Science of Wrestling

Annual Review
2005

David Curby EdD

TABLE OF CONTENTS

Preface

This annual publication is dedicated to the pursuit and use of the knowledge surrounding the noble and timeless sport of wrestling. Each year, an annotated bibliography of the scientific research, published in English, during the year in review, will be compiled and shared with those who work in the wrestling community. It is my hope that this work will spark further research, along with helping to educate those who are in a position to apply this knowledge. I am proud to be affiliated with this great sport. Thanks to our national governing body - USA Wrestling. Thanks to the National Coaching Staff for the support that they have given to me. I am grateful for the chance to work with Ivan Ivanov and Jim Gruenwald and their outstanding wrestlers at the USOEC in Marquette, Michigan. Larry Slater has provided many of the pictures found throughout this document. Finally, thanks to my wife Lynne and family, who have been a big part of my work in the sport, and have patiently supported me.

David G. Curby EdD
LaGrange, IL
USA
davcur@niles-hs.k12.il.us

Chapter 1

The Science of Wrestling

The scientific study of our sport has so much to offer to the wrestlers, coaches, parents, and fans. The many broad areas of research can include: historical and socio-cultural issues, physiology, nutrition, performance, biomechanics, motor learning, psychology, game theory, tactics and strategy, growth and development, and medical/athletic training issues.

Most published work that one finds regarding wrestling is basic research. This is research conducted to answer a question, and merely to add to knowledge. We are just beginning to perform more applied research studies for wrestling. Applied research has as its goal, the direct use of the information gained from the work. For instance, coaches may ask researchers to solve a particular training question. The links between science and sport have not been very strong in wrestling.

I remember running across a wonderful book in the mid 70's, ***What Research Tells the Coach about Wrestling*** by Philip Rasch and Walter Kroll (AAHPER, Washington, D.C., 1964). They investigated many wrestling topics throughout the 50's, 60's and 70's. This book prompted me to begin collecting research papers concerning wrestling. From that time in the mid 70's, I now have a collection of almost 2,000 articles and papers.

While the work of some scientists is of a general nature and can be extended to our sport, there are numerous researchers who have done extensive work in wrestling. Some of these include Don Sayenga (Bethlehem, PA) in history; William Morgan (University of Wisconsin) and Dan Gould (University of North Carolina at Greensboro) in psychology; Wayne Sinning (Kent State), Charles Tipton (ret. University of Arizona), Craig Horswill (Gatorade Sports Science Institute), Robert Oppliger (University of Iowa), Ed Zambraski (US Army Research Institute for Environmental Medicine) and James Scott (Grand Valley State) have made big contributions to assessments of body composition and/or weight loss; William Kraemer (University of Connecticut), Alan Utter (Appalachian State), Terry Housh and Glenn Johnson (University of Nebraska) have documented physical characteristics of wrestlers; Randy Wroble (Grant Hospital, Columbus, Ohio) is a leader in documenting the injuries associated with wrestling; Suzannne Steen (University of Washington) and Randy Clark (University of Wisconsin Hospital Sportsmedicine) have worked with weight loss, weight control plans and nutrition; the Canadians Michael Sharratt and A.W. Taylor have tested elite wrestlers from around the world; James Roemmich (University at Buffalo) and Alan Rogol (University of Virginia) are making important observations on the effects of wrestling and weight loss on growth in youth; and Thomas Kohl (Reading Hospital, West Reading, PA), Brian Adams (University of Cincinnati) and BJ Anderson (University of Minnesota) are established experts regarding the dermatological issues facing wrestling.

This publication will address some of the problems that have prevented the findings of this scientific research from reaching athletes and coaches. Sometimes the research articles never reach the practitioners of wrestling. "Translation" from the rather technical language of scientific research is also needed. The next step is presenting the findings into something that can be applied and used in our sport. This information must be brought to the wrestling community.

In this annual review I will review the wrestling related research from the past year, share the high points, along with potential applications for coaches and wrestlers. In this chapter, I have selected seven research studies from the past three years to provide an idea of the wide range of research that is being conducted and is available for use by coaches and athletes.

