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The Application of Evidence-Based Practices by USM Student Athletes to Manage Exercise-induced Asthma Symptoms

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The Application of Evidence-Based Practices by USM Student Athletes to Manage Exercise-induced Asthma Symptoms

by

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ABSTRACT

Keywords: Exercise-induced asthma (EIA), exercise-induced bronchospasm, student athletes, University of Southern Mississippi (USM), athletic trainers

Purpose: The purpose of this study is to determine if EIA student athletes at USM are being educated about and implementing evidence based practices that help manage asthma symptoms for each individual.

EIA is a prevalent disorder affecting collegiate athletes. Non-pharmacological evidence-based practices can be used by EIA athletes to minimize asthma symptoms. Modifications to the athlete's breathing techniques, diet, and warm-up protocol can be implemented to reduce asthma symptoms. To determine if athletes at USM are using these practices, a survey questioning their education and implementation of these practices was administered to all the USM athletes. Of the 331 athletes surveyed, 27 reported having asthma/EIA. This sample group (n=27) was then asked to answer questions about their asthma management. The data collected from this study was organized into percentages and frequencies. An analysis of the data revealed that many of the asthmatic athletes at USM are not practicing the methods proven to be most effective at reducing asthma symptoms. The data also showed that many athletes have not been educated by athletic trainers about these evidence-based practices.

DEDICATION

After much consideration, I would like to dedicate this thesis to Mr. Jerry Purvis. Your guidance and encouragement has given me the strength I needed to be successful, not only in writing this thesis but also in my career path. I appreciate the time and effort you have put into my success. Thank you for always believing in me and my hopes and dreams. You have made a lasting impact on my life, and I know you will continue to do the same for future students.

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Table of Contents

I. Introduction

Statement of Problem:

Exercise induced asthma (EIA), also known as exercise induced bronchospasm (EIB), is a common disorder that affects athletes with and without asthma. The Center for Disease Control (CDC) reports that 8.2% of adults and 9.4% of children have asthma (2012). With millions of people affected by asthma, a significant percent of athletes are likely to be affected by asthma. Approximately 85% of asthmatics and 15% of non-asthmatics experience EIA when performing physical activity at a moderate level (Gotshall, 2002). EIA occurs almost twice as often in winter weather athletes compared to summer weather athletes, which is attributed to the cold, dry climate (Rundell & Jenkinson, 2002). The prevalence of EIA in adult women is approximately 26% but only 18% in adult men (Rundell & Jenkinson, 2002). A study conducted by Wieler et al. found that the incidence of EIA increased among Olympic athletes from the 1984 Summer Olympic Games, where 11% of competing athletes had EIA, to the 1996 Summer Olympic Games, where 20% of competing athletes had EIA (Wieler, 1986 & 1998). This study shows that the number of athletes suffering from this condition is continually increasing. Such prevalence warrants further investigation into interventions that prevent EIA symptoms.

As the bronchi constrict, EIA patients will likely experience a decline in their physical performance level secondary to pulmonary compromise. Athletes seek to enhance their physical abilities, but those diagnosed with EIA have an underlying disability that can hinder their physical fitness development. They must overcome sub-

optimal breathing conditions in order to perform their athletic event. Adequate ventilation is essential to attaining peak cardiovascular fitness. If sufficient levels of oxygen are not consumed or carbon dioxide is not expelled, the athlete will likely suffer angina or shortness of breath and be unable to complete the exercise routine. EIA most notably causes a decrease in the amount of air expelled from the lungs which directly results in a decrease in pulmonary function.

Statement of Purpose:

Athletes seek to find pharmacological, dietary, and exercise intervention strategies to improve their lung function in order to attain their peak level of performance. Researchers stress the importance of diet in the prevention of EIA symptoms. By avoiding aggravating foods, EIA athletes will experience a reduction in symptoms. The major dietary modification that research recommends is to limit or preferably reduce the amount of sodium chloride intake. Literature has shown the application of pharmacological interventions prevents EIA symptoms, and some researchers have shown that the combination of medication and exercise interventions are most efficacious. Inhaled medications, such as albuterol, are often prescribed to treat EIA, but EIA patients can also explore alternative treatments to use alone or in combination with their prescribed medications. One exercise intervention that EIA patients can implement is the modification of the type of warm-up they perform before their exercise routine. Depending on the intensity and duration of the warm-up, an EIA patient can enhance his or her ventilation during physical activity. A study by Mickleborough, Lindley, and Turner in 2007 showed that the combination of asthma medication and a warm-up was more effective in controlling the symptoms of EIA as

compared to medication alone. The importance of a warm-up session before intensive exercise is established; therefore, EIA athletes should implement these evidence based practices into their routine.

