

**THE PREVALENCE OF RINGWORM IN DIVISION I
COLLEGIATE WRESTLERS
BASED ON ETHNICITY**

By

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Bachelor of Science

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2001

**Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
May, 2004**

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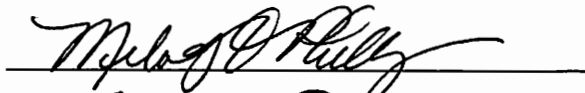
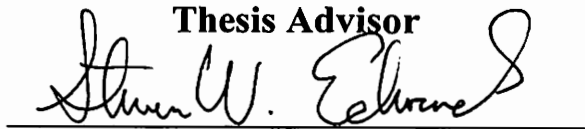
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Thesis Approved:



Thesis Advisor



Dean of the Graduate College

ACKNOWLEDGEMENTS

I would like to express my gratitude to Dr. Bert Jacobson for his guidance, encouragement, and recommendations during the completion of this thesis. The experience I have gathered from writing a thesis I will value forever.

A special thanks to Dr. Edwards and Melody Phillips for their guidance and knowledge throughout my research. For their time and efforts during the preparation and final stages of my research.

Thanks to Dr. Tona Palmer and Jen Kaloupek for their guidance and proofing of my thesis throughout this academic year.

To all of the Division I wrestlers that participated in my study. It could not have been done without your help. I appreciate all of your time and efforts.

Finally and most important I would like to give special thanks to my mother Linda Sekula and my brother Anthony Reynolds for all of their support and guidance throughout my life-long studies. Without their constant love and encouragement I would not be where I am today. Thank You.

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Chapter I

INTRODUCTION

Wrestling, being a close-contact sport, is highly conducive to the spread of skin infections. Impetigo, Tinea corporis, and Herpes simplex are a small sample of the numerous skin infections that are highly contagious via physical contact.

In the United States, ringworm, a fungus that lives on the epidermal layer of the skin, is a growing epidemic in the sport of wrestling. The disease to which we often refer as “ringworm” has many varieties, with the most prevalent genera in the United States being *Trichophyton tonsurans* (Hradil, et al. 1995).

The presence of ringworm lesions on wrestlers is not as recognized as the presence of herpes gladiatorum and is infrequently reported (Adams, 2000). There is a particular absence of data that describes ringworm on a larger scale (Kohl, et al., 2002).

Although very rarely documented, ringworm is becoming a problem of epic proportions in the wrestling world. There is a shortage of published reports on the infection of ringworm, thus leading to a lack of accounting and documentation on the disease (Kohl, 2002). Many wrestling coaches have removed their infected athletes from practice participation due to the increasing risk of a widespread ringworm infection that may have an adverse affect on the team’s ability to compete. When an athlete is prohibited from practicing, it is the job of the athletic training staff and physician to get the athlete back to practice as soon as possible. Increasing the knowledge base regarding

the transmission and prevalence of ringworm may assist in the development of a cure or a more efficient prevention protocol.

Ringworm is primarily transmitted by direct skin-to-skin contact with an individual who is infected (Hradil, 1995). The frequency of skin-to-skin contact in wrestling increases the chances that ringworm will be contracted (Hand, and Wroble, 1999). The warm temperatures and humidity found in the wrestling environment provide optimal conditions for fungal growth.

Identifying the specific traits of susceptible hosts and the frequency at which these hosts are infected, may help to prevent or attenuate the transmission of ringworm. At the olympic, university, and high school levels, cleansing/cleaning, and prevention protocols are implemented to decrease the spread of fungal growth; including the use of a bleach solution to disinfect the mats, washing and showering with antibacterial soap after practice, and using a pre-practice foam to coat the skin. However, in a case study involving 22 college wrestlers, it was found that a skin protecting foam did not significantly reduce ringworm in comparison to the control group (Hand and Wroble, 1999). Preventive protocols, medications and application procedures do exist, but not one has completely stopped the spread of ringworm. Gaining a greater insight into the contraction and incidence of ringworm may help in the prevention of this fungal infection. This project ascertained ethnic discrepancies in the contraction of ringworm and brought the scientific community a step closer to understanding differences in susceptibility to ringworm based on ethnicity. Data obtained in the current project may explain why some wrestlers have a greater chance of contracting ringworm than other wrestlers.

Purpose of the Study

The purpose of the present study was threefold:

1. To investigate the prevalence of ringworm in male collegiate Division I wrestlers based on their ethnic background.
2. To document and describe the most common areas of infection.
3. To find the implications of the condition as it directly relates to missed practice and competition.

Null Hypothesis

Hypothesis: There will be no significant difference in the prevalence of ringworm based on ethnicity in Division I collegiate male wrestlers.

Definitions/Abbreviations

1. **Ringworm-** Common term for any contagious skin infection caused by fungi of the genera *Microsporum* or *Trichophyton*. A well-defined red rash, with an elevated, wavy, or worm shaped border (Venes, 2001).
2. **RW-**Ringworm
3. **Prevalence-** The measure of the number of cases in a given group (Venes, 2001).
4. **Impetigo-** A bacterial infection of the skin, caused by streptococci or staphylococci, marked by yellow to red weeping, crusted, or pustule lesions especially around the nose, mouth, cheeks, or on the extremities. Impetigo occurs

in children and adults and may develop after trauma or irritation to the skin (Venes, 2001).