#1 Dermatology
Anderson BJ. The Epidemiology and Clinical Analysis of Several Outbreaks of Herpes Gladiatorum. ***Med Sci Sports Exerc***. 2003 Nov;35(11):1809-1814.

Analysis of data from three outbreaks at a 28-d wrestling camp showed that most outbreaks (96%) occurred on the front surface of the body, with 71.9% on the head, face, and neck, areas in direct contact

when wrestlers are engaged in a tie-up. Herpes is spread wrestler to wrestler, not from the mats.

Anderson feels that the NFHS guidelines are inadequate to prevent and control outbreaks of herpes. The focus of preventive efforts needs to change from mat cleanliness to more rapid detection of outbreaks by requiring culture results and appropriate therapy for all suspected bacterial and herpes sores before allowing return to contact. **Applications:** This means we need more dermatologists associated with wrestling. We need to all make contacts with skilled dermatologists in our areas, share this sport-specific information from Anderson and others, so they can help us in our programs. **Do you have a team dermatologist?**

#2 Competition
Kraemer, W. J., et al. (2001). Physiological and performance responses to tournament wrestling. ***Med. Sci. Sports Exerc***., 33, 1367-1378.

Twelve Penn State wrestlers lost 6% of total body weight during the week before a simulated, 2-day freestyle wrestling tournament. Lower body power and upper body isometric strength were significantly reduced as the tournament progressed. Elevations in testosterone, cortisol, norepinephrine and lactate were observed after each match. These chemical are indicators of stress. The combined effects of these stresses may hinder a wrestler's ability to maintain top physical performance throughout a tournament. **Applications:** We may actually be going down in performance as the most important matches come up. Coaches should investigate and apply restorative techniques for use **during** a tournament (massage, diet, relaxation/sleep aids, vibration therapy, others?) so performance does not decline. The limitations in applying the findings from this study are the rules changes that have taken place since this study was done. International style tournaments complete a weight class in one day, and the match has been changed in length. The winner is the wrestler to win two out of three periods. The periods are two minutes in length.

#3-Psychology-*Focus on the Coach*
Hahesy, Michael J. ***Transformational leadership theories, attribution beliefs, and self-efficacy: A qualitative study of one successful NCAA wrestling coach.***
Dissertation, EdD, Indiana University of Pennsylvania. 2002.

A former wrestler, Hahesy used extensive interviews of Iowa wrestlers in this interesting study. The results indicate that Gable was successful due to a variety of factors including: enthusiasm for each athlete, motivating everyone, creating a successful environment, and encouraging hard teamwork. Gable led by demonstrating high expectations, strong modeling, and encouraging competition. Gable made his athletes **attribute success to ability and effort and never to dwell on luck**.

#4-Psychology-*Focus on the Athlete*
2000 Sydney Olympic Games: U.S. Athlete and Coach Performance Lessons Learned Assessment- Daniel Gould, Ph.D.
http://www.usoc.org/sportscience/
Athletes from the Sydney Games were asked, "*What, if any, were the three things that your coaches did that **hurt** your performance at the Games?"*
The most frequent response was "poor attitude and demeanor," which was listed 34 times by athletes. "Poor communication and feedback" was cited 15 times. Poor physical training strategies, mismanagement of athlete selection process, lack of availability/ accessibility, and poor pre-competition preparation were other leading factors that reportedly hurt performance.
"*What helped?"* Mental preparation and sport psychology was listed most frequently as a coaching action that helped performance, followed by physical preparation, emotional support, technical / tactical preparation, positive attitude, and preparation for competition.

Application:
Gould states to coaches "…no matter what the initial characteristics of the individuals, unless there is a long and intensive process of encouragement, nurturance, education, training, the individuals will not attain extreme levels of capability in the particular fields."