Evidence based practice can include a variety of techniques that research has shown to be effective. Research has shown promising results in the management of EIA symptoms with the use of non-pharmacological treatments. The National Athletic Trainers Association (NATA) issued a position statement in 2005 regarding the management of asthma in athletes, including EIA. Athletic trainers should follow this position statement regarding non-pharmacological treatments. The position statement states that a refractory period should be induced, but the statement does not give specific details about how this should be accomplished. The position statement also addresses that diet and breathing techniques should be modified to reduce EIA symptoms. Since athlete trainers in a collegiate setting work with athletes extensively, they should educate EIA athletes about techniques to manage their symptoms.

Research Question:

This study addressed the use of evidence-based practices by athletes at the University of Southern Mississippi (USM) in preventing the symptoms of EIA using non-pharmacological methods. A survey addressing the warm-up rituals before an athletic event, diet modifications and supplementations, and breathing techniques was administered to asthmatic/EIA athletes at USM. Since particular warm-ups are shown to cause refractory periods, the athlete's pulmonary function should improve after the warm-up. EIA athletes are likely to perform a warm-up, in addition to their sport specific

warm-up, to induce a refractory period. The results of this study showed the responses of EIA athletes regarding their application of breathing techniques, diet, and warm-ups. This survey questioned different intensities and durations of a warm-up that an EIA athlete would perform, if he or she would perform one at all. Furthermore, the survey addressed if athletic trainers are educating EIA athletes about the importance of breathing and warm-up modifications to manage their symptoms. The purpose of this study was to determine if EIA student athletes at USM are being educated about and implementing evidence-based practices that help manage asthma symptoms for each individual.

II. Literature Review

Exercise-Induced Asthma

EIA is a disorder that causes pulmonary constriction after exercise resulting in a decrease in forced expiratory volume (FEV) (Gotshall, 2002). A reduction in FEV causes air to remain in the lungs that would normally be expelled in non-EIA exercise practitioners. During exercise, the ventilation rate must increase to meet oxygen demands; therefore, air is not warmed and humidified efficiently which can elicit a bronchospasm in certain individuals (Garcia-Marcos & Garde Garde, 2002). Colder air can cause vascular constriction in the bronchioles, and dryness can cause a reduced volume in bronchial cells which leads to the release of leukotrienes that produce a bronchospasm (Garcia-Marcos & Garde Garde, 2002). Histamine and prostaglandins, both which cause constriction, are also released because of the cooling and drying effects that occur in the bronchi (Gotshall, 2002). In order to obtain a diagnosis of EIA, clinical signs and symptoms of an asthmatic attack must manifest during or after exercise (Berkowitz et al., 1986). Spirometers are used to measure different aspects of pulmonary function including: forced expiratory volume in one second (FEV_1), forced vital capacity (FVC), ratio of FEV_1 to FVC ($FEV_{1\%}$), peak expiratory flow (PEF), and forced expiratory flow at 25–75% of FVC ($FEF_{25-75\%}$) (Manoharan & Swaminathan, 2009). Berkowitz et al. used a spirometer to measure FEV_1, FVC, FEV25-75%, and PEF as a means of determining pulmonary function in 18 asthmatic children (Berkowitz et al., 1986). A spirometric measurement with a decrease in FEV_1 a minimum of 10% to 20% post-exercise would indicate EIA (Joyner et al., 2006 & Berkowitz et al., 1986). A study conducted by Berkowitz et al. determined if the participants had EIA by noting a

decrease in post-exercise FEV_1 of 20% or greater compared to pre-exercise spirometry measurements during the pre-testing assessment (Berkowitz et al., 1986). Some clinical signs and symptoms of acute asthma include: dyspnea, coughing, wheezing, and chest tightness (Tillie-Leblond et al., 2009). Individuals may experience EIA differently by having a unique combination of these signs and symptoms.

Exercise-Induced Asthma Interventions

Both pharmacological and non-pharmacological interventions are used in the treatment and prevention of EIA. Medication can be prescribed as a daily preventative long-acting treatment or a prophylactic short-term precautionary measure.

The four common classes of medications used to prevent EIA are: inhaled corticosteroids, cromones, short- and long-acting β_2- adrenergic agonists, and antileukotrienes (Garcia-Marcos & Garde Garde, 2002). Salbutamol, also known as albuterol, is a short-acting β_2- adrenergic agonist that begins to take effect within about fifteen or twenty minutes and last about four to six hours (Garcia-Marcos & Garde Garde, 2002).The majority of athletes use a type of short-acting β_2- adrenergic agonists, such as albuterol, about fifteen minutes prior to physical activity to prevent EIA symptoms (Gotshall, 2002). A study conducted by Mickleborough, Lindley, and Turner found that the use of an albuterol inhaler prior to exercise caused post-exercise FEV to increase by 27%. (Mickleborough, Lindley, & Turner, 2007).