5. **Herpes-** Vesicular eruption caused by a virus (Venes, 2001).
6. **Keratin-** Family of durable protein polymers that are found only in epithelial cells. Provide structural strength to the skin, hair, and nails (Venes, 2001).
7. **Fungistatic saturated fatty acids-** An agent that inhibits the growth of fungi.
8. **Sebum-** A fatty secretion of the sebaceous glands of the skin. It varies in different parts of the body (Venes, 2001).
9. **T-** Stands for Trichophyton- A genus of parasitic fungi that lives in/on the skin or its appendages (hair and nails) and is the cause of various dermatomycoses and ringworm infections. Arranged in rows on the outside of the hair (Venes, 2001).
10. **M-** Stands for Microsporum- A specific genera of fungus that causes disease of the skin, hair, nails (Venes, 2001).
11. **E-** Stands for Epidermophyton - A specific genera of fungus similar to Trichophyton but affecting the skin and nails (Venes, 2001).

Delimitations

The design of this experiment posed certain boundaries, or delimitations, that could have an effect on the data presented in this study.

1. The subjects were collegiate male Division I wrestlers only residing in the United States, who filled out a survey strictly on a voluntary basis.

Limitations

The limitations of this study affect the ability to expand the scope of inference beyond the sample population used in this study. Generalizations made from the results of this study are compromised of the following limitations.

1. The methodology could not control for the population of African Americans in Division I wrestling.
2. The time each wrestler spent on the wrestling mat was based solely on the NCAA's regulations on how often an individual could practice each week. This methodology could not account for any additional wrestling done voluntarily on an individual basis.
3. Each college's protocol for ringworm prevention was not accounted for in this study.

Assumptions

The assumptions that applied to the research design of this study include:

1. Athletes filled out the survey accurately and to the best of their ability.
2. Athletes answered questions truthfully.
3. The survey was accurate and reliable in collecting the information on this topic.
4. The diagnosis of ringworm for each of these athletes was correct.
5. The athletes could accurately identify and diagnose ringworm.
6. The athletes were fully aware of their race and ethnic background.

Chapter II

REVIEW OF RELATED LITERATURE

A Review

For many years, coaches and athletic trainers battled a fungus commonly called ringworm. Ringworm, although not a worm, presents itself in a unique ring-shaped formation of red raised borders on the skin. Not every case of ringworm will present itself in this ring shaped form. Ringworm has gone by various terms: tinea corporis, tinea gladiatorum, and tinea corporis gladiatorum (Kohl, et al., 2000). Tinea itself is a fungus that can actually grow on the skin, nails and in the hair follicle (Kohl, et al., 2000). In more severe cases, ringworm in the hairline can lead to baldness (Adams, 2001). Ringworm reveals itself on the epidermal layer of skin, because it feeds on the keratin layer of the skin and hair follicles (Hand and Wroble, 1999). The fungus is typically an unusual reddish pigment of dry patchy skin that can be very itchy. Ringworm has an incubation period of two to seven days, in which there may be some evidence of infection that enables further spreading of this fungus (Hand, 1999). Ringworm is more of a nuisance than a medical problem within the general population, but in the sport of wrestling, contracting ringworm can lead to the removal of the athlete from athletic competition. A single case of ringworm can spread through an entire wrestling team in a matter of days, if it is not properly detected and treated.

Skin Susceptibility

The skin is very susceptible to the contraction of fungal-like infections because of its porous surface. Tinea itself grows in slender-like strands, or Hypehae (Sutton and Waisman, 1975). The reproduction bodies of fungi are called spores. Ringworm lives on the dead horny layer of the skin, ingesting the keratin. When ringworm digests the keratin, it makes the skin very scaly and causes crumbling of nails and the breaking off of hair (Sauer, 1980). Fungi in the scalp are called tinea capitis. Depending on the type of mircosporum, this fungus can cause temporary baldness (Lewis, 1959). The fungal lesions are classified in two ways according to their level of penetration of the skin. Ectothrix are fungi that attack the outside coating of the hair. When the fungus invades the inside layer of the hair, it is called endothrix.

Ringworm Variations

Ringworm are classified into three genera: Trichophyton, Microsporum, and Epidermophyton. Of these three, two are known to be found in the hair: Microsporum (ectothrix) and Trichophyton (ectothrix and endothorix) (Sauer, 1980). A few common sub-classifications are *M. audouini*, *M. canis*, *M. gypseum*, *E. floccosum*, *T. schoenleini*, *T. violaceum*, *T. tonsurans*, *T. mentagrophytes*, *T. rubrum*, and *T. verrucosum*. Each of these genera have many sub-classifications. The most common sub-classification in the sport of wrestling is *T. tonsuran* (Hradil, et al., 1995). Research on *T. tonsurans* in general shows that fungi are rarely found on smooth skin, and are found moderately in the scalp. *T. tonsurans* is not found on the feet, hands, nails, or groin areas (Sauer, 1980).

Fungal lesions are usually triggered when an individual comes into direct contact with dogs, cats, (*M. canis*) horses, and cattle (*T. cernuosum*) (Borrie, 1975).

Ringworm in Wrestling

Ringworm thrives in warm, moist environments. These types of environments are found throughout the sport of wrestling. This type of environment allows the fungi to survive for prolonged periods of time. A study researching whether wrestling mats are the source of ringworm infections in high school wrestling teams reported that close skin-to-skin contact in wrestling appears to be the primary cause of this fungal transmission (Kohl, 2000). Wrestling presents a high occurrence of skin abrasions among the athletes and the wearing of occlusive apparel makes the skin a target-rich environment for this fungus.