#5 Hydration Status of Wrestlers
Bartok, C.D. et al Hydration Testing in Collegiate Wrestlers Undergoing Hypertonic Dehydration***. Med. Sci. Sports Exerc***., Vol. 36, No. 3, pp. 510-517, 2004.
This study supports a specific gravity cutoff of 1.020 for the identification of dehydration. This urine test is used in almost all weight control plans (NCAA and now many H.S. Federations) that certify you to compete at a minimal weight class. **Applications:** This is still a controversial topic among wrestlers and coaches, since hydration status has a great amount of individual variability. Further work is needed to validate the accuracy and precision of using urine specific gravity to establish whether a wrestler is dehydrated.

#6 Scoring Analysis FILA Coaches and Referees Clinic January 2004 ROME
by Prof. Dr. Harold Tünnemann, IAT – Leipzig

Dr. Tünneman analyzed videotape üof all matches and calculates a points per minute Index of Performance (points scored minus points allowed for each minute) for the 2003 World Championships. The world champions can serve as examples for coaches and young athletes. In Greco, Nazarjan of Bulgaria was highest with 0.94, Kvirkella of Georgia with 0.84 and Tsitsuashvili of Israel with 0.78.

In Freestyle the best value was from the Russian world Champion Bouvaissa Saitiev at 74-kg who had an index of performance of 1.39. Both of the other Russian World Champions, Farniev and Sashidov, as well as the Georgian Kurdanidze are outstanding, too, as they demonstrate an almost perfect defense (no points allowed).

Tünnemann points out that overall, women's defense is not as developed as the men's. But, the champions Marano (USA) with the highest performance index of 2.19, Chiaru Icho (JPN) with 1.56 (not a single lost point), as well as Saori Yoshida (JPN) with 1.54 and Melnik of the Ukraine, with 1.54, stand out.

#7 Activity Analysis
Nilsson J, et al. Work-time profile, blood lactate concentration and rating of perceived exertion in the 1998 Greco-Roman wrestling World Championship**.** ***J Sports Sci*** 2002 Nov; 20(11):939-45
The average periods of work and rest were 37.2 and 13.8 s, respectively. Most of the wrestlers (53.3%) reported exertion to be highest in the flexors of the forearm, followed by the deltoids (17.4%) and the biceps brachii muscles (12.0%). In addition to a relatively high rating of perceived exertion in the arm muscles, this indicates a high specific load on the flexor muscles of the forearm. **Applications:** Interval training work /rest intervals of 40 seconds work and 15 seconds rest are indicated. The question is-does this information apply to our high school and college wrestling, or just to international? This is a good topic for graduate research (videotape and a stopwatch!).

Hopefully, this publication will stimulate further research from among our own. Many young coaches are involved in graduate school. Some topics for future work include:

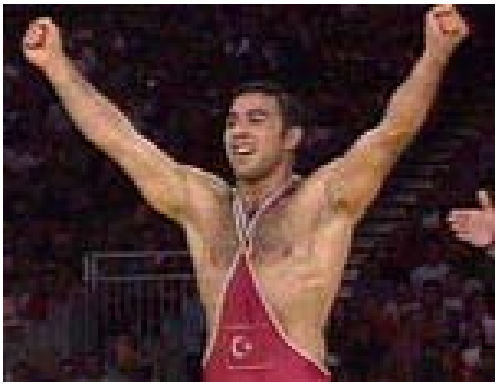
- **Minimal body fat levels for women – Is 12% valid?**
- **Explore whether there are other valid hydration methods and standards for weight control programs?**
- **Are different body composition equations needed for blacks and Hispanics?**
- **Can total body water be measured for weight control programs?**
- **Evaluate restoration methods to be used by wrestlers in training and during competition.**

Please visit my website where I maintain a listing of the most current research regarding wrestling. Website:http://www.nileshs.k12.il.us/davcur/wrestling.html. I can be contacted through this site as well, with your questions and comments.

Chapter 2

When Do Wrestlers Peak?

When sports scientists look at a sport, they often develop a profile of the characteristics of the champions. It is interesting to note the age of wrestlers at the peak of their success. The ages of all Olympic wrestling champions were examined for this article. Birth dates were obtained for most champions on the FILA Database. The average ages of the champions from each Olympics is listed in Table 1. The average age of all Olympic wrestling champions is 26.79 years. The freestyle average age is 26.4 and for Greco Roman it is 27.15. There are no dramatic trends apparent. The champions in Athens were a bit younger than the style average: Greco-Roman-24.38, Freestyle-25.21 and Women-20.88.