One non-pharmacological intervention that EIA patients can implement is the management of their diet. Since excessive sodium and chloride can exacerbate EIA symptoms, dietary salt intake should be restricted in EIA patients (Garcia-Marcos &

Garde Garde, 2002). A study conducted by Mickleborough et al. in 2000 found that the asthmatic participants in the study who were placed on a low sodium diet, 958 milligrams per day, for two weeks had an improvement in FEV and forced expiratory flow. In the same study, asthmatic participants placed on the high sodium diet, 8133 milligrams per day, saw a decrease in pulmonary function; therefore, salt exacerbates asthma symptoms (Mickleborough et al., 2000). Studies lead researchers to believe that dietary sodium can cause the production of leukotrienes, but more research must be conducted before these conclusions can be confirmed (Gotshall, 2002).

Caffeine helps relax smooth muscle in the bronchi; therefore, moderate amounts of caffeine should be consumed before physical activity to help dilate vessels in the lungs (Mickleborough & Gotshall, 2003). Approximately three cups of strong coffee contain the amount of caffeine needed to cause a significant reduction in FEV_1 decrease (Mickleborough & Gotshall, 2003). In a study conducted by Kivity et al. a dose of caffeine, either 3.5 or 7.5 mg/kg, was administered to asthmatic participants. Those who received the larger dose showed a decrease in FEV_1 by only 10% post exercise compared with the smaller dose who displayed a 25% decrease (Kivity et al, 1990). The caffeine did not eliminate the post-exercise FEV_1 decrease, a significant indicator of EIA, but the drop was reduced significantly.

Breathing technique is a key element in ensuring that the muscles are oxygenated efficiently. Miller et al. states that the NATA position statement recommends nose breathing for asthmatic athletes because this technique warms air therefore decreasing the inflammation response (2005). Although nose breathing is not practical during high

intensity exercise, EIA athletes should be encouraged to practice nose breathing whenever possible.

Athletes with Exercise-Induced Asthma

Some of the asthma symptoms that EIA athletes should recognize, especially during or after exercise, are: chest tightness, coughing, dyspnea, wheezing, and inability to catch one's breath (Miller et al., 2005). Athletes will often induce a refractory period which allows them to perform during the athletic event. Asthma symptoms peak within 8 to 15 minutes after exercise, and most EIA patients experience a recovery phase that occurs within 60 minutes after the initial exercise ends (Tan & Spector, 1998). If another exercise session occurs after the primary one, EIA patients show fewer symptoms, or a refractory period (Tan & Spector, 1998). The manipulation of exercise techniques is another non-pharmacological intervention that is used to treat EIA. When an exercise is repeated within four hours of the initial exercise, EIA symptoms are significantly less than during the initial period (Mickleborough, Lindley, & Turner, 2007). By triggering a refractory period, athletes will be able to compete with better pulmonary function.

Warm-up

A warm-up is an essential part of an exercise routine in that it prepares the body for physical activity. Extensive, submaximal, continuous warm-ups and high-intensity, interval style warm-ups have both been shown to induce a refractory period in athletes (Mickleborough, Lindley, & Turner, 2007). In the study conducted by Mickleborough, Lindley, and Turner, eight moderately trained asthmatic athletes performed an exercise challenge test preceded by a warm-up consisting of 8 x 30 second sprints with a 45

second recovery between each run (Mickleborough, Lindley, & Turner, 2007). The study concluded that with the application of this warm-up, FEV_1 decreased -9.1±0.6 % after the exercise challenge test, which is below the 10% decrease needed for EIA diagnosis (Mickleborough, Lindley, & Turner, 2007). The control group in this study showed a decrease in FEV_1 of approximately -16% after the exercise challenge test (Mickleborough, Lindley, & Turner, 2007).

Since EIA athletes can experience a refractory period, during which they experience an improvement in symptoms, after performing exercise, the athlete should perform a warm-up that will elicit this response. A study conducted by Sidiropoulou et al. in 2007 tested different soccer training programs in young athletes with EIA, and he found that a warm-up consisting of high intensity (80-90% MHR) interval sprints lasting 20 seconds with a 100 second low intensity (50-60% MRH) recovery period induced a refractory period that caused a reduction in symptoms during the main training phase. The warm-up did not exceed 10 minutes (Sidiropoulou et al., 2007); furthermore, an extensive warm-up would lead to fatigue.

A study conducted by Schnall and Landau in 1980 showed that seven 30 second sprint intervals with 150 second rest before or before and after a six minute run caused bronchodilatation in EIA athletes. The bronchodilatation is a result of an increase in the sympatho-adrenal drive caused by the high intensity exercise (Schnall and Landau, 1980). The sympatho-adrenal system causes an increase in circulating catecholamines which target β_2-andrenoreceptors, and the stimulation of β_2-andrenoreceptors causes bronchodilatation (Gotshall, 2002).