Prevalence

The prevalence of ringworm over the years was reported in 10 studies. Out of those 10 studies, four were from the United States. The reported prevalence rates ranged from 20% to 77%, and each study varied in methodology (Adams 2002). Hazen, et al., in 1997, reported that using Itraconazole significantly reduced the contraction of ringworm. Ten cases of ringworm were reported in 37 active high school wrestlers when the Itraconazole treatment was given. The prevalence rate of ringworm found in this study was 27% (Hazen, et. al., 1997). The study was weakened due to its lack of a control group. Kohl and colleagues (1999) compared topical and oral treatments for tinea gladiatorum in high school wrestlers. There were 22 wrestlers enrolled and 17 finished

the study. Wrestlers in high school wrestling teams in Reading, PA, were randomized to receive either Clotrimazole 1% cream or oral Fluconazole, and each treatment was compared for its efficacy. Both Clotrimazole and Fluconazole produced improvements, but Fluconazole's results showed arithmetical but not statistical improvements. The study yielded a 35% prevalence rate of ringworm in the high school wrestlers (Kohl et al., 1999). A double blind placebo-controlled study was conducted during the 1998 to 1999, wrestling season which tested Fluconazole, an oral medication, for the prevention and treatment of tinea gladiatorum (Kohl et al., 2000). The study took place in Reading, PA, and reported out of 21 cases of ringworm, 17 were identified as *Trichophyton tonsurans*. The study yielded the prevalence of ringworm as 22%. These results were calculated using high school wrestlers in a control group not receiving prophylaxis. The Fluconazole showed a significant reduction in the number of infections as compared to the placebo (Kohl et al., 2000). In 2000, a single incidence comparison study of a high school wrestling team and a high school track team in Cincinnati, OH, showed that seven out of 29 wrestlers, (24%), had ringworm at the time of the study. The track team reported no instances of ringworm. This was the first study to examine the prevalence of tinea corporis gladiatorum in a high school wrestling team without a recognized epidemic (Adams, 2000). From 1993 to 1995, a survey sent nation wide to mycology and microbiology laboratories looked at specific genera of fungus found on humans. The study was trying to find the prevalence rates of different types of genera within the United States. The subjects were human patients who sought medical attention. The results showed that *Trichophyton tonsurans*, was the most frequent fungal infection. It comprised 44.9% of all ringworm cases reported in the United States (Weitzman, et al.,

1998). A year long study of eight adults at the Henry Ford Hospital in Detroit, MI, researched whether tinea capitis in adults was a misdiagnosis due to its frequent atypical clinical presentation. The authors found that of the 72 cases of ringworm, 11% were adults (Cremer, et al., 1997). These studies have all given a background in the prevalence rates of ringworm in high school wrestlers and in some adult cases. There are no cases that looked at the prevalence rate of ringworm in collegiate wrestlers, thus there were grounds for further research.

Prevention/ Protocols

In wrestling, the athletes usually know from prior experience if they are particularly susceptible to ringworm. Currently, there are no known etiologies as to why some individuals are more susceptible to contracting ringworm more frequently than other individuals. When an athlete does come in contact with the ringworm fungus, the fungal dermatophytes can then be found on pets, clothing, towels, hairbrushes, and in bedding (Kohl, et al., 2000). All of these objects must be washed thoroughly with a sanitizing solution in order to prevent further outbreaks. When dermatophytes are found in common, every day items, it is even more difficult for the athletes to rid themselves of the fungus.

The removal of an infected athlete from competition due to pre-match skin checks is one of many steps taken in past years to try and eliminate this fungus. Covering the lesions and removing the athletes with signs of ringworm from practice is the usual protocol when a lesion is found. Washing the mats with a bleach, anti-bacterial, or anti-fungal solution every day prior to every practice, requiring athletes to shower with an

anti-bacterial soap within thirty minutes post activity, putting on clean clothes prior to each practice, and washing headgear and other protective wear, helps to prevent further ringworm breakouts (Hand and Wroble, 1999). A skin foam called, Ken Shield, (Kennedy Industries, Maple Glen, PA) a white non-greasy foam that is rubbed on the skin prior to working out, is said to act as a protective shield or anti-fungal agent to prevent the contraction of ringworm. Hand and Wroble, (1999) divided 22 college wrestlers into two groups. One group applied the anti-fungal foam and the other used a placebo. Both groups showed a decrease in ringworm, with no significant difference between the placebo and the foam (Hand and Wroble, 1999). These techniques are not proven to be an effective and practical barrier against ringworm, due to the foam's required reapplication prior to every episode of sweat (Hand and Wroble, 1999). All of these above mentioned precautions may slow the spread and transmission of ringworm, but nothing has proven to completely stop its transmission.

Often, the hardest part of controlling ringworm is discovering the lesion. Frequent skin checks and compliant athletes make the job of detecting ringworm much easier. Athletes who are not periodically checked, are non-compliant, or try to self treat the ringworm lesion, all increase the probability of continuously transmitting ringworm to other participants and teammates. In past studies, there has yet to be precaution, technique, or protocol that stops the spread of ringworm. For this reason, further research needs to be done on ringworm.

Diagnosis

In order for the lesion to be properly treated, it must first be correctly diagnosed. A wrestler should see his doctor or another qualified medical professional for this diagnosis. For a physician to make a proper diagnosis of a skin lesion, an epidermal scraping of the infected skin must be taken. The scrapings are placed on a Petri-dish and then examined under a microscope with a mixture of potassium-hydroxide (KOH/20%) (Hradil, et al., 1995). Scrapings of these lesions are not always done. Many times a physician will make a diagnosis based only on the ringworm's unique ring shape. Another instrument a physician sometimes uses to diagnose ringworm is a Woods lamp. A Woods lamp is an ultra-violet light that causes the fungal lesions to glow, enabling the physician to make a proper diagnosis.