Hamza Yerlikaya of Turkey (above) is the most recent arrival on the youngest list, winning the 1996 GR 82 kg title at 20.13 years of age. He also won a World Championship in 1993 when he was just 17.29 years old! He is still active and won the 2005 GR world title at 96 kg. **Adolf Lindfors** (left) of Finland is the oldest Olympic wrestling champion in wrestling, winning the heavyweight gold in 1920 in the Antwerp Games, when he was 41.52 years of age.

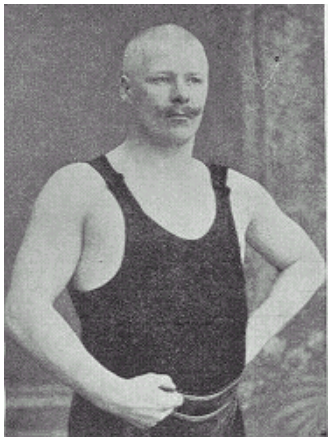


Table 1: Average Age of Wrestling Champions

	Greco-Roman	Freestyle
1896 Athens	26.91	
1904 St. Louis		24.69
1906 Athens	24.92	
1908 London	25.72	23.16
1912 Stockholm	26.66	
1920 Antwerp	32.91	25.03
1924 Paris	28.03	25.23
1928 Amsterdam	26.80	28.21
1932 Los Angeles	31.80	27.53
1936 Berlin	28.18	29.61
1948 London	29.16	28.85
1952 Helsinki	28.43	28.37
1956 Melbourne	27.90	25.49
1960 Rome	28.08	26.80
1964 Tokyo	26.56	26.52
1968 Mexico City	27.62	29.19
1972 Munich	27.2	25.84
1976 Montreal	25.51	25.23
1980 Moscow	26.31	23.63
1984 Los Angeles	25.69	24.83
1988 Seoul	25.26	27.25
1992 Barcelona	24.89	26.67
1996 Atlanta	26.02	26.62
2000 Sydney	27.09	25.83
2004 Athens	24.38	25.21
Style Average	**27.15**	**26.42**
Average Age of All Wrestling Champions is 26.79 years		

The extremes of ages are shown in Table 2. This table lists the ten youngest and ten oldest champions. The youngest ever champion was 19.6 years old and the oldest was 41.52.

Table 2: Youngest and Oldest Olympic Wrestling Champions

Ten Youngest Olympic Wrestling Champions			
Wrestler	**Age**	**Games**	**Wt. Class**
Saban Trstena YUG	19.6	1984 LA	FS 52 kg
Suren Nalbandyan USSR	20.13	1976 Montreal	GR 68 kg
Yerlikaya Hamza TUR	20.13	1996 Atlanta	GR 82 kg
Shazam Safin USSR	20.30	1952 Helsinki	GR 67 kg
Sanasar Oganesyan USSR	20.48	1980 Moscow	FS 90 kg
MagomedgasanAbushev USSR	20.71	1980 Moscow	FS 62 kg
Alexander Karelin USSR	21.00	1988 Seoul	GR 100+ kg
Il Kim PRK	21.02	1992 Barcelona	FS 48 kg
Varteres Samourgashev	21.03	2000 Sydney	GR 63 kg
George de Relwyskow GBR	21.06	1908 London	FS 66.6 kg
Bouvaisa Saitiev RUS	21.39	1996 Atlanta	FS 74 kg
*Bayram Sit TUR, FS 62 kg, 1952 Helsinki, listed as born 1/1/1930. This would mean that he was 21.34 years old. However, the records of many early Turkish wrestlers have birth dates entered as Jan 1st, probably as a default.			
Ten Oldest Olympic Wrestling Champions			
Adolf Lindfors FIN	41.52	1920 Antwerp	GR 82+ kg
Anatoli Roschtschin USSR	40.49	1972 Munich	GR 100+ kg
Arsen Mekokishvili USSR	40.27	1952 Helsinki	FS 87+ kg
Gyula Bobis HUN	38.81	1948 London	FS 87+ kg
Johanes Kotkas USSR	37.48	1952 Helsinki	GR 100+ kg
Kaarlo Anttilla FIN	36.85	1924 Paris	GR 62 kg
Carl Westergren SWE	36.80	1932 LA	GR 87+ kg
Valentin Jordanov BUL	36.51	1996 Atlanta	FS 52 kg
Kaarlo Maekinen FIN	36.21	1928 Amsterdam	FS 56 kg
Claes Johansen SWE	35.78	1920 Antwerp	GR 82.5 kg