Another method of modifying exercise intensity level is the addition of weight. A study conducted by Faigenbaum et al. in 2006 found that a dynamic warm-up with a vest weighted with 2% of the participant's body mass caused a significant increase in performance in the long jump and vertical jump tests as compared to static stretching or a dynamic warm-up without the vest in high school female athletes (Faigenbaum et al., 2006). With the addition of the weight vest, a larger number of muscle fibers are recruited, causing more neural activation to occur, to perform the warm-up (Faigenbaum et al., 2006). Since the study by Gotshall in 2002 showed that high-intensity exercise causes brochodilatation, evidence leads to the conclusion that sympatho-adrenal activation is likely the result of muscle fiber recruitment; therefore, a warm-up that recruits more muscle fibers will likely elicit a refractory period. Studies should be conducted to verify this conclusion.

Multiple body systems are affected during the execution of a warm-up. Stretching, continuous aerobic activity, and interval aerobic exercises are all commonly used methods of warm-up. A study conducted by Skof and Strojnik in 2007 tested the effects of different types of warm-ups on muscle contraction. In middle distance runners, the application of an intensive warm-up, consisting of stretching, a continuous run, and sprints, caused a significant increase in the torque of voluntary muscle contraction and speed of contraction as compared to a warm-up with only stretching and a continuous run (Skof & Strojnik, 2007). With the application of a high-intensity warm-up phase, participants demonstrated an increase in maximum twitch torque by 16.5% and more muscle activation (Skof & Strojnik, 2007). Since a greater number of muscle fibers are

recruited, evidence points to an increase in the sympatho-adrenal symptom inducing bronchodilatation. Research would need to be conducted to verify this conclusion.

Athletic Trainers

The NATA states that athletic trainers are responsible for diagnosing, treating, and preventing acute and chronic musculoskeletal conditions and select other medical conditions to reduce the risk of subsequent injuries or functional limitations (2010). Athletic trainers can work for high schools, colleges, professional sports teams, and clinical health care providers (NATA, 2010). Approximately 23% of athletic trainers are employed by a health care clinic, and 20% of athletic trainers are employed by a university or college (Terranova & Henning, 2011). Since a large majority of athletic trainers manage athletes, athletic trainers should be aware of disorders that commonly affect athletes. Since approximately 18-26% of adults have EIA, a significant number of athletes are likely to be affected by EIA (Rundell & Jenkinson, 2002); therefore, athletic trainers should be competent in treating, specifically educating, athletes with asthma and EIA.

A position statement issued by NATA stated that athletic trainers should be able to identify, refer, manage, and educate athletes with asthma, including EIA (Miller et al., 2005). Some of the asthma symptoms athletic trainers should recognize, especially during or after exercise, and educate players about are: chest tightness, coughing, dyspnea, wheezing, and the inability to catch one's breath (Miller et al., 2005). A study conducted by LaBella, Sanders, and Sullivan found that 58% of the athletic trainers they surveyed did not feel that their training for dealing with asthmatic athletes was sufficient (2009).

This study also found that 25.3% of athletic trainers surveyed considered themselves "very comfortable" when managing asthmatic athletes (LaBella, Sanders, & Sullivan, 2009). Since athletic trainers are responsible for educating athletes, EIA student athletes at USM should have been educated by an athletic trainer about their disorder.

III. Methodology

Sample

The sample consisted of 331 athletes over the age of 18 who are involved in athletics at USM. This number included all of the athletes enrolled at USM. Gender and race were not a factor in the participant's eligibility. The participants attended USM and were a member of one or more of the collegiate athletic teams. Red-shirt freshmen were able to participate in the study as long as they met the age requirement. Their athletic statuses were reported by the USM Athletic Department. In order to maintain privacy, names were not released. A hardcopy of the survey was administered to the athletes. The athletic training department was responsible for administering and collecting the survey tool.

Measures

In this study, the evidence-based practices served as the independent variable, and the participant's EIA non-pharmacological treatment techniques were the dependent variable. The control variable was the participant's student athletic status. A hard copy of the seven question survey was administered to the athletes. Student athletes who reported that they did not have asthma/EIA were not included in the analysis of the evidence-based practices. The questionnaire is listed in Appendix 1. The survey asked the student athletes about their sport, asthma education, and non-pharmacological asthma prevention methods. The answers to the survey questions were completely anonymous. Participants were allowed one month to complete the survey. If the survey was not completed in the given time frame, the participant was discarded from the study.

Procedures and Data Collection

Each participant was administered a hardcopy of the survey by the USM athletic training staff. The participants were notified that their responses to the survey are completely anonymous and the information would not be used against them in any way. After the results from the survey were collected, an analysis was performed to compare evidence-based practice regarding EIA to the EIA athletes' practices. The number of USM student athletes reporting that they had asthma/EIA was used for analysis. A percentage of the number reporting was then determined to show the knowledge and use of evidence-based practices relating to EIA symptom management. The conclusions from the study showed the variation between actual practices and evidence-based practices for EIA management in athletes. The results also communicated the education level of the athletes regarding their asthma management.

