Low Back Pain Among College Athletes - A Survey of Basketball Players, Swimmers, Track and Field Athletes and Nonathletic Controls

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LOW BACK PAIN AMONG COLLEGE ATHLETES – A SURVEY OF
BASKETBALL PLAYERS, SWIMMERS, TRACK AND FIELD
ATHLETES AND NONATHLETIC CONTROLS

A Thesis
Presented to
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In Partial Fulfillment
Of the Requirements for the Degree
Master of Science

By
Nicholas T. Bacon

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LOW BACK PAIN AMONG COLLEGE ATHLETES – A SURVEY OF
BASKETBALL PLAYERS, SWIMMERS, TRACK AND FIELD
ATHLETES AND NONATHLETIC CONTROLS

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Appendix A. Table 1: Descriptive Characteristics by Sport and Gender

Appendix B. Table 2: Responses to Various LBP Questions by Group
Study Design. Cross-sectional survey among athletes competing at the collegiate level in basketball, swimming, and track and field, as well as a matched nonathletic control group.

Objective. To compare the prevalence of low back pain between sports: basketball, swimming, and track and field, as well as nonathletic control group.

Summary of Background Data. With conflicting reports, it is not clear whether athletes are at higher risk for low back pain when compared to nonathletic counterparts. Some literature has found that low back pain was less common in former elite athletes when compared to nonathletes; however, much of the literature supports that athletes experience more low back pain.

Methods. Self-reported questionnaire on low back pain adapted for sports based on the Nordic questionnaires for musculoskeletal symptoms. Responders were 10 basketball players, 57 swimmers, 47 track and field athletes and 382 controls.

Results. The main findings of the current study support previous literature displaying a greater prevalence of low back experienced in athletes when compared to age-and-sex matched controls. This study found a significant relationship of reported low back pain as age and weight increased.

Conclusions. Athletes have a greater prevalence of low back pain when compared to their less athletic peers. A larger sample size could suggest a significant relationship between the prevalence of low back pain and training volume, training season and sport.
Chapter One

Introduction

College athletics provide entertainment for spectators across the globe. According to the National Collegiate Athletic Association (NCAA), ticket sales in Division I-A athletics was the greatest source of revenue (27%), followed by alumni and booster contributions which make up 18% of the total revenue (Fulks 2005). This boost can be partly credited to the increasing number of students participating in collegiate sports each year (Fulks 2005). College athletics can provide a vast array of opportunities for both athletes and their supporters, as they generate jobs, publicity, sponsorships, scholarships and a devoted fan base.

Unfortunately, these opportunities can collapse and a collegiate athlete’s career can end soon after it begins. An athlete’s injury and pain may lead to functional deficits and eventually impede performance (Nadler et al. 2002; Trainor and Wiesel 2002). It is not uncommon for athletes to experience similar injuries and pains related to their sport, however, other injuries and pains outside of their sport do occur.

Low back pain is an issue for all divisions of society. For the estimated lifetime prevalence of non-specific low back pain is 60% to 85%, and at any point in time roughly 15% of all adults have low back pain (Krismer and Tulder 2007). Recent studies have also shown that the prevalence of low back pain steadily increases from childhood to adolescence and peaks between the ages of 35 and 55 (Burton 2005). In addition, low back pain within the industrial population is the leading cause of work absenteeism, especially when associated with low job satisfaction and performance (Burton 2005, Hoogendoorn et al, 2002). While many previous research studies are available to
industries, more research is needed on the prevalence of low back pain in collegiate athletics.

Low back pain is perhaps the most common pain experienced by both athlete and nonathletes alike (Kim et al. 2004 and Trainor and Wiesel, 2002). An increasing number of high school, collegiate and professional athletes are developing low back pain (Flory et al, 1993). This is a concern for the athlete, as well as for their team, coaches, university and community. If an athlete becomes injured, the outcome of the season could be jeopardized and negatively affect athletic recruiting and ticket sales. The athletic program must recruit to increase wins and conference titles. Without a sufficient number of wins, schools often become overlooked by the media. This can have an effect on potential recruits, sponsors and alumni funds. Without publicity, sport programs will dwindle, affecting the program (school, university or franchise) and surrounding community.

Basketball players, swimmers and track and field athletes must be aware of low back pain within their sport. Swimmers, for example, perform highly repetitive motions that can lead to overuse injuries, specifically to the shoulder and back (Kenal et al, 1996). Back injuries in swimmers include disc degeneration, hyperextension, or myofascial involvement (Kenal et al, 1996). Swimmers who frequently participate in the breast stroke and butterfly continually hyperextend their backs in order to perform the movement, and studies have shown that this element is related to spondylolysis (Nyska et al, 2000).

Evidence suggests that female basketball players commonly experience injuries residing within three regions of the body: the knee, ankle, and lumbar spine (Hickey et al.
While research on track and field athletes is limited, javelin throwers seem to experience more low back pain than other athletes participating in track and field (Schmitt et al. 2004). Nadler et al. discovered out of 210 college athletes, 31 (14%) of them reported low back pain within that particular year (2000). Conversely, Brynhildsen et al. discovered the prevalence of low back pain in female athletes compared to controls was 30% and 18% respectfully (1997). The present study will enable researchers to potentially increase safety of training regimes, improve exercise prescriptions and reduce lost playing time of competitive athletes.

Statement of Problem

The purpose of this study is to determine if differences exist between low back pain experienced in Western Kentucky University (WKU) winter athletes and nonathletic controls. Furthermore, this study will also evaluate whether differences in low back pain experience exist between sporting groups. Demographics such as gender, height and weight will also be assessed to determine if differences exist between athletes and nonathletes experiencing low back pain.

Hypotheses

The null hypothesis is that the athletes and nonathletic controls will have the same prevalence of low back pain, while the alternative hypothesis is that the athletes will have a higher prevalence of low back pain when compared to nonathletic controls.

