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Fluid Replacement Knowledge and Sources of Hydration Information among Illinois High School Athletic Coaches: A Pilot Study

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ABSTRACT

Objective: The purpose of this study was to examine Illinois high school coaches' knowledge of hydration and fluid replacement strategies. We also sought to identify their primary sources of fluid replacement information. **Design:** Descriptive Survey. **Participants:** 22 Coaches who were members of the Illinois High School Association were the survey respondents in this study. The mean age (\pm SD) of subjects was 37.4(\pm 11.5) years with an average coaching experience of 11.4(\pm 8.96) years. **Intervention:** A questionnaire was developed based upon the National Athletic Training Association's Position Stand and the American College of Sports Medicine's roundtable discussion of fluid replacement and hydration. The instrument contained three sections: 1) demographic information, 2) sources of hydration information, and 3) knowledge assessment of fluid replacement guidelines. The instrument was examined for face and content validity by three exercise physiology experts, one of whom had substantial expertise in sport nutrition. **Main Outcomes Measures:** Descriptive statistics were used to identify the sources of information and scores on the knowledge assessment. Consistent with similar studies, a score of 80% was used for the passing rate for the knowledge assessment. A chi square test with a significance set a priori at $p < .05$ was used to determine whether a difference existed between those with formal fluid replacement and exercise physiology training and those without in regards to passing the knowledge assessment. **Results:** 22 surveys were returned from 500 coaches that were randomly selected for mailing, resulting in a response rate of 4.4%. The mean assessment score was 12.7 (\pm 1.77) correct responses out of a possible 17. Only 12 participants (54.5%) obtained a passing score on the questionnaire, indicating nearly half of the coaches had an unacceptable level of hydration/fluid replacement knowledge. The chi square test revealed no significant difference in passing rates between those coaches with fluid replacement training ($p = .394$) or formal exercise physiology background ($p = .088$). The primary sources of information for the majority (>50%) of coaches was from magazines, conferences, and medical staff. **Conclusions:** The results from the hydration and fluid replacement questionnaire indicate that a large percentage of Illinois high school coaches do not possess adequate knowledge related to fluid replacement for their athletes. The nature of the survey may have contributed to the response rate. The low response rate for this survey should be taken into consideration and, thus, the results interpreted with caution. **Practical Applications:** Professional associations should consider targeting coaching magazines and conferences to share critical information related to fluid replacement. Coaches must also take responsibility and keep abreast of the latest information related to the safety of their athletes.

INTRODUCTION

Proper fluid replacement to maintain hydration is a vital component of an athlete's general nutrition and athletic performance. Every athlete relies on adequate hydration to maintain peak performance throughout competition and prevent heat illness.¹ The importance of adequate hydration is underscored by the implementation of fluid replacement guidelines by both the 2000 National Athletic Trainers' Association (NATA) and the 2007 American College of Sports Medicine (ACSM).^{2,3}

A study by Nichols, Jonnalagadda, Rosenbloom, and Trinkaus found that college athletes understood general hydration, but did not fair well with respect to understanding the NATA and ACSM fluid replacement guidelines.⁴ Coaches commonly provide nutritional recommendations to athletes, and thus, athletes rely on knowledgeable coaches.^{5,6} Though recent studies have examined high school coaches' knowledge of the prevention, recognition, and treatment of heat illness, there is a paucity of research related specifically to coaches' hydration and fluid replacement knowledge. The number of high school sports participants has grown in recent years, making this a particularly important issue in the secondary school setting.

United States high school athletic participation has grown from four million participants in 1971-1972 to an estimated 7.2 million student-athletes in 2005-2006.⁷ Among the high school athlete population, heat illness constitutes the third leading cause of death.⁷ Prevention of heat illnesses relies not only on recognizing environmental risk factors and proper adjustment of athletic participation, but also on maintaining adequate hydration status. High school athletes rely heavily on their coaches to inform them about proper hydration and fluid replacement strategies to avoid heat-related illness (i.e. heat stroke, heat exhaustion, heat cramps, and syncope) as a result of dehydration. It's unclear, however, whether high school coaches have sufficient knowledge of fluid replacement. The purpose of this study, therefore, was to examine Illinois high school coaches' knowledge of hydration and fluid replacement strategies. We also sought to determine any shortcomings of the dissemination of fluid replacement strategies and hydration guidelines to high school coaches in Illinois.