Data Analysis and Interpretation

Participants' responses were compared to the techniques recommend by the evidence-based practices detailed in this study. Data was organized and analyzed using Microsoft Excel, and the percentages were calculated for each question in the survey. The percentage of participants was found using the total number of athletes. Of the number of athletes that responded to the survey, the ones who reported having asthma/EIA were used to calculate the percentages of athletes using the evidence-based practices. The athletes that reported that they did not have asthma/EIA were not used in the calculation of the percentages for evidence-based practices. Each survey question was analyzed both for application of practice and population applying the practice. The number of student

athletes using the evidence-based practices was then analyzed to determine if more education should be provided to asthmatic athletes.

Benefits and Risks

This study is beneficial to the USM athletic community because it addresses a health condition which negatively affects athletic performance. Athletic trainers at USM can use this study to effectively gauge their performance in educating USM asthmatic athletes. If the study showed that students were not using the most effective practices to reduce asthma symptoms, athletic trainers should provide educational materials to the athletes about these practices. By effectively controlling EIA symptoms, USM athletes will in turn have a successful performance. Overall, this study was shown to be low risk to the sample group. The responses to the survey were kept confidential to eliminate risks to the participants.

Confidentiality

Since confidentiality was maintained by keeping the survey anonymous, the athlete was not at risk for exposure of private health information. If the study is replicated, measures should be taken to ensure the athletes' health information remain private. The athletes were also notified that their answers would not affect them in either a negative or positive manner. Appendix 2 shows the informed consent letter that was administered to the participants. Also, the survey did not ask information that could be used to link the responses back to a particular individual.

IV. Results

Sample Demographics

Of the 331 student athletes at USM, 184 participants responded and completed the survey. Of the responding participants, 27 of them reported having been diagnosed with asthma/EIA. Demographics relating to age, gender, race, ethnicity, and activity level were not included in the survey. The sports the EIA athletes participate in are listed below in Table 1.

Table 1. Breakdown of sports in self-reporting EIA student athletes at USM

Football	7	Softball	3
Basketball	4	Volleyball	3
Soccer	4	Unanswered	2
Track	4		

Differential Analysis

Question 1:

> Have you ever been diagnosed with asthma or exercise induced asthma? If not, please do not answer the following questions.

Of the 184 participants, 26 answered yes. The remaining 157 answered no. The participants who responded no were not asked any remaining questions. One participant left question 1 unanswered but completed the remainder of the survey. He or she was believed to have asthma/EIA and was included in the sample n=27.

Question 2:

Are you a student athlete at USM?

For this question, 24 of the participants responded yes. Three participants left this question unanswered, but the assumption was made that the students were athletes because the survey was only administered to USM student athletes.

Question 3:

What sport do you participate in?

The responses to this question are located in Table 1. Only 2 participants did not respond to this question. One can assume that the participants are involved in one or more of the 16 athletic teams at USM. These teams include: baseball, basketball (men's/women's), cross country (women's), football, golf (men's/women's), soccer (women's), softball, tennis (men's/women's), indoor and outdoor track and field (men's/women's), volleyball (women's).

Question 4:

Have you ever been educated by an athletic trainer about breathing techniques to help with your asthma symptoms?

To this question, 10 participants responded yes. Fifteen participants reported that they had not been educated by an athletic trainer regarding breathing techniques to reduce

asthma symptoms. Two participants left the question unanswered. This question shows that 37% of asthmatic athletes at USM have been educated about breathing techniques to help manage asthma symptoms, compared the remaining 55.6% who had not. Of the participants questioned, 7.4% did not respond to this question. An analysis of the individual sport breakdown for this question is listed below in Table 2.

Table 2. Analysis of responses to Question 4 by specific sports.

Sport	Yes	No	No Response
Football	6	1	0
Track	3	0	1
Soccer	1	3	0
Basketball	1	3	0
Volleyball	1	2	0
Softball	1	2	0
No Sport Reported	0	1	1
Total	13	12	2

Question 5:

> Have you ever been educated by an athletic trainer about different types of exercises to reduce asthma symptoms?

Of the 27 participants surveyed, four reported that they had been educated about exercises that help manage asthma symptoms. On the contrary, 20 participants answered that they had not been educated. Three participants did not report an answer for this question. Only 14.8% of asthmatic athletes at USM had been provided knowledge about particular exercise techniques to reduce asthma symptoms, compared to the 74.1% who

had not. No response constitutes 11.1% of the reported answers. An analysis of the individual sport breakdown for this question is listed below in Table 3.

Table 3. Analysis of responses to Question 5 by specific sports.