Significance

Based on the literature to date, there is an expected relationship between athletics and low back pain. Determining which sports and genders have a higher prevalence of
low back pain will aid college athletes and their respective universities. College athletes will be more knowledgeable about potential low back injuries that are often associated with their sport. This will then enable the athlete to communicate with the sport physician, and perhaps lead the athlete to a quicker diagnosis and recovery. This coincides with the athlete’s playing time and the team’s fan base. If valuable players are injured, teams could have a losing season and both the university and community fan base could lessen. The present study will help determine what variables are associated with low back pain. Such knowledge could also assist college strength and conditioning coaches in prescribing conditioning programs that more effectively decrease lost playing time.

Limitations

A limitation in the present study is that the participants may not have answered the questionnaire honestly or to the best of their knowledge. Participants were being asked to recall low back pain over a course of seven days to 12 months. Participants had a five to ten minute time-limit in which they were to answer the questionnaire. The fact that the study was a field study is a limitation as well.

Delimitations

Restricting the selection of athletic participants to three sports, weight and age of non athletic controls, and present sample sizes are delimitations of the study.

Assumptions

Assumptions to the study include: individuals can read and understand the provided questionnaire, are accustomed to the demands of college athletics, and the questionnaire is appropriately designed and provides valid results.
Definition of Terms

- Low back pain - “pain, ache, or discomfort in the low back with or without radiation to one or both legs” (Bahr et al, 2004; and Kurinka et al, 1987)

- Spondylolisthesis – “Fibrous defects are present in the pars interarticularis which permit forward displacement of the upper vertebrae and separation of the anterior aspects of the vertebrae from its neural arch” (Fredrickson et al, 1984)

- Spondylolysis – stress fracture of the pars interarticularis of the facet joint of the lumbar spine (Congeni et al, 1997)
Chapter Two

Review of Related Literature

Previous literature supports that low back pain is more prevalent in the athletic population when compared to age-sex matched nonathletic controls. The study by Bahr et al. (2004) utilized and validated a modified version of the standardized Nordic questionnaire for musculoskeletal symptoms to compare an athletic population and nonathletic controls. This is the only study of its kind. The study’s objective was to compare the prevalence of low back pain in both athletes and nonathletes. The study was performed during the 2000 Norwegian Championships in cross-country-skiing, rowing and orienteering. After the athletes arrived, consent forms were distributed. During the championship rounds, study personnel encouraged athletes to complete the modified Nordic questionnaire concerning low back. The championships lasted anywhere between two and five days, in which the study personnel were available to answer various questions. Athletes who did not participate in the championship rounds were mailed the questionnaire to complete at a later time. The nonathletic controls were matched by age and gender and then selected randomly from the national registrar. The study did not permit how the researchers determined if the control was truly “nonathletic.” The athletic sample was comprised of 737 athletes, which included 257 cross-country skiers, 199 rowers and 278 orienteerers. The nonathletic sample totaled 197 individuals. However, 39 reported being competitive athletes and a definition of a competitive athlete was not available. No evidence was found in regard to the physical activity of the control subjects. The results suggest that low back pain was more common in cross country
skiers and rowers when compared to orienteerers and nonathletic controls. The prevalence of low back pain in cross-country skiers over the course of 12 months (63%) was higher than that of nonathletic controls (48%). Twenty-five percent of the rowers and 13% of the orienteerers noted loss in training days due to low back pain over the course of 12 months. All athletes combined, regardless of their sport, experienced more low back pain when training and when their competition load was heavier.

Greene et al. (2001) examined the history of low back pain in 679 Yale athletes of various sports. A survey was created to obtain information about the history of the athletes’ low back pain. The researchers asked whether the athlete sustained a low back injury over the past 5 years, when the injury occurred, the duration of the injury, how much time was lost for regular season training, and whether there was a family history of low back pain. The athletes were observed for one year and low back injuries were documented. Greene et al. only recorded low back pain injuries if the athlete missed three practices or competitive sessions, which required the athlete to seek medical attention from a sports physician. The study found that an athlete’s history of low back pain is a significant predictor for sustaining a low back injury. Furthermore, athletes with a history of low back injuries were three to six times more likely to experience future low back injuries when compared to other athletes. However, sport type (contact vs. noncontact) did not play a significant role in establishing risk for low back injury.

Sallis et al. (2001) sought to find a pattern of injuries between genders. They performed a retrospective study of injuries, documented by certified athletic trainers, over the course of 15 years. The subjects were NCAA Division III college athletes, ranging from ages 18 to 22 years old, which participated in basketball, cross-country running,
soccer, swimming, tennis, track, and water polo. Over 3,700 athletes were included in the research, with 1800 injuries were reported. The data indicates that minor gender differences do exist for the total number of injuries; however, little evidence exists to demonstrate a pattern of injury between genders. Nevertheless, the minor differences should be noted. Female swimmers experienced a higher rate of back/neck, shoulder, hip, knee, and foot injuries, while female water polo players experienced a higher rate of shoulder injuries.

Hickey et al. (1996) also performed a retrospective study. The study lasted for five years and the injuries of 49 scholarship-funded, female basketball players at the Australian Institute of Sport were recorded. The average age of the female basketball players was 17.6 years old. The most injuries occurred at the knee (18.8%), ankle (16.6%), lumbar spine (11.7%) and lower legs (10.8%). The most frequent diagnosis of the lumbar spine was mechanical low back pain.

Ong et al. (2003) had a different approach when investigating an athlete’s lumbar region. Disc degeneration of elite athletes was compared with the normal population (non-athletes). Thirty-one Olympic athletes with low back pain participated in this research inquiry. The subjects ranged from ages 19 to 46 and participated in a variety of sports, with track and field as the sport with the largest number of contingents (N=12). Magnetic resonance imaging was used to determine three variables of the disc: loss of disc height, loss of disc signal intensity and disc displacement. The results supported that elite athletes have a greater prevalence and degree of lumbar disc degeneration than that of the normal population. However, there is mixed literature on whether or not disc degeneration is correlated with low back pain (Bono 2004).
Though uncommon, another type of low back pain distance runners may experience could originate from the sacral region. Sacral stress fractures can become a potential cause of low back pain and treatment is always nonoperative (Bono 2004 and Klossner 2000).