METHODS

Participants and Procedures

Coaches who were members of the Illinois High School Association (IHSA) were the primary sample in this study. Mailing labels were purchased from the IHSA to establish the initial population. A total of 2280 mailing labels were obtained and a table of random numbers was then used to randomly select the subjects who were mailed a survey. We had hoped to receive a 25% response rate, but were limited financially to conduct a follow up survey and/or reminder to participate. Therefore, all responses received within a four week period constituted the sample.

Instrumentation

A survey was developed based upon the National Athletic Training Association's guidelines for hydration and fluid replacement and the American College of Sports Medicine's roundtable discussion of fluid replacement and hydration guidelines.^{8,9} The survey contained three parts. Part one included questions of demographic nature including years of experience, time at current position, sports currently coached, competitive class, highest degree earned, age, gender, and formal education related to exercise science and fluid replacement. Part two asked coaches to identify their sources of information related to sources of information related to heat and hydration. The last section, part three, contained 17 questions to examine the coaches' knowledge of fluid replacement guidelines. A copy of the 17 fluid replacement and hydration guideline questions can be seen in Table 1.0. The survey was examined for face and content validity by three exercise physiologists, one of who had an area of expertise in sports nutrition. The initial draft of the survey went through one revision to clarify the content before being approved by the panel.

RESULTS

Response Rate

Of the 500 surveys that were mailed, only twenty-two respondents (17 male and 5 female) completed the survey. This represented a response rate of 4.4%. We believed the response rate would be extremely low because of the nature of the study (coaches' knowledge and sources of information related to proper hydration). Because of budget constraints, we were not able to follow up with a reminder or another mail survey to increase the response rate.

Participant Demographics

The mean age (\pm Standard Deviation) of subjects was 37.4 (\pm 11.5) years (see Table 2.0) with an average coaching experience length of 11.4 (\pm 8.96) years. Fourteen (63.6%) of the participants had training in exercise physiology while 9 (41%) had hydration education. Table 3.0 displays the breakdown of sports coached by both male and female respondents. Subjects coached as many as five separate sports, and as little as one. Track and Field provided the largest number of subjects with a total of 19 coaches between boys and girls track and field. Boys and girls cross country provided the second largest number of coaches

with 12. A majority of the subjects participated at larger high schools, as indicated by their competitive class. Twelve subjects participated at either 7A or 8A high schools (as dictated by competitive class for football). Four subjects participated at 1A or 2A high schools, and 4 subjects participated at 3A, 4A, 5A, or 6A schools. Two subjects were unsure of their competitive class.

Table 1.0 Survey Questions and the % of Correct Scores for Each (n=22)

Survey Question	Total Correct n(%)
1. Thirst is a timely indicator that an athlete needs to drink fluids (False)	14 (63.64%)
2. Monitoring urine color is an effective way for an athlete to determine if he/she is dehydrated (True)	20 (90.91%)
3. Comparing body weight before and after training/competition is not a useful way to determine how much fluid needs to be consumed (False)	8 (36.4%)
4. Dehydration improves performance in endurance events (False)	22 (100%)
5. Dehydration increases the risk of experiencing heat-related illnesses, such as heat cramps, heat exhaustion, etc . (True)	22 (100%)
6. Exercise or physical activity in hot and humid conditions has no effect on dehydration (False)	21 (95.45%)
7. Athletes should begin each training session or competition well hydrated (True)	20 (90.91%)
8. 2-3 hours prior to exercise an athlete should aim to consume: 17-20 fluid ounces (500-600 ml) of fluid (True)	14 (63.64%)
9. 10-20 minutes before competition an athlete should aim to consume: 7-10 fluid ounces (200-300 ml) of fluid (True)	17 (77.27%)
10. Fluid replacement during exercise should, at the very minimum, prevent dehydration of greater than 2% body weight reduction (True)	18 (81.82%)
11. Post exercise fluid replacement should be approximately 150% of the fluid lost during activity. (False)	10 (45.45%)
12. During endurance training or competition that exceeds more than 50 minutes, water is equally as effective as a sports drink containing carbohydrates and electrolytes. (False)	14 (63.64%)
13. Sports drinks, if being ingested during exercise, should have a carbohydrate concentration of at least 8% (False)	4 (18.18%)
14. The main form of carbohydrate in a sports drink should be fructose. (False)	17 (77.27%)
15. Sodium should be included in fluid replacement beverages if the physical activity lasts 4 or more hours. (True)	19 (86.36%)
16. During recovery, athletes should aim to re-hydrate within a 2 hour period after exercise (True)	20 (90.91%)
17. The addition of sodium and carbohydrate to the re-hydration beverage (after exercise) will speed re-hydration and replenish glycogen stores, respectively. (True)	20 (90.91%)