Weight classes have changed throughout the years and the youngest champions seem to be present in the lighter classes. 7 out of 10 champions were from weight classes less than 70 kg. However, Alexander Karelin, one of the greatest wrestlers/heavyweights of all time, won his first title as the 7th youngest Olympic wrestling champion of all time. What one generally sees is that the oldest competitors come from the heaviest weight classes. Six of the ten oldest champions come from the highest weight class. Weight class differences seem to be operating, with a tendency for heavyweight wrestlers towards greater longevity. The length of the competitive careers of heavyweights have been found to be longest.

Another wrestler who is currently active is Bouvaisa Saitiev of Russia, who is on the youngest champions list, having won in Atlanta, and then again in Athens.

Some American wrestlers of interest are: Henry Wittenberg, the oldest American Gold Medalist, at 87 kg in 1948, when he was 33.92 years old; and the youngest American Olympic Champion, Peter Mehringer who won the FS 87 kg class in the 1932 games when he was 22.04 years old.

Bruce Baumgartner won a bronze medal at the Atlanta Games, 130 kg class, FS, at 35.74 years of age. Chris Campbell won a bronze in Barcelona in FS at age 37.87 at 90 kg. Jimmy Carr, at 17.58 years of age, was the youngest US wrestling Olympian, in the 1972 Games, in FS at 114.5 lbs.

Athens Olympics – 2004

Ages of Greco-Roman Olympic Champions

Wt. Class	Wrestler	Country	Age
55	Istvan Majoros	HUN	30.12
60	Ji-Hyun Jung	KOR	21.42
66	Farid Mansurov	AZE	22.29
74	Dokturishvili, Alexander	UZB	24.59
84	Alexej Michin	RUS	25.55
96	Ibragim Gaber	EGY	24.99
120	Khassan Baroev	RUS	21.73
		Average	**24.38**

Ages of Men's Freestyle Champions

Wt. Class	Wrestler	Country	Age
55	Mavlet Batirov	RUS	20.71
60	YM Quintana	CUB	24.58
66	Elbrus Tedeev	UKR	29.73
74	Bouvaisa Saitiev	RUS	29.47
84	Cael Sanderson	USA	25.19
96	Khadshimourad Gatsalov	RUS	21.72
120	Artur Taimazov	UZB	25.11
		Average	**25.21**

Ages of Women Olympic Champions

Wt. Class	Wrestler	Country	Age
48	Irina Melnik	UKR	22.54
55	Saori Yosida	JPN	21.88
63	Kaori Icho	JPN	20.19
72	Wang Xu	CHN	18.91
		Average	**20.88**

Women: Women competed in their first Olympic wrestling competition in Athens. They are approximately 4-5 years younger than their male counterparts. This probably reflects the relative recent development of women's wrestling. As more structures (Olympic resident training) are put in place for post education competition, this age will probably increase.

There are factors operating at both ends of the age distribution affecting the chances for observing champions that are either very young or relatively old. Most young champions are certainly prodigies with a "genius" for wrestling.

FACTORS THAT MAY INCREASE CHANCES FOR EARLY SUCCESS:

1) **Growth and Maturation** There has been a steady increase in height and weight at all ages from birth to adulthood. There has been a general increase in the height and weight of Olympic athletes during the last generation. This has been matched with an acceleration in reaching sexual maturity. In women, there has been a steady decrease in the age of menarche – from 17 in 1840 to 13.5 in 1960. A trend of earlier maturation has been observed in boys who reach their maximum height at an earlier age than a generation ago.

