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Use of the Wet Bulb Globe Temperature in NCAA FBS Athletic Training Staffs

ABSTRACT

Background: Heat illnesses present a major risk for athletes, especially football players. The NATA established recommendations to prevent heat illnesses that include measuring wet bulb globe temperature (WBGT), but adherence to this recommendation is unknown. **Methods:** A survey was sent to all 130 Division 1 FBS athletic training staffs to determine their use of the WBGT to assess heat stress. **Results:** Of the 82 respondents (63% response rate), 59 use WBGT to assess heat stress. However, only 19 use it for summer conditioning. Of the 23 universities that do not use WBGT, 10 noted that extreme heat or humidity is not an issue where they are located. **Conclusion:** The majority of FBS training programs (72% of respondents) use the WBGT, but adherence to this NATA recommendation varies throughout the season (summer conditioning versus practice) and is likely influenced by the geographical location of the university.

Key words: heat stroke, hot temperature, survey

INTRODUCTION

Exertional heat illnesses (EHI) are prevalent and dangerous in athletics because of strenuous exercise in hot environments and the health risk they present. The National Athletic Trainers Association (NATA) defines exertional heat illness as a “moderate to severe heat illness characterized by organ and tissue injury associated with sustained high body temperature resulting from strenuous exercise and environmental heat exposure.”¹ EHI can be categorized as dehydration, cramps, heat syncope, heat exhaustion, and heat stroke, which can ultimately lead to death. In high school and college football there is an average of 12.2 fatalities each year from heat related deaths.² Although deaths from heat illness are rare, exertional heatstroke (EHS) is the third-leading cause of on-the-field sudden death in athletes.³ The National Collegiate Athletic Association (NCAA) has also eliminated two-a-day practices to help prevent heat related illnesses.⁴ Because of the serious nature of EHIs, guidelines have been set up to help protect athletes.

The NATA has created guidelines to help protect athletes from EHIs. To anticipate potential problems, a preseason heat acclimatization policy is recommended for organized sports, and event guidelines formulated for hot, humid weather conditions based on the type of activity and wet-bulb globe temperature (WBGT).¹ The acclimation period allows the athlete to adapt to the new environmental conditions. Cooper et al.⁵ reported that the greatest risk of EHI occurred within the first 14 days of practice. The increased number of practice sessions, consecutive days of practice, intensity of practices, and higher WBGT levels at the start of the football season all contribute to greater physiological stress, causing a higher EHI incidence.⁵ Careful monitoring of weather conditions might help reduce the athletes’ risk for EHIs.

The NATA recommends athletic trainers use WBGT index to assess heat stress. The

WBGT is a comprehensive index that takes into account air temperature, humidity, and radiation. Specifically, WBGT includes the measurement of wet-bulb temperature (humidity), dry-bulb temperature (ambient temperature), and globe temperature (radiant heat). The equation for WBGT is: $WBGT = 0.7T_w + 0.2T_g + 0.1T_d$, where T_w = humidity, T_g = globe thermometer, and T_d = air temperature. The WBGT value is used to assess the potential impact of environmental heat stress and establish exercise guidelines.³

NCAA sports other than football also use WBGT index to assess heat stress. Two sets of heat stress guidelines, each based on WBGT, were designed for men's NCAA Championship Division I distance-running competitions. One set of guidelines was established to minimize the chance of heat injury during distance running events. A second set was designed to predict heat stress related performance decrements. During the time the heat injury guidelines were used (1974-1993), no heat injuries were reported.⁶ However, football poses an additional heat stress because the protective pads keep heat confined near the athlete's body causing an increase in body temperature. Armstrong et al.⁷ demonstrated that full football uniforms, and even partial football uniforms, reduced exercise performance and increased core temperatures compared to not wearing a football uniform. Football linemen completed a series of exercise tests in a controlled environment of 33°C and 48-49% humidity. Core temperature increased at a significantly faster rate when study participants wore a full uniform ($0.042 \pm 0.010^\circ\text{C}/\text{min}$) compared to a partial uniform without a helmet and shoulder pads ($0.034 \pm 0.006^\circ\text{C}/\text{min}$), compared to wearing only socks, sneakers, and shorts ($0.026 \pm 0.008^\circ\text{C}/\text{min}$). Consequently, even at the scholastic level, WBGT index has been used to assess heat stress in some Texas high school football programs.⁸ Despite the widespread use of WBGT index and the NATA position stand recommending its use to assess heat stress, no published data exist regarding the

prevalence of WBGT index within NCAA Football Bowl Subdivision (FBS) schools. Thus, the purpose of this study was to determine how many NCAA FBS athletic training staffs use WBGT to assess heat stress. Further, if WBGT is not being used, what is the rationale for not using it, and what alternative methods are being used to assess heat stress.