For approximately one year, Nadler et al. (2002) investigated whether an athlete with a history of low back pain would perform slower in a 20 meter shuttle run when compared to a normal athlete free of low back pain. 211 (161 male, 50 female) athletes participated, 27 of which had been treated because of low back pain over the course of a year. Athletes were from a variety of sports and competed at the NCAA division I level. The results indicated that an athlete with a history of low back pain was on average, slower than that of the normal athletic population.

Low Back Pain in Industry

Low back pain causes economic loss through medical expenses or work absenteeism (Krismer and Tulder 2007). In order to reduce these potential costs more research regarding low back pain prevalence within the industrial sector of society must be conducted. Ghaffari and colleagues (2006) administered a questionnaire that was used to discover the prevalence of low back pain among industrial workers. The purpose of the questionnaire was to examine various factors that might be associated with low back pain. Both physical factors and demographics were considered. Subjects were 18,031 Iranian industrial workers that worked for a car manufacturing plant. Researchers considered four job categories: unskilled workers, skilled workers and technicians, office workers and managers. The Nordic questionnaire was used to determine musculoskeletal symptoms. The questions assessed each worker’s low back pain during the last 12
months and during the last seven days of when the questionnaire was administered. These questions were answered in a dichotomized answer ("yes" or "no"). In this study, low back pain was defined as any ache, pain and/or discomfort in the low back.

Results showed that 14,384 industrial workers responded to the self-reported questionnaire creating a 78% response rate (Ghaffari et al. 2006). Only workers who had completed at least 12 months of work at the manufacturing plant were included, making 10,941 workers available for the sample. The results showed that of the remaining participants 21% had experienced low back pain within the last 12 months. Within seven days prior to filling out the questionnaire, 8.5% of the industrial workers had experienced low back pain. Of all the workers' annual absences low back pain prevalence totaled five percent. Only 4% of the sample were females and the majority were males under the age of thirty. The results also supported that low back pain was associated with physical factors such as heavy lifting, repetitive work and awkward positions often reported of the unskilled workers. Evidence supports that various factors such as increasing age, heavy lifting, repetitive work, and monotonous work were risk indicators for low back pain.

Meerding and colleagues (2005) examined musculoskeletal symptoms using the Nordic questionnaire among various industrial and construction workers (N=388, N=182). However they defined pain as pain that had continued for at least a few hours during the past 6 months and was specified by body region. They defined chronic pain as pain present almost everyday throughout the last 6 months, with a minimal presence for at least three months.
The results indicated that 66% of industrial workers and 59% of construction workers had musculoskeletal complaints (Meerding et al. 2005). This is interesting because musculoskeletal complaints on the previous workday were higher in the construction setting than that of the industrial setting. Regarding sick leave due to musculoskeletal complainants, construction workers had a higher percentage (24%) when compared to the industrial workers (13%). Forty-five percent of industrial workers and 41% of construction workers complained of low back pain within the last six months. People that had medical care and complained of low back were also considered. When medical care was indeed taken into account, the construction population had a higher percentage of complaints than that of the industrial population. However, sick leave due to low-back complaints was more prevalent in the construction worker population.

These results indicate that back complaints were the most prevalent musculoskeletal problem within these working populations and responsible for workers seeking medical care and sickness absence (Meerding et al. 2005).

Nieuwenhuyse et al. (2004) examined individuals with first-ever low back pain within health care institutions and distribution companies throughout Belgium. Subjects had to meet certain criteria in order to be in the research sample. The workers that participated in the study had no previous history of low back pain in their first employment, and they were all 30 years of age or less.

The baseline questionnaire looked at the job’s physical factors. Studies have shown that jobs involving lifting, pushing and pulling with inappropriate execution techniques will increase one’s chance for low back pain (Garg et al. 1992). In addition, the variables related to the physical factors of the job were working with the trunk in
awkward postures, long periods of seated work, ability to change posture regularly, driving vehicles or machines, lifting weights, pushing or pulling loads and working schedule (Nieuwenhuyse et al. 2004).

The results indicated that 23% of the 278 workers polled developed a first-episode low back pain between when their job started and when the study ended (Nieuwenhuyse et al. 2004). Forty seven percent of the workers that developed low back pain did so in the first year after the start of their job. The main risk factor for low back pain was that the subjects lifted greater than 55 lbs at least once an hour. Differences were also found in workers who sat for long periods of time and who flexed or rotated their trunk more than 12 times an hour. The evaluation of flexion and rotation of the trunk was evaluated via video recordings of the subject.

In general, literature supports that workers in these physical demanding occupations are at risk for low back injuries. Furthermore, the pain from these low back injuries is associated with low job satisfaction and performance. Low back injuries can lead to potential absenteeism and financial hardships as well (Morken et al. 2003). Studies have supported that workers in occupational settings that lift, bend and twist repetitively are at risk for low back pain (Bahr et al, 2004). In addition, low back injuries are commonly found when overexertion or repetitive trauma occurs. Pope et al. discovered that overexertion in industrial workers was the cause of 60% of low back pain injuries and of those injuries 86% of them were linked with lifting, pushing or pulling (Pope 1989).
Chapter Three
Methodology

Description of Subjects

A total of 496 subjects (123 athletes and 373 controls) who completed this questionnaire were associated with the study. Of the 373 controls, 204 were identified as athletic and could not be classified as a nonathletic control. Due to the age-and-sex matching criteria, 202 subjects were used in the data analysis. To attain an age-and-sex matched criteria between the two samples, the athlete sample was condensed by removing those athletes over 225 lbs and those below 140 lbs. The control sample was condensed by removing those individuals over 215 lbs. Though 18 athletes and 72 controls were eliminated, this approach ensured an age-and-sex matching criteria was achieved.