Treatments

There are many over-the-counter treatments for the communication or transmission of ringworm. Fungal therapy comes in a variety of applications; primarily creams or sprays. Over-the-counter anti-fungal medications are not very strong and need to be used for no less than four to six weeks before the lesion is no longer contagious. Over-the-counter medications include Tinactin solution and spray (Schering Plough, Madison, NJ) and Mication spray (McNeil Consumer Products, Fort Washington, PA) (Hand and Wroble, 1999). In addition, many anti-fungal prescriptions in the form of topical creams or pills, are used to treat ringworm. Most prescriptions are topical creams that are to be used two to three times a day. Since ringworm has a long incubation period, it may take several weeks before the lesion is unnoticeable, but after five days of

treatment, it is not usually contagious (Dienst, et al., 1997). In severe cases, or if lesions are found in the hairline, oral medications are used to kill the fungus. Physicians hesitate to use oral antifungal medications because of their toxic effects on the liver and kidneys (Hand and Wroble, 1999). Over all, there are many treatments for fungal infections that do work, but in the sport of wrestling, time is of the essence. Athletes cannot afford to take two days off from practice in the middle of the season, thus the overall prevention of ringworm is key. Finding a preventative measure that works requires more studies on ringworm.

Skin Biology

Aging affects all aspects of the human body. During puberty the sebaceous glands and their secretions undergo profound changes. One of these changes is an increase in the fungistatic action of triglycerides in the sebum that occurs after puberty (Rothman, et al., 1947). Sebaceous gland changes at puberty occur rather slowly. The process is not spontaneous (Rothman, et al., 1947). After puberty, there is an increase in the amount of sebum on the scalp. The adult has five times the amount of fungistatic fatty acids of that of children. The increase in fungistatic fatty acids may be correlated with an increase in the size and number of sebaceous glands (Rothman, et al., 1947). After the fatty acids are formed in the sebaceous glands, they diffuse into the follicular canal and are secreted to the surface of the scalp and skin. The fungistatic and fungal properties are due to the content of acetic, propionic, caproic, caprylic, lactic and ascorbic acids (Rothman, et al., 1947).

Factors to Consider

There seems to be a direct correlation between immune suppression and occurrences of ringworm (Bielan, 1994). Furthermore, there are significantly more cases of ringworm reported and documented in children than in adults (Rothman, et al., 1947). The number of ringworm cases that go unreported may be due to the lack of any long-term or short-term morbidity rates caused by certain diseases, i.e. herpes (Dienst, et al., 1997). In the medical community, ringworm is considered more of a nuisance than a medical problem. In a study conducted between 1993 and 1995, data was collected from 46 school children. The reported occurrences of ringworm were found to be a significant health problem in children (Fari, et al., 2000). There are many different reasons as to why there is a decrease in ringworm infections at puberty. One reason focuses on the changes in lifestyle and hygiene as an individual enters puberty and begins maturation (Fari, et. al. 2000). A second reason states, that in adults, there is an increased amount of fungistatic saturated fatty acids in the sebum (Deirdre, et al., 2000). Fari and colleagues (2000) studied an outbreak of ringworm in 15 of 46 child wrestlers, ages 7 to 17. The ringworm genera was identified by the use of molecular methods, sequence comparison of ribosomal internal spacer (ITS) regions, and polymerase chain reaction fingerprinting. The study reported that fungistatic saturated fatty acids were said to be the reason for the low frequency of ringworm in adults, thus preventing the fungus from growing on the skin (Fari, et al., 2000). In the scalp, the dermatophytic colonization diminishes at puberty, which could also account for the increased number of cases in children (Buckley, 2000).

Chapter III

METHODOLOGY

Introduction

The main objective of this study was to determine ethnic influences on the incidence of ringworm in adult male Division I collegiate wrestlers. The present study documents and describes the most common regions of infection on the body, and the implications of the condition as it relates to missed practice and competition.

Subjects

Division I adult male collegiate wrestlers voluntarily participated in the study. All athletes that participated in the study were 18 years of age or older. The survey was sent to 86 of the Division I wrestling schools in the United States. The list of 86 schools was found on the NCAA web site under Division I wrestling teams. As of 2002, there were 86 Division I wrestling schools registered within the NCAA.

Survey

The 14 item survey was tested for reliability using a test-retest reliability measure prior to this study. The test-retest included nine Division I wrestling subjects. The wrestlers completed the survey on two occasions separated by two weeks. The test-retest reliability was .81. The clarity of each question was determined when each wrestler

participated in the test-retest survey. During the test-retest reliability measure, the participants were asked if any of the questions were unclear or misleading in anyway. Each survey participant completed a consent form at the beginning of the questionnaire. The study was approved and processed as an exempt review by Oklahoma State University's Institutional Review Board (Appendix A.).

Setting

Letters were sent to the athletic trainers of each Division I wrestling university. The wrestlers could complete the survey under the supervision of a Certified Athletic Trainer, or student athletic trainer, but this was not a requirement. The wrestlers completed the survey online.

Procedures

The survey's web site address was distributed to all 86 collegiate Division I wrestling schools. This was done via a letter (Appendix B.), which was mailed to each wrestling team's athletic trainer. After the wrestlers completed and submitted the survey online, the data was automatically sent to a database at Oklahoma State University. The data was then entered into an Excel ® program. This program allowed the data to be later transferred to an SPSS program for statistical analysis.

Data Collection

An online survey was sent to the athletic trainers of 86 Division I universities (Appendix C.). Participation was completely voluntary, and the data was anonymously sent electronically to a database on Oklahoma State University's campus. Four hundred wrestlers were expected to complete this three-to-four minute survey. The gathering and analyzing of the data took a total of four months.

Statistical Analysis

Data were analyzed using SPSS univariate statistics to describe the valid number, mean, minimum, maximum, and standard deviation. The results were coded and calculated for each survey question (See Appendix C). Descriptive statistics were used to quantify each response and a Chi-Square was used to note a difference in the prevalence of ringworm in college Division I male wrestlers based on ethnicity. An alpha level of ($p < 0.01$) was used for the Chi-Square analysis. An Odds Ratio was employed to determine which race was more likely to contract ringworm.