Sport	Yes	No	No Response
Football	2	3	2
Track	1	3	0
Soccer	0	4	0
Basketball	1	3	0
Volleyball	0	3	0
Softball	0	3	0
No Sport Reported	0	1	1
Total	4	20	3

Question 6:

> Do you feel that you are able to tell the difference between your asthma symptoms and general exercise fatigue during your athletic event?

For this question, 20 athletes reported that they could recognize the difference in asthma symptoms and general exercise fatigue. This is equivalent to 74.1% of the asthmatic athletes at USM. Four participants said they could not recognize the difference, and three participants left the question unanswered. In total, 14.8% of the asthmatic athletes surveyed lacked the knowledge needed to adequately identify their symptoms. Of the participants surveyed, 11.1% did not answer this question.

Question 7

Respondents were asked if they used any of the non-pharmacological techniques listed in Question 7. The respondents could indicate as many or as few measures as they chose to. The responses to Question 7 related to non-pharmacological techniques used by the participants are listed in Table 4.

Table 4. Frequency and percentage of participants using a given practice.

Practice	**#**	**%**
Low Sodium	0	0
High Sodium	1	3
Caffeine	4	14
Nose Breathing	16	59
Mouth Breathing	9	33
High Intensity W/U	4	14
Low Intensity W/U	10	37
10 Min. Continuous W/U	6	22
10 Min. Interval W/U	7	25
Weight Vest	0	0
No Response	4	14

V. Findings, Recommendations, and Conclusions

Summary

The purpose of this study was to determine if USM student athletes are educated regarding and using evidence-based non-pharmacologic methods to help manage their asthma/EIA symptoms. This study also seeks to find if athletic trainers are educating student athletes with asthma/EIA about these methods.

The setting of this study was USM in Hattiesburg, MS, and the target population was all USM student athletes. A convenience sample of 27 asthmatic/EIA athletes participated in the study, despite the survey being administered to 331 athletes. A researcher-developed questionnaire was utilized to obtain the data. The results of this study were reported as percentages and frequencies. An analysis of the data was then performed to determine if student athletes are aware of and using evidence-based practices.

Findings and Conclusions

In this study, more education has been provided to student athletes regarding breathing techniques to help reduce bronchospasm rather than exercise methods, which could induce a refractory period. The refractory period is a method proven to show significant improvements in symptom reduction by previously exposing athletes to exercise conditions before the main event. Education about the refractory period is equally important in asthma symptom management. Both the conscious and physiological components of breathing are vital in helping athletes perform at optimum performance levels. Possibly, athletic trainers are mentally aware that asthma/EIA is a respiratory

condition and associate breathing with assisting in counteracting its effects. Although the route of breathing is important, the physiological mechanisms occurring inside the lungs are essential to adequate gas delivery and exchange. Since diet and exercise warm-up techniques cause changes to the tissue inside the lungs, athletic trainers should raise consciousness to these modifications. In doing so, the athletes would have the knowledge needed to perform practices that improve all physiological aspects of pulmonary function, as opposed to solely the air intake aspect.

Helping athletes to identify the symptoms of asthma may ensure that they take measures to prevent the negative consequences of the disorder. A majority of the students in this study (74.1%) did recognize their asthma symptoms as the disorder and not general exercise fatigue. This number shows that education, whether formal or informal, has been effective in the first step of asthma/EIA management, which is the recognition of symptoms. If athletes can identify their symptoms early, treatments, whether pharmacological or non-pharmacological, can be administered earlier. Also, when asthmatic athletes are able to recognize their symptoms, adjustments to their treatment plan can be made more easily compared to those who are unaware of their symptoms.

Of the sample group, n=27, the majority of the participants were football players. Although athletes from the football team and other sports, including soccer, track, basketball, volleyball, and softball, participated in this study, many of the athletic teams at USM were not represented. At USM football is an outdoor sport played in late fall; therefore, more athletes in this sport might experience asthma symptoms due to the cold climate. The survey did not ask the 184 respondents what athletic team they were a member of. If this question had been asked, a percentage of asthmatic/EIA athletes in a

given sport could have been determined. In this study the football team had the largest number of participants. The football is much larger than other athletic teams, such as the volleyball team. Potentially, the volleyball team could have had a higher percentage of athletes with EIA. Because volleyball is played indoors, this may explain why more football players than volleyball players reported having asthma/EIA. Percentages of EIA athletes in a given sport cannot be determined with the data collected; therefore, the data does not allow for comparisons of asthma/EIA prevalence across sports.