Subjects used in the present study totaled 97 nonathletic controls (60 female and 37 male) and 105 athletes (62 female and 43 male) ranging from ages 18 to 23. When divided up by sport, the total numbers are as follows: 10 basketball players, 56 swimmers, and 39 track and field participants. Table 1 (Appendix A) breaks down subject characteristics by group and gender. Subject characteristics include age, weight and the number of years the athletes have competed in the relevant collegiate sport. The study was approved by the Western Kentucky University (WKU) Human Subject Review Board (HSRB) and all subjects signed a written informed consent describing the nature, purpose and risks associated with the study.
Instruments Utilized

Athletes and nonathletes completed a modified standardized Nordic questionnaire. The questionnaire was constructed based on the standardized Nordic questionnaire, which has been developed and validated to study the prevalence of occupational musculoskeletal symptoms (Kurinka et al, 1987). Low back pain was defined as, “pain, ache, or discomfort in the low back with or without radiation to one or both legs (sciatica)” (Bahr et al, 2004; and Kurinka et al, 1987). As seen in appendices G and H, the questionnaire also included a full-figure outline of the posterior body where the low back was shown as a darkened area covering the lumbar section (Bahr et al, 2004; and Kurinka et al, 1987). The definition of low back pain and the full-figure outline were only shown on the first page of the questionnaire. The standard questions from the Nordic questionnaire were utilized in the present study. In addition to the standard questions, questions relating to symptoms and sports activity were added and are similar to that of the modified Nordic questionnaire developed by Bahr et al. (2004). The athlete’s questionnaire is displayed in Appendix G, while the nonathlete’s questionnaire is shown in Appendix H (Bahr et al, 2004; and Kurinka et al, 1987).

Procedures

The investigator used a convenient sample for the nonathletic population. After the informed consent was signed, the investigator disseminated the questionnaire to the athletic or nonathletic population. Instructions on how to complete the questionnaire were included on both types of questionnaires as well as questions concerning age, weight and height. To maintain confidentiality, no names were recorded. Various classes within WKU College of Health and Human Services were administered the
questionnaire once permission was granted by the Dean. WKU basketball players, swimmers and track and field athletes served as the athletic population.

The consent form and the survey were administered once to nonathletic controls in the month of February. All athletes were administered the questionnaire within one week of the competition of a particular sport’s regular season, and prior to the beginning of that sport’s post-season tournament. All athletes who had participated in regular season training in the three sports were asked to complete a two-page questionnaire on LBP.

Coaches and athletes were informed about the study prior to the investigation. The questionnaires were administered during practice times in the three sports. The investigator was present during the practice to answer questions, encourage the athletes to complete the form and collect the forms before practice was dismissed. Athletes who did not participate in the practice when the questionnaire was administered received the questionnaire the following day. All athletes that participated filled out the questionnaire within one week of the end of the regular season. Questionnaires were also administered to an age-and-gender matched control group that was a convenient sample from the WKU College of Health and Human Services’ total population.

For the present study, the investigator had to modify certain questions in order to make the questionnaire sport specific, remove confusion and restore clarity in certain questions.

The present questionnaire included specific questions pertaining to swimming and track and field events, however, questions that pertained to basketball position and movement were omitted. The reason for omitting basketball-specific questions was due
to the lack of biomechanical variation between the different positions. All basketball players, regardless of their position, utilize similar energy systems requiring them to dribble, shoot, and rebound regularly. In comparison, swimmers and track and field athletes perform in a variety of events. Furthermore swimmers and track and field athletes’ skills are dependent on an assortment of events, requiring the use of an array of energy systems.

The questionnaire design allows for the thought provoking questions to be answered first in order to keep subjects’ interest and attention. Questions pertaining to demographics were specifically placed at the end of the questionnaire. This questionnaire design was used for both the athlete and the nonathlete questionnaire.

The nonathletic questionnaire (Appendix H) is a version of the modified Nordic questionnaire. Questions nine and ten are designed to determine the participant’s activity level. The study must utilize data from nonathletic controls to compare to the collegiate athletics. In order to meet the criteria of a “nonathletic control”, the participant cannot classify themselves as an athlete or be active for more than 5 days a week.

When distributing the questionnaire to the nonathletic population the investigator made it clear that collegiate athletes and people who had completed this particular questionnaire before were not allowed to take the questionnaire. Athletes who did not take part in competition during the regular season were told not to complete the questionnaire (Bahr et al, 2004).

Design and Analysis

The study was designed as a cross-sectional survey among athletes competing at the collegiate level in basketball, swimming and track and field, as well as a nonathletic
control group. The investigator used a questionnaire based on the standardized Nordic questionnaires that have been developed and validated to study the prevalence of occupational musculoskeletal symptoms (Kuorinka et al. 1987). There were two questionnaires, one for athletic and one for the nonathletic control groups. The athletic questionnaires (Appendix G) were administered within one week of the particular sport’s regular season competitions and prior to the beginning of the sport’s post-season tournament. A nonathletic questionnaire (Appendix H) was administered to various classrooms within the College of Human and Health Services. The questions evaluated the subject’s experience (if any) with low back pain during the last 12 months and during the last seven days. Extreme low back pain that might prevent subjects from working, training, or competing was also included, and phrased in dichotomized answer alternatives “yes” or “no,” as well as multiple choice options. Demographics such as age, sex, height, weight, sport and athletic experience were also assessed. The investigator provided writing utensils and appropriate questionnaires to all participants. For each setting in which the questionnaires were administered an envelope was also provided to maintain confidentiality. Participants were given approximately 10 minutes to complete the questionnaire and place their questionnaire into the envelope.