2) **Talent Identification** Systematic identification and selection of young athletes, along with earlier specialized training could also be factors.

3) **Weight Training** The use of weight training is now widespread in the training regimens of most young athletes. Most physiological parameters peak in the early 20's.

At the other end of the age spectrum, we know that physiological functional capacity declines with age. There are declines in aerobic capacity, peak strength and power.

FACTORS THAT MAY INCREASE THE LONGEVITY OF WRESTLING CHAMPIONS:

Training Programs that slow the aging process. What may have formerly been considered "normal" deterioration may be forestalled by continuous training.

Preservation of Strength: Many of the oldest champions compete in the heaviest weight class. Is strength more of a factor in this class? Bulgarian research indicates that the competitors in the heaviest weight categories have the longest careers at the international level of 10.7 years.

Improved Tactics and Psychological Preparation: Veterans can take advantage of experience. This could be especially valuable in controlling competition stress, and application of tactics and strategy.

Improved Sports Medicine: Improved training, which again includes weight training, along with better medical care, may provide athletes the ability to withstand the rigors of training and competition. This includes prevention, better treatment of injuries,

and rehabilitation. Surgical repair is an important factor in extending careers.

Professionalization of Sport: This cultural phenomenon has provided athletes with the financial support so an athlete can remain in sport longer, before having to go on to their "real world" career. Some examples are support through sport federations, endorsements, sponsorships, and prize money.
How old were the American teams in Athens?

Ages of USA Men's 2004 Freestyle Olympic Team (age on day of finals in Athens)

Wt. Class	Wrestler	Age
55	Stephen Abas	26.63
60	Eric Guerrero	27.29
66	Jamill Kelly	26.84
74	Joe Williams	29.76
84	Cael Sanderson	25.19
96	Daniel Cormier	25.44
120	Kerry McCoy	30.07
	Average	**27.32**

Ages of USA Men's 2004 Greco-Roman Olympic Team-(age on day of finals in Athens)

Wt. Class	Wrestler	Age
55	Dennis Hall	33.56
60	James Gruenwald	34.21
66	Oscar Wood	29.18
74	Keith Sieracki*	33.09
84	Brad Vering	27.01
96	Garrett Lowney	24.90
120	Rulon Gardner	33.03
	Average	**30.71**

* US did not qualify this weight class

Both American men's team's were mature groups. The Greco-Roman team average is over three years older than the Olympic champion average of 27.15. Veteran teams are what one would expect at the end of an Olympic cycle.

Ages of USA 2004 Women's Freestyle Olympic Team(age on day of finals in Athens)

Wt. Class	Wrestler	Age
48	Patricia Miranda	25.20
55	Tela O'Donnell	22.10
63	Sara McMann	23.91
72	Toccara Montgomery	21.65
	Average	**23.22**

The average age of this first American women's Olympic wrestling team is just over 23 years old. It will be interesting to track the evolution of this division. A shift towards older athletes is anticipated.

Beijing 2008?

Who will continue wrestling? This is a question all of our medalists field after they achieve Olympic success. Joe Williams and Sara MacMann both won bronze medals in the 2005 Budapest World Championships.

Then there are the athletes who know they are done. Certainly, Rulon Gardner made his intention known when he placed his ASICS wrestling shoes on the center mat after winning the bronze medal. Coach Steve Fraser says that Dennis Hall and Garrett Lowney are also retired. If Jim Gruenwald were to win gold in 2008, he would be the 5th oldest champion!

Chapter 3

Principles for Training Your Wrestlers

The training we put athletes through is done to teach them the sport and to improve their performance. Through the years, coaches, teachers and sport scientists have identified some key principles and concepts that can guide coaches to safely and effectively train athletes. These basic principles form the basis for this chapter, and can be successfully applied by coaches at all levels.