Nose breathing is an evidence-based practice that reduces asthma symptoms by warming and humidifying the air entering the lungs. Over half (59%) of the students in this study use this method to reduce bronchospasms. This practice is more conducive to certain sports than others. For example, nose breathing is more easily performed by cross-country runners as opposed to sprinters. Some participants (33%) reported using mouth breathing as a means to reduce asthma symptoms. This practice has not been proven by evidence to be effective in symptom reduction. The participants who use this practice possibly lack the education regarding the need for air warming and humidification before entering the lungs in asthmatics. Some of the participants might experience symptom relief with mouth breathing, but this practice is not supported or encouraged for EIA athletes. Although certain individuals might experience symptom reduction with mouth breathing, this conclusion would pertain to only the individual and not EIA athletes as a whole. Of the participants surveyed, only 37% reported being educated by athletic trainers about breathing techniques. This number shows that the athlete was most likely educated by other sources about the importance of nose breathing.

Although many of the participants are applying this practice, education by the athletic trainers regarding nose breathing and the rationale for the practice should be performed.

Dietary intake during a young athlete's college years may be affected by many factors including: time constraints, monetary considerations, and availability. When competing at the collegiate level, athletes should strongly consider their nutritional intake as part of their training. Studies show that nutrition can play a role in asthma symptom manifestation. Since a high sodium diet can be linked to an increased inflammatory response, athletes should avoid processed foods and adding salt to foods. Low sodium diets have been shown to reduce asthma symptoms; therefore, EIA athletes should implement this practice as part of their symptom management plan. None of the participants (0%) indicated that they had implemented a low sodium diet as part of their asthma management. The lack of participants using this practice could be attributed to the unavailability of fresh foods. The athletes might not be aware of the benefits of a low sodium diet. The survey did not address the athlete's prior education on this issue; therefore, the assumption that inadequate education is the source of the practice can only be speculated.

Caffeine is a supplement that is shown to cause bronchodilatation by relaxing the smooth muscles in the lungs when administered prior to exercise. A small number of the participants (14%) reported using caffeine as a method to reduce their asthma/EIA symptoms. Because caffeine is widely available in today's marketplace, more athletes were expected to be implementing caffeine supplementation. Caffeine can be consumed in the form of drinks, pills, or powders, and these forms range widely in cost. As a result, the price of caffeine supplementation is likely not the cause of the low number of

participants using this practice. Education about this supplement should be provided to USM student athletes. The survey did not question the participant's prior education about the supplement, but inadequate education is likely the cause of the low number of athletes using this practice. Caffeine supplementation is an easily administered, affordable supplement that would provide symptom reduction to asthmatic athletes.

A proper warm-up is essential to optimal athletic performance. The warm-up also plays a vital role in EIA control. If an appropriate warm-up is performed, the EIA athlete will experience a refractory period several minutes after the warm-up. The refractory period allows the athlete to perform an athletic event with minimal symptoms. Athletes should utilize the warm-up to experience the greatest reduction in symptoms provided by the refractory period. Although a given athletic team has a specific warm-up, asthmatic/EIA athletes should include a warm-up that is designed for refractory period induction. An interval warm-up over a 10 minute period has shown to be more effective at inducing a refractory period than a continuous warm-up. Of the participants surveyed, 25% reported performing an interval warm-up compared to 22% who selected the continuous warm-up. Both types of warm-ups are effective, but the interval provides the greatest reduction of symptoms. Only 14% of the participants reported performing a high intensity warm-up to help manage asthma symptoms. This number is relatively small considering that high-intensity interval style warm-ups have been shown to be the best method of refractory period induction. Low intensity warm-ups do not raise the athletes' heart rate and respiratory rate to the extent of high intensity ones. When high intensity warm-ups are performed, the body, especially the muscle fibers, is prepared for a greater amount of oxygen delivery. The bronchioles will dilate in preparation for the higher

oxygen demand. Bronchodilatation will in turn cause more oxygen to reach the alveoli for gas exchange. No participants reported using a weight vest to supplement their warm-up program. A weight vest would provide more muscle recruitment which would cause an increase in cardio-respiratory function. Although this practice has not been proven to help reduce EIA symptoms, the practice is likely to help because of the higher intensity level caused by the addition of the weight vest. Further research would need to be conducted regarding this practice to make a definitive conclusion. One possible reason that no participants reported using the weight vests was that they are not provided to the athletes. The vest could also be too expensive for the athletes to purchase. Athletes are trained to perform warm-ups and exercises before an athletic event; therefore, many are receiving the benefits of a warm-up even if they are not mentally aware that this practice can reduce EIA symptoms.

Education is essential in helping athletes manage asthma/EIA conditions. Although only 14% of the participants reported that they did not use any of the practices listed, education should be provided to ensure that the athletes are using the most efficacious approaches to obtain symptom reduction. The participants who did not respond to any of these practices could be using other evidence-based practices not addressed in this study to have symptom improvement. Comparisons between Question 4 and Question 5 in the survey relating to the education given by the athletic trainers shows that more breathing education has been provided to the athletes with a lesser focus on exercise education. This could be related to the athletic trainers' knowledge about breathing techniques as opposed to specific exercise protocols. Overall, more education is advised for this group of student athletes, particularly to exercise and diet techniques.