Table 2.0 Participant Descriptive Information

	Male	Female	Total
Subjects	17	5	22
Age (years)	39.1	31.8	37.4
	± 12.3	± 5.2	± 11.5
Experience (years)	12.8	9.6	11.4
	± 6.8	± 3.6	± 8.9

Table 3.0 Breakdown of Sports Coached By Respondents

	Male (n=17)	Female (n=5)	Total (n=22)
Boys Basketball	2	0	2
Boys Cross Country	8	0	8
Football	2	0	2
Boys Track & Field	6	2	8
Wrestling	2	0	2
Girls Basketball	0	1	1
Girls Cross Country	2	2	4
Girls Track & Field	8	3	11

Sources of Information

Table 4.0 provides descriptive information about the coaches' sources of knowledge. The majority (>50%) of coaches obtained information from magazines, conference, and their medical staff.

Table 4.0 Descriptors of Respondents to Hydration and Fluid Replacement Guidelines Questionnaire

	Total
Info From Magazines (% of responses)	59.09%
Info From Text (% of responses)	31.82%
Info From Colleagues (% of responses)	45.45%
Info From Professional Journals (% of responses)	45.45%
Info From Medical Staff (% of responses)	54.55%
Info From Professional Conferences (% of responses)	59.09%
Info From Professional Organizations (% of responses)	18.18%
Info From Brochures (% of responses)	40.91%
Note: multiple sources of information could be identified	

Knowledge of Hydration Strategies

The hydration knowledge portion of the instrument contained 17 questions. The required score for passing the fluid replacement knowledge assessment was 14 or more correct responses (80% or higher), which is consistent with similar knowledge-based tests (Ransone & Dunn-Bennett, 1999) as well as the certification standards of organizations such as the American Red Cross. The mean assessment score (\pm standard deviation) was 12.7 ± 1.77 . Additionally, only 12 participants (54.5%) obtained a passing score on the questionnaire, indicating nearly half of the responding coaches had an unacceptable level of hydration/fluid replacement knowledge.

Of interest was that two questions were missed more frequently than any others. These questions addressed ideal percent of carbohydrate content of sports drinks (question # 11) and the ideal percentage of total fluids to be replaced (question # 13). Table 1.0 presents the fluid replacement assessment portion of the instrument.

With respect to obtaining a passing score, we also sought to determine whether there was a difference between those who received formal exercise physiology and fluid replacement training and those who did not. We hypothesized that there would be a difference between those with formal training in either exercise physiology or fluid replacement and those without training. The Chi Square descriptive data is presented in Table 5.0. The chi square test revealed no significant difference for those with fluid replacement training ($p = .394$) or formal exercise physiology background ($p = .088$); thus, our hypothesis was not supported.

Table 5.0 Formal Training Descriptive Data

		Test outcome		Total
		Fail	pass	
Exercise Physiology Training	no	6	2	8
	yes	9	5	14
Fluid Replacement Training	no	9	4	13
	yes	6	3	9

Note: Respondents could select exercise physiology training, fluid replacement training, or both.