The data was manually entered into Statistical Program for Social Science (SPSS) version 15.0 for Windows and then double checked by accuracy. Subject’s characteristics were documented as means with ± standard deviation, and group means were evaluated using unpaired t-tests. Low back pain prevalence among groups was assessed by using $x^2$ statistics.
Logistic regression analyses were utilized to check for differences in low back pain prevalence among groups that were adjusted for demographic variables such as age, height, weight and gender. Recorded data was displayed within 95% confidence limits and $P$ values. Logistic backward stepwise regression analysis included three dummy variables, age, height and weight. The nonathletic control group served as a reference group instead of the sport groups (Bahr et al. 2004).
Chapter Four

Results

Descriptive statistics of athletes and nonathletes are displayed in Table 1. Controls and athletes were matched in age, gender, height, and weight, and chi squares were performed for questions 1-8 (Table 2). Pearson’s “r” displayed no difference between controls and athletes for questions 1, 3, 4, 5, 7 or 8 (refer to Appendices G and H). However, Pearson’s “r” did reveal that differences existed when comparing athletes and controls for outpatient medical assistance (Asymp. Sig (2-sided) 0.020). The athletes reported a higher prevalence of receiving outpatient medical assistance. Athletes, when compared to nonathletic controls, have also an increased prevalence of low back pain within the past seven days (P value 0.003). When compared to previous literature the controls had an unusually high prevalence of low back pain within the past seven days. Bahr et al. (2004) discovered that 20% of nonathletes experienced low back pain within that particular seven day window, whereas the present study revealed that more than 40% of nonathletic individuals had experienced low back pain within the past seven days. Table 3 also displayed a difference between sport groups and controls in regard to prevalence of low back pain within the past seven days. However, a difference between gender and prevalence of low back pain did not exist.

The logistic regression (Table 4) did not show any significant relationship between weekly training volume and low back pain during the last 12 months. However, a logistic regression was performed regarding sport and demographics. Significant differences were found for age and weight. Results showed that the older an athlete, the more likely he or she would experience low back pain.
Weight showed the same correlation; the more an athlete weighed, the more likely that athlete was to experience low back pain. The beta coefficient displays the relationship for age and weight was .537 and .046, respectfully.

In regard to training seasons, the prevalence of low back pain by sport revealed no difference. However, Figure 1 does display that the prevalence of low back pain in athletes is less within the active recovery season when compared to the basic, transitional, and competitive training seasons.
Chapter Five

Discussion/Conclusion

The purpose of this study was to determine if differences exist between low back pain experienced in WKU winter athletes and nonathletic controls. Furthermore, this study evaluated whether differences in low back pain exist between sporting groups. Demographics such as gender, height and weight were also assessed to determine if differences existed between athletes and nonathletes experiencing low back pain. This study has the potential to increase safety of training regimes, improve exercise prescriptions and reduce lost playing time of competitive athletes.

The main results of the current study support previous literature displaying a greater prevalence of low back pain experienced in athletes when compared to age-and-sex matched controls. The results of this study revealed a significant relationship of reported low back pain as age and weight increased.

Cross-sectional studies are acceptable when comparing the prevalence of low back pain, however, this type of study did have its limitations (Bahr et al, 2004). In this study, 496 subjects participated but only 202 subjects were utilized. The decrease in sample size was made in order to gain statistical power from the age-and-sex matched controls. The nonathletic controls were from a convenient sample and caused over half of the subjects to be eliminated from the study. More athletes would be needed to determine significance between low back pain and sports as well as training volume and missed training days. Perhaps differences exist within the athlete’s training season in regard to the prevalence of low back pain (Bahr et al, 2004). The strength of the study lies in the time period the athletes filled out the questionnaire. All athletes in the study
completed the questionnaire one week prior to the end of their respective 2007 regular seasons. This provided a seasonal baseline for all the athletes.

The study was also based on self-reported questionnaire data, not a clinical interview (Bahr et al, 2004). The validity and reliability of the standardized Nordic questionnaire for musculoskeletal symptoms have been demonstrated (Bahr et al, 2004; and Kuorinka et al, 1987). However, it should be taken into consideration that the Nordic questionnaire is generally used for prevalence of low back pain in occupational settings, not sports (Bahr et al, 2004; and Kuorinka et al, 1987).

All athletic questionnaires were administered during practice time. Athletes who did not participate in the practice received the questionnaire the following day. Although the athletes should be at practice, absentees may have occurred due to school or sickness. The investigator attempted to diminish the possibility of error by asking athletes which teammates were not at practice. The second day follow-up reduced this possibility of error by distributing the questionnaire to athletes who were not present at the prior practice. The investigator only received questionnaires from the athletes that were at practice on those two particular days.

Despite the fact that the informed consent clearly states that the anonymous questionnaire will not affect the student or athlete in anyway, some athletes may have been uncomfortable answering the questionnaire honestly. Many athletes are scholarship athletes and may not be performing to the best of their ability because of an unknown injury.

It should also be noted that low back pain in athletes may not always occur because of sport participation, and that injuries may take place outside of their sport
Athletes may also have a lower threshold for reporting low back pain due to the demands of athletic performance when compared to regular daily activities (Bahr et al, 2004). Although low back pain in athletes may contribute to a decline in athletic performance, it is acute and therefore benevolent in nature due to the low number of athletes that report being hospitalized or having surgery for low back pain (Bahr et al, 2004). This could also be due to the young age of the athletes. The athletes reported a higher prevalence of receiving outpatient medical assistance. This is most certainly due to the accessibility athletes have to training rooms, athletic trainers and sports physicians.