Chapter IV

RESULTS

Introduction

The purpose of the study was to determine whether ethnicity influenced the incidence of ringworm in adult male Division I collegiate wrestlers. Data was collected throughout a period of four months, via the internet, using an online survey. The descriptive data was shown in Tables 1, 2, 3, and 4. Due to the lack of responses to the survey in the categories of Mexican American, Native American, Asian, and Other, these races were combined into one broad category called “Other” for the use of descriptive statistics. The group “Other” did not have a significant number of responses to represent a population, so it was not used for any statistical analyses in this study. Descriptive statistics were used to quantify each response and a Chi-Square was used to note whether there was a significant difference in the prevalence of ringworm in college Division I wrestlers based ethnicity: Caucasian or African American. An alpha level of ($p < 0.01$) was used for the Chi-Square analysis. An Odds Ratio was used to quantify whether Caucasians or African Americans were more likely to contract ringworm. The group “Other” could not be used in the Chi-Square or the Odds Ratio due to its small population (See Tables 5 and 6).

TABLE 1

Average Age of Participant

Variable	Mean	Minimum	Maximum	Std. Dev.
AGE	21.42	18	27	1.74

TABLE 2

Number of Participants

Race	N	Percent
Caucasian	112	53.85
African American	37	17.78
Mexican American	4	1.92
Native American	2	.96
Asian	4	1.92
Other	5	2.40
TOTAL	164	

Hypothesis

One hypothesis was tested in this research project. The following data was collected and analyzed to test the stated hypothesis.

Null Hypothesis

There will be no significant difference in the prevalence of ringworm based on ethnicity in Division I collegiate wrestlers.

Descriptive Results

The data in Table 3 shows that ringworm was most commonly contracted 1-3 times per infected wrestler, followed by a second most common answer, 10+ times. The most commonly picked answer for: what is the longest a wrestler had ringworm was first: 1-3 and second: 4-6 weeks. Only two wrestlers missed a competition: 1-3 times due to ringworm, 18 wrestlers missed a practice: 1-3 times, and 10 wrestlers missed practice: 4-6 times, due to ringworm. Only 56 of 151 wrestlers who reported having had ringworm, had seen their doctor about ringworm; while 87 out of 120 wrestlers had seen their athletic trainer regarding the fungal infection.

Table 3

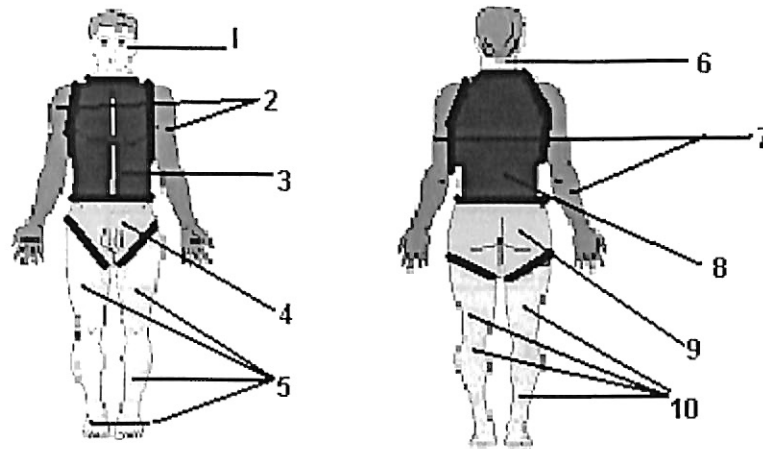
Descriptive Statistics

Variable	Caucasians	African Americans	Other
Did they have RW	N=112	N=32	N=15
Yes	80	8	3
No	32	24	12
Number of times contracted RW	N=80	N=8	N=10
1-3	44	6	4
4-6	14	1	1
7-9	4	1	1
10+	18	0	4
Missed Practice b/c RW	N=109	N=30	N=15
Yes	22	1	3
No	87	29	12
Times Missed Practice b/c RW	N=23	N=1	N=4
1-3	16	1	1
4-6	7	0	3
Missed Competition b/c RW	N=108	N=0	N=15
Yes	1	0	1
No	107	0	14
Times Missed Comp (in weeks)	N=1	N=0	N=1
1-3	1	0	1
Longest had RW (in weeks)	N=80	N=8	N=9
1-3	66	7	5
4-6	12	0	3
7-9	1	0	
10+	1	1	1
Seen Dr. for RW	N=108	N=28	N=15
Yes	49	2	5
No	59	26	10
Told Athletic Trainer about RW	N=90	N=16	N=14
Yes	72	7	8
No	18	9	6
Years wrestled in college and had RW	N=68	N=8	N=8
1-3	38	5	4
4-6	15	2	3
7-9	15	1	1

The total responses for question number 13, in the survey (Appendix C) (frequency of ringworm on body regions) for African Americans and Caucasians was N=152 (Appendix C.). The four most common areas of ringworm contraction for both African Americans and Caucasians were regions 5 (Anterior Legs), 4 (Pubic Region), 2 (Anterior Arms), and 1 (Face/Neck) (See Table 4).