METHODS

The head athletic trainers from all 130 NCAA FBS athletic training staffs were contacted and asked to complete a survey. The head athletic trainers were contacted by email, which was obtained from each individual universities' athletics website. The survey was administered by REDCap (Research Electronic Data Capture). Data were collected and managed using REDCap electronic data capture tools hosted at Utah State University. REDCap is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources.⁹ The survey questions were: "Do you use the WBGT index to assess heat stress?" If the participant answered yes, they were asked, "Do you follow the NATA exercise guidelines based on the WBGT index?" If the participant answered no to question 1, they were asked "Why do you not use the WBGT?" and "What method or strategy do you use to assess heat stress?" The Institutional Review Board at Utah State University approved this survey, and the participants were informed of the intent to publish this data. An informed consent letter was sent out with the survey and completion of the survey assumed consent. Participation was voluntary. Descriptive data, such as frequencies were evaluated to identify trends.

RESULTS

Out of the 130 Division 1 FBS football athletic training staffs contacted, 82 programs responded, for a 63% response rate. There was representation from every conference. Out of the 82 universities that responded, 59 said they use WBGT to assess heat stress. A summary of the respondents by conference is in Table 1. Of the 59 programs that use WBGT, 52 said that they follow WBGT guidelines for exercise participation, while 7 responded that they do not follow the guidelines. Of the 23 universities that said they do not use WBGT to assess heat stress, 10 said it was because there is no extreme weather where they are located. Three of the 23 universities that do not use WBGT said it was because they were unaware of the guidelines.

Of the 23 schools that do not use WBGT to assess heat stress, 11 of them use another weather app on a mobile device. The other 12 schools either do not use any formal measuring system or did not respond to that question.

Of the 59 universities responding that they use WBGT to assess heat stress, 58 of them said they use WBGT to assess heat stress for practice. Twenty-seven of the 59 universities said they use WBGT for games, and only 19 of the 59 universities use WBGT for summer conditioning.

COMMENTARY

The NATA position paper recommending that WBGT be used to establish safe exercise guidelines in the heat was published in 2015¹, but this is the first study evaluating how these guidelines are being implemented at NCAA FBS universities. Of the survey respondents, a majority (72%) are using WBGT to assess heat stress. The assessment of heat stress is important in providing a safe environment for athletes to compete; only 12 universities (15%) that answered the questionnaire do not have a formal measuring system to assess heat stress, or they did not answer that question.

There was a low response rate when asked whether or not the athletic trainer uses WBGT during summer conditioning. It would be expected that the athletic trainers use WBGT during summer conditioning as most programs condition outside, and summer is when heat illnesses are most prevalent. The low response rate could be because the responder thought that “practice” encompasses summer conditioning. Alternatively, maybe these training sessions are less formal, and trainers are being lax in taking appropriate precautions and adhering to the NATA guidelines.

Geographic trends can be seen in the data. Each conference has their respective geographic region within the United States, with the exception of independent universities. Conferences in regions with adverse environmental conditions responded with greater WBGT use than conferences that are not in regions with adverse climates. All (100%) of the ACC respondents and nearly all of the SEC respondents (91%) use WBGT compared to just 33% in the MWC and 44% in the PAC-12. Universities in the ACC and SEC are located in the high-humidity regions of the south and northeast United States, increasing the risk of heat illnesses. Whereas the MWC and PAC-12 are located in the western region of the United States, where humidity is much lower.

Another trend is “power five” conferences (ACC, Big-12, Big-10, PAC-12, and SEC) use WBGT more than “group of five” universities (AAC, C-USA, MAC, MWC, and Sun Belt). For example, the SEC and Sun Belt conferences are within a similar geographic region, but the SEC universities use WBGT more than the Sun Belt universities. We can only speculate why this trend exists, but possibly, there is a financial burden to using WBGT, as “power five” universities tend to have more resources than “group of five” schools. There were 4 universities

that responded that the cost of using WBGT is the reason that they do not use it. Three of these 4 schools are in the “group of five” category.

This study is limited by a 63% response rate. Although $\geq 50\%$ of universities from each conference responded, the 48 universities that did not respond could alter the findings and conclusions of this survey substantially. It is unknown why the others did not respond, and if the percentage of WBGT use is the same between respondents and nonrespondents.

CONCLUSION

The majority of NCAA FBS athletic training programs in each conference responded to the survey, and nearly three-quarters of respondents follow the NATA position statement to use WBGT in the prevention of EHI. These findings suggest that programs not using WBGT often use another method of assessing heat stress or are located in regions with a low heat index. The NATA can use this information to assess the effectiveness of their position statement and make revisions if necessary.

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