Results of the current study and of previous literature clearly supports that athletes experience more low back pain than nonathletic controls. Age and weight also play roles as risk indicators for the prevalence for low back pain. In previous literature it has been known that the prevalence of low back pain increases with age (Jones and Macfarlane 2005). It is not uncommon for older populations to complain of low back pain (Lazero and Quinet 1994). Joesphson et al. (1996) discovered that older nurses who perceived their physical exertion at work as being high were a risk indicator for low back pain symptoms. More research needs to be done on older athletes to determine if physical exertion of training in regards to intensity and frequency is a risk indicator for low back pain symptoms. It is unlikely to find a difference in low back pain in regards to age within college athletics. This is due to the age of college athletes ranging only from 18 to 23 in NCAA Division I sports. However the athletes who have remained active over the years may allow researchers to infer upon college athletics.

In the present study, the participants were all between the ages of 18 to 23 years old. It is well known that after adolescence, body mass tends to increase with age. Past
studies have a significant association between body weight and low back pain (Flamme 2005). Although unlikely athletes could also be slightly overweight therefore containing a higher body fat percentage than what is necessary to participate in college sport. This could cause complications in the athletes training thus leading to low back pain or injury. Coaches are constantly training their teams, and not taking into consideration individual differences. Small details such an athlete’s increased gain can have dramatic effects on training. An athlete’s training will naturally become more physical demanding when unwanted pounds are gained.

Conclusions

The focal points of the current study support previous literature displaying a greater prevalence of low back pain experienced in athletes when compared to age-and-sex matched controls. The results of this study show a significant relationship of reported low back pain as age and weight increase. Athletes also reported a higher prevalence of receiving outpatient medical assistance than did the nonathletes. Future research is needed to determine the prevalence of low back pain in these three sports, and the season in which low back pain occurs the most. This will enable researchers to potentially increase safety of training regimes, improve exercise prescriptions and reduce lost playing time of competitive athletes.
Appendix A
Table 1. Subjects Characteristics (n = 202) by Sport and Gender

<table>
<thead>
<tr>
<th></th>
<th>Swimming (n = 56)</th>
<th>Track &amp; Field (n = 39)</th>
<th>Basketball (n = 10)</th>
<th>Nonathletes (n = 97)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men (n = 26)</td>
<td>Women (n = 30)</td>
<td>Men (n = 17)</td>
<td>Women (n = 22)</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>19.84 ± 1.29</td>
<td>19.67 ± 1.06</td>
<td>20.35 ± 1.13</td>
<td>20.72 ± 1.39</td>
</tr>
<tr>
<td>Height (in)</td>
<td>72.30 ± 3.09</td>
<td>67.34 ± 2.48</td>
<td>70.82 ± 2.09</td>
<td>56.27 ± 3.73</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>174.58 ± 16.45</td>
<td>144.30 ± 15.55</td>
<td>155.35 ± 12.90</td>
<td>142.86 ± 33.62</td>
</tr>
<tr>
<td>Competition (yrs)</td>
<td>2.42 ± 1.30</td>
<td>2.30 ± 1.06</td>
<td>2.41 ± 1.23</td>
<td>2.73 ± 1.29</td>
</tr>
</tbody>
</table>

Results shown as mean ± SD. Competition years of competitive college participation in their sport. — = data not applicable.
Appendix B
Table 2. Responses (%) to Various LBP Questions by Group (n=203)

<table>
<thead>
<tr>
<th></th>
<th>Athlete (n = 106)</th>
<th>Control (n = 97)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP ever</td>
<td>89.6</td>
<td>91.8</td>
<td>0.603</td>
</tr>
<tr>
<td>LBP previous 12 mos</td>
<td>96.9</td>
<td>91</td>
<td>0.242</td>
</tr>
<tr>
<td>Examined for LBP previous 12 mos</td>
<td>30.2*</td>
<td>15.7</td>
<td>0.02</td>
</tr>
<tr>
<td>LBP previous 7 days</td>
<td>62.5*</td>
<td>40.4</td>
<td>0.003</td>
</tr>
<tr>
<td>Operation</td>
<td>2.1</td>
<td>2.2</td>
<td>0.939</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>8.3</td>
<td>3.4</td>
<td>0.154</td>
</tr>
<tr>
<td>Occupational change</td>
<td>13.5</td>
<td>14.6</td>
<td>0.835</td>
</tr>
<tr>
<td>Experienced radiating LBP ever</td>
<td>25</td>
<td>16.9</td>
<td>0.175</td>
</tr>
</tbody>
</table>

The P values shown refer to the overall x2 analysis between all groups.
Paired comparisons between groups; *denotes different from nonathletic control group.
LBP = low back pain.
Appendix C
Table 3. Responses (%) to Various LBP Questions by Sport (n=203)

<table>
<thead>
<tr>
<th></th>
<th>Swimming (n = 56)</th>
<th>Track &amp; Field (n = 40)</th>
<th>Basketball (n = 10)</th>
<th>Control (n = 97)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP ever</td>
<td>91.1</td>
<td>97.5</td>
<td>90.0</td>
<td>91.8</td>
<td>0.891</td>
</tr>
<tr>
<td>LBP previous 12 mos</td>
<td>100.0</td>
<td>94.2</td>
<td>100.0</td>
<td>91.0</td>
<td>0.710</td>
</tr>
<tr>
<td>Examined for LBP previous 12 mos</td>
<td>26.9</td>
<td>34.3</td>
<td>33.3</td>
<td>15.7</td>
<td>0.106</td>
</tr>
<tr>
<td>LBP previous 7 days</td>
<td>61.5*</td>
<td>62.9*</td>
<td>66.7*</td>
<td>40.4</td>
<td>0.028</td>
</tr>
<tr>
<td>Operation</td>
<td>3.8</td>
<td>0</td>
<td>0</td>
<td>2.2</td>
<td>0.643</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>9.6</td>
<td>2.9</td>
<td>22.2</td>
<td>3.4</td>
<td>0.067</td>
</tr>
<tr>
<td>Occupational change</td>
<td>11.5</td>
<td>14.3</td>
<td>22.2</td>
<td>14.6</td>
<td>0.851</td>
</tr>
<tr>
<td>Experienced radiating LBP ever</td>
<td>26.9</td>
<td>22.9</td>
<td>22.2</td>
<td>16.9</td>
<td>0.563</td>
</tr>
<tr>
<td>Missed training</td>
<td>21.2</td>
<td>11.4</td>
<td>22.2</td>
<td>—</td>
<td>0.131</td>
</tr>
<tr>
<td>Missed competition</td>
<td>7.7</td>
<td>0</td>
<td>0</td>
<td>—</td>
<td>0.473</td>
</tr>
</tbody>
</table>