Table 4

Measuring Frequency of Ringworm on Body Regions



Number of Times a Region had Ringworm

Body Region	African Americans/Caucasians Percent	African Americans N= 30	Caucasians N=112
1 (face/neck)	19 (12.5%)	5 (12.5%)	14 (12.5%)
2 (anterior arms)	19 (12.5%)	3 (7.5%)	16 (14.29%)
3 (thorax)	8 (5.26%)	3 (7.5%)	5 (4.46%)
4 (pubic region)	31 (20.39%)	13 (32.5%)	18 (16.07%)
5 (anterior legs)	37 (24.34%)	2 (5%)	35 (31.25%)
6 (posterior neck)	8 (5.26%)	3 (7.5%)	5 (4.46%)
7 (posterior arms)	10 (6.58%)	3 (7.5%)	7 (6.25%)
8 (back)	2 (1.32%)	1 (2.5%)	1 (.89%)
9 (buttocks)	8 (5.26%)	2 (5%)	6 (5.36%)
10 (posterior legs)	10 (6.58%)	5 (12.5%)	5 (4.46%)

The independent variable in the Chi-Square analysis (Table 5) was race. The data showed that 55.56% of Caucasians contracted ringworm while wrestling in college, while 22.22% of African Americans contracted ringworm while wrestling in college. These data revealed a significant difference in the number of African Americans who contracted ringworm versus the number of Caucasians who contracted ringworm.

Table 5.

Chi-Square Analysis of Race and “Ever Having Had” RW

Chi-Square = 22.58, df = 1, (p < .01)

	Ringworm	No Ringworm	Row Totals
Caucasians	80	32	112
Percent of Total	55.56%	22.22%	77.78%
African Americans	8	24	32
Percent of Total	5.6%	16.67%	22.22%
Column Totals	88	56	144
Percent Totals	61.11%	38.89	

The Caucasian/African American Odds-ratio revealed Caucasians were 7.5 times more likely to contract ringworm than were African Americans.

Table 6.

Distribution of “Ever Have Had” RW between Caucasian/African American

Race	Ringworm	No Ringworm
Caucasian	80	32
African American	8	24

Odds ratio = 7.5

Chapter V

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Included in this chapter is a brief summary of the hypothesis, a discussion of the results/findings, a conclusion, and a list of recommendations for further research.

Summary of the Hypothesis

Hypothesis: There will be no significant difference in the prevalence of ringworm based on ethnicity in Division I collegiate wrestlers. Hypothesis 1 was rejected due to the results of the Chi-Square. The Chi-Square showed a difference in the prevalence of ringworm based on ethnicity in Division I collegiate wrestlers.

Discussion of Research Results

The data were collected and analyzed using a Chi-Square, which showed a significant difference in the prevalence of ringworm, between Caucasian and African American Division I collegiate wrestlers. The Odds Ratio further yielded results that indicated, Caucasian wrestlers were 7.5 times more likely to contract ringworm than African American wrestlers.

No further statistical analyses were possible with subcategories derived from the dichotomous response to ever having had contracted ringworm; due to the cell numbers for African American wrestlers being severely limited.

The mechanism accounting for the difference in incidence of ringworm between Caucasians and African Americans is, as of yet, unknown. One explanation may be the differences in sebum constituent. This would more than likely decrease the susceptibility of African Americans to the contraction of ringworm. No scientific documentation exists currently to confirm this theory

Another possible explanation for the predominance of ringworm in wrestlers was due to the profuse sweating that occurred during wrestling. The extensive sweat may have diluted the fungistatic fatty acid concentration on the skin, even washing it away, thus the chances of fighting this fungal infection were decreased.

An inherent weakness in this study was the small number of African Americans in comparison to the Caucasian group. The small number of African American wrestlers in this study may have provided an inappropriate comparison between the groups. However, in the sport of collegiate wrestling, this ratio appears to be normal. The Big 12 Conference 2003 Wrestling Guide reported 114 wrestlers in the conference. Of the 114, 10 were African American wrestlers. This provided some evidence that African American wrestlers were a minority within the wrestling population, thus decreasing their susceptibility to ringworm. In addition, these data provided evidence this study's population had in fact, represented an accurate number of African Americans in the Division I wrestling community.

. Past studies in the United States looked at high school wrestlers and the prevalence of ringworm. The prevalence rates of ringworm in the United States ranged from 22% to 35%. The results of this study showed a prevalence rate of 61.11% for Division I collegiate wrestlers. This prevalence rate was significantly higher than any

rates found in previous wrestling and ringworm research. The results themselves showed that in the wrestling community, ringworm was a growing epidemic and it did not just occur in children.

The results from Table 4 show, not only was ringworm common, but it was also reoccurring. The number of times most individuals contracted ringworm were: 1-3, followed by: 10+. Only two wrestlers missed competition due to ringworm, and 26 had missed a practice due to ringworm. These results showed there were many wrestlers who competed and practiced with this infection, thus the reason for the high prevalence rates seen in this study. Not only did they not miss a practice or a competition, they had wrestled with a contagious infection for weeks. Table 3 shows, most ringworm lesions lasted for: 1-3 weeks, followed second by: 4-6 weeks. These results further emphasized the reason for such a high prevalence rate in wrestlers in this study.

In addition, having found a prevalence of ringworm in Division I collegiate wrestlers based on ethnicity also gave insight into the frequency and methods of documentation of ringworm. The results presented in Table 3, indicated that athletes were more likely to see their athletic trainers than their doctors about an outbreak of ringworm. This may have reflected the access to doctors in the sport of wrestling, but it also showed that some of these wrestlers had not been getting the proper prescribed medication. If 72.5% of the wrestlers had seen their athletic trainers, and 37.1% had seen a doctor, what was happening to the documentation of these visits. According to Dienst, et al. (1999), there was a lack of proper documentation of ringworm. It was possible that because ringworm was so easily treated and was seen as just a nuisance in the medical community, that wrestlers were just given a topical cream by a team doctor or athletic

trainer and allowed to continue to participate. Ringworm may have been perceived as such a minor non-debilitating infection, it was failed to be recorded.

The incidence of ringworm in Division I college wrestling was higher in the current project than the 3-5% previously found in adults (Cremer, et al., 1997). This showed that wrestlers got ringworm more frequently than the general population, thus having showed a need for further research. It also showed there was a significant difference between the prevalence of ringworm in Division I wrestlers based on ethnicity. These findings gave reason for further discussion as to why ethnicity affected the frequency of contraction between these two populations.