Electronic educational materials and in-class education can be accomplished inexpensively for the athletic program. Benefits to the athletic program would be increased productivity and successful, healthier student athletes.

Limitations

Several limitations have been identified in this study. A convenience sample was used, and the number of athletes reported having EIA was a small number compared to the expected percentage of approximately 26% of women and18% of men (Rundell & Jenkinson, 2002). Only 14.7% of the USM athletes who completed the survey reported having asthma/EIA. Because of the limited number of reporting participants, findings in this study may only be generalizable to the sample who participated. The instrument was not checked for construct validity. The participants were not asked to identify any demographics except the sport they participate in. If demographics regarding age, sex, race, or nationality had been asked, a more in-depth analysis of the sample group could have been performed. The survey instrument also did not question the participants about prior education regarding dietary intake. A major limitation in the study was the ordering of the survey questions. If all persons surveyed would have reported the sport they participate in, statistical analysis comparing the percentages of EIA athletes across all sports could have been performed. The way the data was collected did not yield the total number of athletes surveyed in a given sport; therefore, conclusions about the prevalence of EIA in a sport cannot be determined.

Recommendations

If this study was to be replicated, modifications should be made to gain a better representation of the asthmatic/EIA athletes at USM. The survey should address both the gender and race/ethnicity of the participants. In doing so, the researcher would be able to perform chi-squared tests to compare an evidence-based practice to a given sub-group in the sample. By adding more demographic questions to the survey, the study could be used to determine if the sample is representative of the population of asthmatics in general and to determine if women or men have a greater knowledge and application of non-pharmacological interventions to reduce EIA.

Also, the use of pharmacological agents in addition to non-pharmacological means should be assessed. If asthma medications are included in the study, the researcher should have the participants specify the type and dosage of medication and the frequency of medication administration. Inclusion of a random sample of all college level athletes age 18 and older in the Hattiesburg, Mississippi area would also be recommended. Although the study would not be generalizable to USM, the larger sample group would provide a better assessment of the application of evidence-based practices in the area.

A five-point Likert scale should also be used for the data collection to further identify the level of knowledge of the appropriate use of specific techniques. If this type of scale was used, more statistical analyses could be performed with the data collection, and this in turn would yield a better understanding of the participants use and knowledge of the practices.

Overall, this study provided suggestions to the USM athletic department to educate its EIA athletes about practices to help reduce symptoms, but this study did not provide a clear understanding of which specific groups should be targeted. In conclusion, the study should be repeated in hopes of attaining a larger sample group. In doing so, a more generalizable conclusion could be made about these practices and the education regarding them.

Appendix 1. Survey Instrument

1. Have you ever been diagnosed with asthma or exercise induced asthma? If not, please do not answer the following questions.
2. Are you a student athlete at the University of Southern Mississippi?
3. What sport do you participate in?
4. Have you ever been educated by an athletic trainer about breathing techniques to help with your asthma symptoms?
5. Have you ever been educated by an athletic trainer about different types of exercises to reduce asthma symptoms?
6. Do you feel that you are able to tell the difference between your asthma symptoms and general exercise fatigue during your athletic event?
7. Please select any of the following modifications you have made to help manage your asthma symptoms.

   __ Low sodium diet (i.e. limit salt intake)

   __ High sodium diet (i.e. add salt to foods)

   __ Consume any form of caffeine before an athletic event (i.e. pills, energy drinks, powders)

   __ Breathe through your nose as much as possible during an athletic event

   __ Breathe through your mouth as much as possible during an athletic event

   __ Perform a high intensity warm-up (i.e. sprints)

   __ Perform a low intensity warm-up (i.e. light jogging)

   __ Perform a continuous 10 minute warm-up (i.e. run 1 mile without stopping)

__ Perform an interval 10 minute warm-up (i.e. sprint for 30 seconds then walk for 90 seconds)

__ Wear a weight vest during your warm-up

Appendix 2. Informed Consent Letter

Potential Participant,

My name is Meagan Ishee, and I am an Honor's College senior at the University of Southern Mississippi. I am conducting a study about USM student athletes with asthma or exercise induced asthma (EIA).

I have included a hard copy of a seven question survey that will ask you about your education and treatment for EIA. Participants are eligible for this study if they have been diagnosed with asthma or EIA and are currently a student athlete at USM. Participants must be 18 years of age or older. The survey should take between five to ten minutes of your time to complete.

The survey will be anonymous, and no identifying information will be asked in the survey. Participation in this study is completely voluntary. Participation in this study may be discontinued at any time without penalty. Data will be shredded within 30 days of the completion of the study.

This project has been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

If you have any questions, please feel free to contact me at 601-335-2441 or Meagan.Ishee@eagles.usm.edu or my adviser, Jerry Purvis, at Jerry.Purvis@usm.edu.

Thank you,

Meagan Ishee

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