the enclosed informed consent and survey. These can be returned using the self-addressed postage-paid envelope that has been enclosed for your convenience. If you have any questions about the rights of research subjects or research-related injury, please contact Jan Canny, IRB Administrator, (515) 294-4566, jcs1959@iastate.edu, or Diane Ament, Research Compliance Officer (515) 294-3115, dament@iastate.edu

If you have received multiple copies of this survey related to your multiple coaching responsibilities, only complete one survey. We would appreciate you sharing any extra copies of this survey with any of your fellow coaches.

Thank you for taking the time to share your thoughts and opinions with us. We would appreciate your responses by **December 20, 2006**. We value your input as we plan future educational programs and resources for high school coaches and athletes.

[redacted]

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APPENDIX H. FOLLOW-UP SURVEY INFORMED CONSENT

Title of Study: Nutrition in High School Athletics

Investigators: Ruth Litchfield - State Nutrition Extension Specialist
Andrea Seminara - Graduate Research Assistant

INTRODUCTION:

The purpose of this study is to collect information on nutrition knowledge, attitudes, and practices among high school coaches and athletic directors. **You are being invited to participate in this study to help evaluate changes in nutrition knowledge, attitudes, and practices among high school coaches from communities that received sports nutrition education.**

DESCRIPTION OF PROCEDURE:

If you agree to participate in this study, you will be asked to complete the enclosed survey, which will take approximately 15 minutes. You are not required to answer any or all questions that may make you feel uncomfortable. You may elect to withdraw from the study at any time without penalty. If you elect to complete the enclosed hard copy of the survey, this informed consent and they survey will be returned to the investigators using the enclosed postage-paid envelope.

RISKS:

There are no foreseeable risks at this time from participating in this study.

BENEFITS:

If you decide to participate in this study there will be no direct benefit to you. It is hoped that the information gained in this study will benefit society by providing valuable information about future nutrition programs and/or curriculum development for high school athletes, coaches, and athletic directors.

COSTS AND COMPENSATION

You will not have any costs from participating in this study. You will not be compensated for participating in this study.

PARTICIPANT RIGHTS

Your participation in this study is completely voluntary and you may refuse to participate in the study at any time. If you decide to not participate in the study, it will not result in any penalty or loss of benefits to which you are otherwise entitled.

CONFIDENTIALITY

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available.

To ensure confidentiality to the extent permitted by law, each survey will be identified with a participant code rather than name. The specific study records obtained (surveys) will be kept in a safely locked cabinet and will only be used by Andrea Seminara and Ruth Litchfield.

QUESTIONS OR PROBLEMS

For questions or further clarification regarding the study please contact Andrea Seminara (515-294-6507) and/or Ruth Litchfield 515-294-9484. If you have any questions about the rights of research subjects or research-related injury, please contact the Human Subjects Research Office, 2810 Beardshear Hall, (515) 294-4566; austingr@iastate.edu or the Research Compliance Officer, Office of Research Compliance, 2810 Beardshear Hall, (515) 294-3115; dament@iastate.edu.

SUBJECT SIGNATURE

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered.

Subject's Name (printed) _____

_____ _____

(Subject's Signature) (Date)

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ACKNOWLEDGEMENTS

I would like to acknowledge the financial contributors of the Iowa Beef Council Industries and Iowa Dairy Association. I would also like to thank Kelly Burke and Lindsey Metcalf for their work in developing the survey and the Iowa head high school coaches and athletes who participated in the project. In addition, I would like to thank the Iowa State University Extension and Health Field Specialists for their dedication to the 'Eat to Compete' program.

I would like to express my deepest gratitude to my major professor, Dr. Ruth Litchfield. She not only provided me the opportunity to with her on the project, but her effort and contribution to the development and implementation of the Diet and Exercise, BS/MS program allowed me to pursue my passion for nutrition and exercise. I would also like to acknowledge my program of study committee members, Dr. Rick Sharp and Dr. Warren Franke, for their support and contributions to my research and my success as a graduate student. I would like to thank Emily Lasley for her help in the development of 'Eat to Compete' materials and her friendship.

Lastly, I would especially like to thank my family and friends for their love and support throughout all of my endeavors. Their patience and understanding were essential for my success.