The data presented here partially agreed with previous reports that the most common regions on the body for ringworm infection were the shoulder, neck, or face (Stiller, 1992). Those regions were in the top five of the most prevalent regions reported by this study's surveyed population. The descriptive results of this study showed the following: the most common regions of the body that contracted ringworm were region 5 (Anterior Legs), region 4 (Pubic Region), region 2 (Anterior Arms), and region 1 (Face/Neck) (See Table 4). Three of these regions were not normally covered by any clothing such as shorts, short sleeves, normal practice attire, or the wrestling singlet worn during competition. The results shown in Table 4, indicated that direct skin-to-skin contact was one of the most likely ways for ringworm to be communicated. The data supported past statements (Kohl, 1999) that (Hand 1999) stated skin-to-skin contact was the primary cause of transmission.

Conclusion

Based on the findings of this study, the following conclusions were submitted:

There was a difference between Caucasians and African Americans in the contraction of ringworm. Caucasians were 7.5 times more likely than African Americans to contract ringworm.

When wrestlers contracted ringworm, 62.5% neglected to report it to a doctor and 25.47% neglected to report it to their athletic trainer (See Table 3). The low numbers of wrestlers who went to see a doctor might possibly explain why the documentation on ringworm was lacking. Last, the data showed within the population studied, 57.23% of wrestlers had contracted ringworm. These data revealed a higher prevalence of ringworm in collegiate wrestling than had been previously reported. The results also showed that a large number of athletes had ringworm from: 1-3 times, followed by: 10+ times, but only two missed competitions and 26 practices. All of these results indicated there is an increased prevalence of ringworm in college wrestling compared to the general population.

Recommendations for Future Research

Based on the findings of this study, the following recommendations were suggested for future research: 1) Further studies should be done related to skin type: dry, oily, and/or sensitive skin. This information may help researchers establish why there are increases in the release of fungistatic saturated fatty acids in the sebum of some skin types. 2) Further studies should be conducted to find the cause and effect relationship between ethnicity and ringworm. 3) Further studies should be conducted to ascertain why African Americans are less likely to contract ringworm than are Caucasians.

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APPENDIX A.

INSTITUTIONAL REVIEW BOARD

APPROVAL LETTER

APPENDIX A.

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

Oklahoma State University
Institutional Review Board

Protocol Expires: 11/20/2003

Date of this letter: November 21, 2002

IRB Application No. ED0335

PROJECT TITLE: THE PREVALENCE OF RINGWORM IN DIVISION I COLLEGIATE WRESTLERS
BASED ON ETHNICITY

PI Name:
Investigator(s):

Chawn Reynolds
204 Willard
Stillwater, OK 74078

Bert Jacobson
204 Willard
Stillwater, OK 74078

IRB Chair and
Researcher(s) Name(s):

Approval Status Recommended by Reviewer(s): Approved

Dear PI:

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research, and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 415 Whitehurst (phone 405-744-5700, sbacher@okstate.edu).

Sincerely,



Carol Olson, Chair
Institutional Review Board

APPENDIX B.
LETTER TO COLLEGES

APPENDIX B.

LETTER TO COLLEGES

11-26-02

Dear Wrestling Athletic Trainer:

My name is, Shawn Reynolds, the Graduate Assistant Athletic Trainer in charge of wrestling at Oklahoma State University, as well as a former Division I wrestler. I am writing you to ask for your team's help in participating in a study. The study is designed to help increase the understanding of how ringworm is contracted within our sport. Your university and each participant will remain anonymous throughout the survey. The subjects will be allowed to stop at any time during the survey without any negative impact. The data collected will be destroyed at the end of this study. You and all other Division I wrestling programs will be asked to participate. The survey is available on line at, <http://fp.okstate.edu/bhj52/>, and will take approximately 2-4 minutes to complete. I appreciate your team's participation. Your timely attention to this request is also greatly appreciated. Should you have any questions you may contact, Shawn Reynolds, at 405-372-3634, or the University IRB office, Sharon Bacher, at 405-744-5700.

Thank You.

Sincerely,

Shawn Reynolds ATC/L
Graduate Assistant Wrestling
Oklahoma State University
103 Gallagher-IBA Arena
Stillwater, OK 74078
405-744-7823

APPENDIX C.
SURVEY WITH INFORMED
CONSENT

APPENDIX C.

SURVEY WITH INFORMED CONSENT

Reynolds Survey©

By taking the time to fill out this survey you have agreed to voluntarily participate in a study conducted by

Shawn Reynolds of Oklahoma State University.

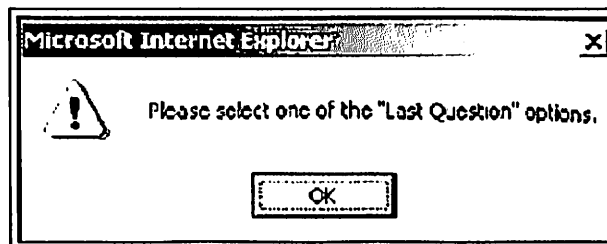
To ensure your confidentiality and anonymity, your name has not been requested in this form.

The purpose of this survey is to investigate the prevalence of ringworm in Division I wrestlers, based on ethnicity.

**All data will be destroyed at the end of this study.
If at anytime you wish to stop filling out this survey
you may do so without penalty.**

Survey Completion Instructions

- Please do not hit the "Enter" key while completing the questions on this the survey.
 - Hitting the Enter key will try to submit the survey before you are finished.
- If you inadvertently hit the Enter key this message will appear prompting you to answer the last question on the survey.