DISCUSSION

The purpose of this study was to examine Illinois high school coaches' knowledge of hydration and fluid replacement strategies. We also sought to examine the sources of knowledge coaches used to learn of fluid replacement strategies. The results of this study revealed that a large portion of the Illinois high school athletic coaches involved with this study are in need of further education related to fluid replacement and hydration knowledge. This finding is important because previous studies have shown that a large percentage of coaches give hydration advice to their athletes.⁶ Thus, a large percentage of Illinois high school coaches may not be disseminating accurate information to their athletes. There needs to be a push for more quality information regarding hydration and fluid replacement getting to Illinois high school athletic coaches.

Having had formal exercise physiology training did not seem to have an impact on performance on the fluid replacement questionnaire. Of the 22 respondents, 13 subjects had a Masters degree or higher; however, only 38.46% of these respondents obtained a passing score. Respondents with only a Bachelors degree however, passed 77.78% of the time indicating that higher education did not translate to better performance on the questionnaire.

The respondents received their knowledge regarding hydration and fluid replacement from a variety of sources. The two sources most often reported were professional conferences and magazines, reported 59.09% of the time. While professional conferences are a quality choice to obtain fluid replacement knowledge, magazines are not always contributing scientifically sound advice. Professional organizations such as the National Athletic Trainers Association and the American College of Sports Medicine would be an ideal source to obtain information regarding hydration strategies and fluid replacement. However, professional organizations were reportedly utilized only 18.18% of the time.

The survey revealed, however, that coaches were less knowledgeable regarding post-exercise fluid replacement and ideal carbohydrate concentration of sports drinks. Respondents correctly answered the questions regarding these issues only 45.45% and 18.18%, respectively. Organizations should explicitly attempt to provide information related to ideal carbohydrate concentration of sports drinks and post-exercise fluid replacement to improve coaches' knowledge base regarding these important issues. The popularity of sports drinks and the importance of post-exercise fluid replacement make these issues vital to disseminating quality information to high school student-athletes.

In a recent study examining high school coaches' knowledge of prevention, recognition, and treatment of heat illnesses, coaches who attended information sessions on heat illness and were certified in first aid scored higher on the recognition and treatment of heat illnesses, respectively.⁷ Perhaps on-site educational sessions provided by medical staff (i.e., athletic trainers and team physicians) are a viable option to improve the knowledge of coaches.

Limitations

There were a few limitations in this study. The low response rate and resulting low number of subjects limit the ability to generalize the findings to its representative population. The low response rate of 4.4% may be due to the timing of the release of the survey. The survey was mailed in August, just after the start of the school year. If any of these coaches taught in the secondary school setting, this would likely be a hectic time of the year. The response rate may also be a byproduct of individuals not participating in a test of knowledge if the individual feels he/she does not have a solid background on the subject in question.

A second limitation is the utilization of only one state. To truly determine high school coaches' grasp of hydration and fluid replacement guidelines a national survey should be performed. Different geographical locations may provide different performances on the test of knowledge of hydration and fluid replacement guidelines. A nation wide survey would also provide a larger sample size, even with a similar response rate.

An interesting limitation is that a majority of the coaches who responded to the survey were not team sport coaches. Only 7 team sport coaches were represented in this study. The majority of respondents reportedly coached track and field, or cross-country. This may be due to the emphasis placed on hydration in long distance running events.

Conclusion

The results of this study indicate that Illinois high school athletic coaches may be in need of further education related to fluid replacement and hydration knowledge. There needs to be a concerted effort for the broadcasting of more quality information regarding hydration and fluid replacement to Illinois high school athletic coaches. The reportedly low levels of utilization of professional organizations to garner information may be an avenue from which quality information can be distributed to high school athletic coaches. While organizations such as the NATA and ACSM have developed educational resources regarding the importance of hydration during exercise, the performance of the Illinois high school athletic coaches surveyed failed to reflect the efforts of the organizations. Based on the identified sources of information, a better dissemination of information by professional organizations, targeting coaching magazines, may lead to improved fluid replacement knowledge and fewer tragic events on the athletic field, as well as a higher level of performance for high school athletes. Future research should examine the extent to which educational interventions such as coaching workshops improve the knowledge of coaches about fluid replacement and heat illness prevention.

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