The P values shown refer to the overall x2 analysis between all groups.
Paired comparisons between groups, * denotes different from nonathletic control group.
LBP = low back pain; — = data not applicable.
Appendix D
Table 4. Logistic Backward Stepwise Regression Analysis for Examined or Treated LBP in the Previous 12 Months With Sport Groups and Training Volume as Forced Variables into the Regression Equation and Controls as Reference Group

<table>
<thead>
<tr>
<th>Forced variables</th>
<th>Regression Coefficient</th>
<th>SE</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basketball</td>
<td>0.045</td>
<td>0.99</td>
<td>0.964</td>
</tr>
<tr>
<td>Track &amp; Field</td>
<td>0.203</td>
<td>0.558</td>
<td>0.757</td>
</tr>
<tr>
<td>Average weekly training volume</td>
<td>0.071</td>
<td>0.331</td>
<td>0.829</td>
</tr>
<tr>
<td>Backwards selected variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>-0.196</td>
<td>0.103</td>
<td>0.056</td>
</tr>
<tr>
<td>Weight</td>
<td>0.046</td>
<td>0.016</td>
<td>0.005</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>0.538</td>
<td>0.204</td>
<td>0.008</td>
</tr>
</tbody>
</table>

LBP = low back pain. SE = standard error
Appendix E
Figure 1. Prevalence of reported LBP (%) during four periods of the season: the active resting period, the basic training period, the transitional period, and the competition season for basketball players (n=9), swimmers (n=52), and track and field athletes (n=55).
Appendix F
INFORMED CONSENT DOCUMENT

Project Title: Low Back Pain Among College Athletes – A Survey of Basketball Players, Swimmers, Track and Field Athletes and Nonathletic Controls

Investigator: Nicholas T. Bacon, Physical Education and Recreation, (270) 535-6880

You are being asked to participate in a project conducted through Western Kentucky University (and -- if applicable -- any other cooperating institution). The University requires that you give your signed agreement to participate in this project.

The investigator will explain to you in detail the purpose of the project, the procedures to be used, and the potential benefits and possible risks of participation. You may ask him/her any questions you have to help you understand the project. A basic explanation of the project is written below. Please read this explanation and discuss with the researcher any questions you may have.

If you then decide to participate in the project, please sign on the last page of this form in the presence of the person who explained the project to you. You should be given a copy of this form to keep.

1. Nature and Purpose of the Project:
   This study is designed to determine the prevalence of low back pain in college athletics. Basketball players, swimmers, track and field athletes, and nonathletic controls will be assessed. The data gathered in this study will be made available to strength training coaches to improve exercise prescriptions for the assessed sport. It will also assist with the comprehension of low back pain prevalence and help correct future occurrences leading to a healthier season.

2. Explanation of Procedures:
The questionnaire should take approximately five to 10 minutes. A brief summary and instructions of the questionnaire will be given verbally by the investigator before the questionnaire is administered. Questionnaires will be handed out and then collected upon completion.

3. Discomfort and Risks:
As data will be collected through the survey instruments, the procedure is noninvasive, and no risks to human subjects are anticipated.

4. Benefits:
You may benefit through increased knowledge of risk factors associated with the low back pain within your particular sport. The data gathered in this study will be made available to the WKU strength training coaches to improve exercise
prescriptions for the assessed sports. For the nonathletic subjects, the low back pain assessment will help the student become more aware of their current physical conditions surrounding their lower back.

5. **Confidentiality:**
The information will be kept in a lock box in the Physical Education and Recreation department of Western Kentucky University. Names will not be present on any of the questionnaires to ensure confidentiality. The instructor will also verbally state, before the questionnaire is administered, that names are to be omitted. At the bottom of each page of the questionnaire the statement, “Please do not put name on questionnaire”, will be written in bold type.

6. **Refusal/Withdrawal:**
Every subject has the right to withdraw from the study at any time. No penalties will be issued if one refuses to take or chooses not to submit the questionnaire. Refusal to participate in this study will not adversely affect the subjects in any manner.

Refusal to participate in this study will have no effect on any future services you may be entitled to from the University. Anyone who agrees to participate in this study is free to withdraw from the study at any time with no penalty.

You understand also that it is not possible to identify all potential risks in an experimental procedure, and you believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

_________________________   ________________________  
Signature of Participant     Date

_________________________   ________________________  
Witness                      Date

THE DATED APPROVAL ON THIS CONSENT FORM INDICATES THAT THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY THE WESTERN KENTUCKY UNIVERSITY HUMAN SUBJECTS REVIEW BOARD
Sean Rubino, Human Protections Administrator
TELEPHONE: (270) 745-4652
Appendix G
LOW BACK
How to answer the questionnaire: In this picture you can see the approximate position of the part of the body referred to in the questionnaire. Low back pain is defined as pain, ache, or discomfort in the low back with or without radiation to one or both legs (sciatica).

Please answer by putting a cross in the appropriate box – one cross for each question. You may be in doubt as to how to answer, but please do your best anyway.