Click on the "OK" button to return to the survey questions.

Make sure you click "Yes" in the last question before clicking the "Submit" button.

1: What is your age?

18

2: What is your ethnicity?

- White
- African American
- Mexican American
- Native American
- Asian
- Other

3: Have you ever contracted ringworm while wrestling in college?

- Yes
- No

4: If you answered "Yes" to question #3, how many times did you contract ringworm in college?

- 1 - 3 times.
- 4 - 6 times
- 7 - 9 times
- More than 10 times.

5: Did you ever miss any wrestling practice in college due to ringworm?

- Yes
- No

6: If you answered "Yes" to question #5, please tell us how many practice times in college you did miss.

- 1 - 3 times.
- 4 - 6 times
- 7 - 9 times.
- More than 10 times.

7: Did you ever miss any competitions in college due to ringworm?

- Yes
- No

8: If you answered "Yes" to question #7, please tell us how many competitions in college you missed.

- 1 - 3 times.
- 4 - 6 times.
- 7 - 9 times.
- More than 10 times.

9: What is the longest ringworm has lasted in college?

- 1 - 3 weeks.
- 4 - 6 weeks.
- 7 - 9 weeks.
- More than 10 weeks.

10: Has a physician ever treated you for ringworm in college?

- Yes
- No

11: Did you inform your athletic trainer in college when you contracted ringworm?

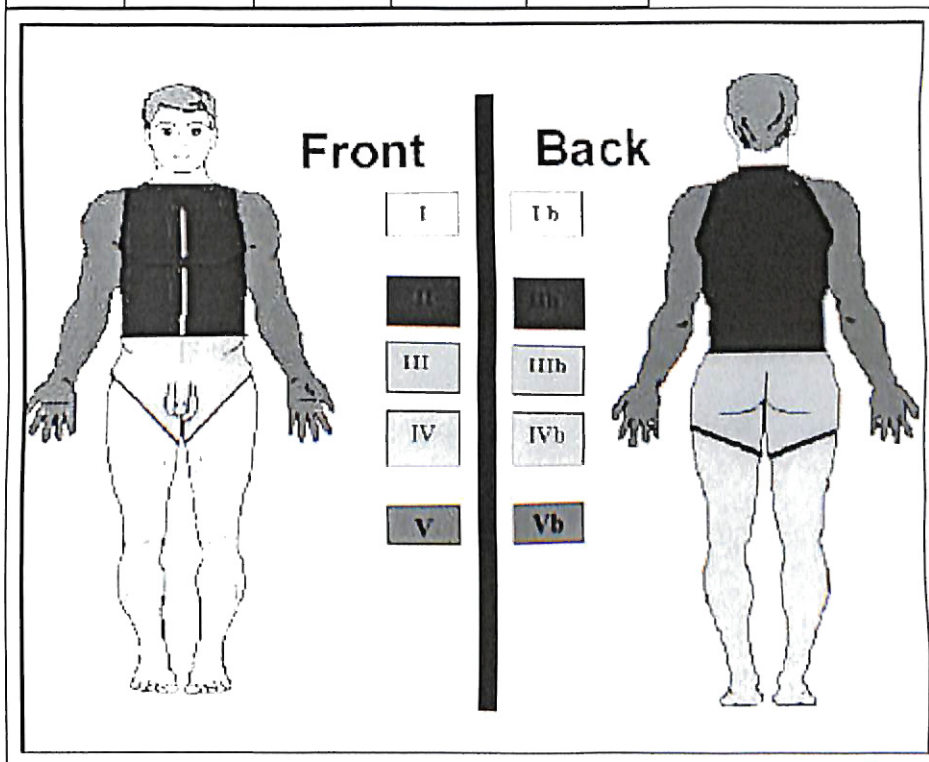
- Yes
- No

12: How many years in college have you contracted ringworm?

- 1
- 2
- 3
- 4
- 5
- 6

13: Choose the two most common regions you have contracted ringworm while in college.

<input type="checkbox"/> I	<input type="checkbox"/> II	<input type="checkbox"/> III	<input type="checkbox"/> IV	<input type="checkbox"/> V
<input type="checkbox"/> Ib	<input type="checkbox"/> IIb	<input type="checkbox"/> IIIb	<input type="checkbox"/> IVb	<input type="checkbox"/> Vb



14: What region are/were you located in while in college?

<input type="radio"/> 1	<input type="radio"/> 2	<input checked="" type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
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I **II** III IV V

15: Are you ready to submit this form?

Yes

[Submit Form](#)

[Reset Form](#)

VITA ①

Shawn Carl Reynolds

Candidate for the Degree of

Master of Science

Thesis: THE PREVALENCE OF RINGWORM IN DIVISION I COLLEGIATE
WRESTLERS BASED ON ETHNICITY

Major Field: Health and Human Performance

Biographical:

Personal Data: Born in New Britain, Connecticut, on September 6, 1979 son of
Linda Reynolds.

Education: Graduated from Berlin High School, Berlin, Connecticut in May 1997;
Received a Bachelor of Science in Human Performance/Athletic Training
from Sacred Heart University, Fairfield Connecticut in May 2001.
Completed requirements for the Masters of Science Degree with a Major
in Health and Human Performance at Oklahoma State University,
Stillwater, Oklahoma in May 2004.

Experience: Employed at Berlin-Kensington YMCA during high school; wrestler,
student athletic trainer and resident assistant at Sacred Heart University;
employed by SHU as moving crew director, worked wrestling camps as
coach and athletic trainer; employed by OSU, Department of Athletics as
graduate assistant with the wrestling team, 2001 to present.

Professional Memberships: National Athletic Trainers Association, District 5
Athletic Trainers Association, Mid-America Athletic Trainers Association,
National Strength and Conditioning Association.