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Have you ever experienced low back pain (ache, pain, or discomfort)?</td>
<td>1 No, 2 Yes</td>
</tr>
<tr>
<td>If you answered No to question 1, please proceed to question 16. Do not answer questions 2 – 15.</td>
<td></td>
</tr>
<tr>
<td>2. Have you been examined or treated for low back pain by a physician, physical therapist, chiropractor, or other health personnel as an outpatient during the previous 12 months?</td>
<td>1 No, 2 Yes</td>
</tr>
<tr>
<td>3. Have you ever been admitted to a hospital because of low back pain?</td>
<td>1 No, 2 Yes</td>
</tr>
<tr>
<td>4. Have you ever had surgery because of low back pain?</td>
<td>1 No, 2 Yes</td>
</tr>
<tr>
<td>5. Have you ever had to change your occupation or working assignments because of low back pain?</td>
<td>1 No, 2 Yes</td>
</tr>
<tr>
<td>6. Have you experienced low back pain during the previous seven days?</td>
<td>1 No, 2 Yes</td>
</tr>
<tr>
<td>7. Have you ever experienced radiating low back pain that extends down one or both legs?</td>
<td>1 No, 2 Yes</td>
</tr>
<tr>
<td>8. How many days during the past 12 months have you had low back pain?</td>
<td>1 0 days, 2 1–7 days, 3 8–30 days, 4 More than 30 days, but not every day, 5 Every day</td>
</tr>
<tr>
<td>9. Have you experienced low back pain during the resting period of the season?</td>
<td>1 No, 2 Sometimes, 3 Weekly, 4 Daily</td>
</tr>
<tr>
<td>10. Have you experienced low back pain during the basic training period of the season?</td>
<td>1 No, 2 Sometimes, 3 Weekly, 4 Daily</td>
</tr>
</tbody>
</table>

Please do not put your name on the questionnaire.
11. Have you experienced low back pain during the transitional period of the season?
1. No
2. Sometimes
3. Weekly
4. Daily

12. Have you experienced low back pain during the competitive season?
1. No
2. Sometimes
3. Weekly
4. Daily

13. How many days of training have you missed because of low back pain during the past 12 months?
1. 0 days
2. 1 – 3 days
3. 4 – 8 days
4. 9 or more days

14. How many days of competition have you missed because of low back pain during the past season?
1. 0 days
2. 1 – 2 days
3. 3 – 4 days
4. 5 or more days

15. Using which of these techniques have you experienced low back pain? (For swimmers only)
1. Freestyle
2. Backstroke
3. Breaststroke
4. Butterfly

16. In what collegiate sport do you participate?
1. Basketball
2. Swimming
3. Indoor Track and Field

17. During competition, which of these techniques do you use in your primary event? (For swimmers/divers only)
1. Freestyle
2. Backstroke
3. Breaststroke
4. Butterfly
5. Diver

18. During competition, within what event do you predominantly compete? (For indoor track and field athletes only)
1. 55 m – 400 m
2. 800 m – 1600 m
3. 3000 m – 5000 m
4. High Jump
5. Long/Triple Jump
6. Throws

19. How many years have you competed at the collegiate level in the relevant sport?
1. 1 year
2. 2 years
3. 3 years
4. 4 years
5. 5 years

20. What is your average weekly training volume?
1. < 8 hours
2. 8 – 10 hours
3. 11 – 13 hours
4. > 13 hours

21. What is your gender?
1. Female
2. Male

22. What is your age? _______ yrs

23. What is your weight? _______ lbs

24. What is your height?
______ ft + ______ in

Please do not put your name on the questionnaire.
Appendix H
**LOW BACK**

How to answer the questionnaire: In this picture you can see the approximate position of the part of the body referred to in the questionnaire. Low back pain is defined as pain, ache, or discomfort in the low back with or without radiation to one or both legs (sciatica).

Please answer by putting a cross in the appropriate box – one cross for each question. You may be in doubt as to how to answer, but please do your best anyway.

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Have you ever experienced low back pain (ache, pain or discomfort)?</td>
<td>1: No  2: Yes</td>
</tr>
<tr>
<td>2. Have you been examined or treated for low back pain by a physician, physical therapist, chiropractor, or other health personnel as an outpatient during the previous 12 months?</td>
<td>1: No  2: Yes</td>
</tr>
<tr>
<td>3. Have you ever been admitted to a hospital because of low back pain?</td>
<td>1: No  2: Yes</td>
</tr>
<tr>
<td>4. Have you ever had surgery because of low back pain?</td>
<td>1: No  2: Yes</td>
</tr>
<tr>
<td>5. Have you ever had to change your occupation or working assignments because of low back pain?</td>
<td>1: No  2: Yes</td>
</tr>
<tr>
<td>6. Have you experienced low back pain during the previous seven days?</td>
<td>1: No  2: Yes</td>
</tr>
<tr>
<td>7. Have you ever experienced radiating low back pain that extends down one or both legs?</td>
<td>1: No  2: Yes</td>
</tr>
<tr>
<td>8. How many days during the past 12 months have you had low back pain?</td>
<td>1: 0 days  2: 1 - 7 days  3: 8 - 30 days  4: More than 30 days, but not every day  5: Every day</td>
</tr>
<tr>
<td>9. How many days a week do you strenuously exercise for more than 20 minutes at a time?</td>
<td>1: 0 days  2: 1 - 2 days  3: 3 - 5 days  4: More than 6 days</td>
</tr>
<tr>
<td>10. If you exercise more than 3 days a week, how would you classify yourself?</td>
<td>1: Fitness enthusiast  2: Recreational athlete  3: Competitive athlete  4: Other</td>
</tr>
<tr>
<td>11. What is your gender?</td>
<td>1: Female  2: Male</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>12. What is your age?</td>
<td>_____ yrs</td>
</tr>
<tr>
<td>13. What is your weight?</td>
<td>_____ lbs</td>
</tr>
<tr>
<td>14. What is your height?</td>
<td>_____ ft + _____ in</td>
</tr>
</tbody>
</table>
Bibliography