Principle of Adaptation

We know that our bodies undergo changes as a result of participating in a sport. Our bodies adapt to the particular demands placed upon it. When the body encounters a stress to which it is not accustomed, over a period of time it adapts so as to better meet this new stress. Just by doing the sport, these changes will occur. A person takes up cycling and will experience an increase in the strength and endurance of the thigh muscles; a kayaker will experience similar changes in the upper body muscles; soccer and basketball players will find increases in their ability to run harder for longer periods of time; and wrestlers will get stronger and larger neck muscles because of the unique stress applied to this region. During the earliest stage, the body will react by becoming sore and there may even be a decrease in performance, but this is followed by an adaptation which overshoots the starting performance level. Effective coaches take advantage of these adaptations by planning training sessions which will maximize the desired adaptations. Conversely, failure to use the basic training principles and concepts can also have a negative impact on sport performance.

Principle of Progressive Overload

Two important concepts are the foundation for all sports training-**overload** and **progression**. Overload is the stress mentioned in the previous paragraph to which the body is unaccustomed. A beginning wrestler engages in some activities where his partner is pushing the head down to execute a half-nelson. The first response will be soreness, but is quickly followed by an increase in the strength of these muscles allowing for a stronger resistance to this applied pressure. Progression involves increasing the overload. In this example with the neck muscles, coaches will further increase this overload by using specific exercises, such as bridges, that strengthen the neck musculature to even higher levels.

Principle of Specificity

Training adaptations are specific to the type of activity performed. For example, a swimmer must swim, or runner has to run, in order to effectively adapt to their particular sport. These adaptations are also specific to the manner in which the activity is done. If the runner is a sprinter, the training would emphasize shorter sprints, rather than the slower, longer distances of the distance runner. The weight training of a shot-putter would emphasize low repetitions done explosively, rather than slow actions with a high number of repetitions. The principle of specificity dictates that the training program must stress the physiological systems that are critical for top performance in the sport in order to get the necessary specific training adaptations.

In order to apply this principle, one has to have an understanding of the needs for the sport, along with a basic understanding of how the body produces energy for movement. During physical activity, the energy output from the working muscles can be 120 times higher than when at rest. Depending on the intensity and duration of the activity, the relative contributions of the body's various means for energy production will be different. There are three main energy systems our body's use to supply the energy for activity.

Immediate Energy: **The ATP-PC System** is an immediate source of energy0 for muscles, used within the first 5-15 seconds of activity. The energy is provided from the bonds in the phosphates adenosine triphosphate (ATP) and phosphocreatine (PC) stored in the muscles. There is enough stored energy from these sources to sustain all-out exercise for less than 10 seconds. Brief, maximal efforts, such as the beginning of a sprint, a maximum lift in weight lifting, or a double leg takedown, use energy from these stored phosphagens.

Wrestlers from the USOEC using sport specific equipment. Here they are shown training for the gut wrench with the "Bone" training dummy.

Short-Term Energy: The Lactic Acid System (also called Anaerobic or Glycolytic system) is an intermediate source of energy for high intensity activity and is used from the time that the stored energy already present in ATP and PC is used up (about 6 seconds in all-out activity) and can extend up to two minutes. This short term system actually "recharges" the ATP high energy bonds for further use. When ATP is used to transfer the stored energy to the muscles for work, one of the high energy phosphate bonds is broken and energy is released. This leaves adenosine diphosphate (ADP), and phosphate. The energy to recharge ADP back into ATP comes mainly from the sugar glucose. This blood sugar is also stored, and available in muscles as the chemical called glycogen. When glucose is split to recharge this ADP under intense conditions, it results in the formation of lactic acid. This short-term energy pathway, along with the energy from the already present in the immediate system, probably supplies about 90% of the energy for wrestling. Competitive, or live wrestling, uses an all-out effort from a large amount of muscles mass.

Why can we only use this system for only 1 to 2 minutes? As was stated, an intermediate by-product of this short-term energy system is lactic acid. Accumulation of lactic acid can increase to 25 times that over rest or light activity. This acidification Inhibits, or shuts down the enzymes which control these glycolytic (sugar splitting) reactions in the body. We have to stop, or at least lower the intensity of the activity.

Long Term Energy: The Aerobic System (also called oxidative system) is a long-term source of energy and can be employed for hours. It uses a constant supply of oxygen which can keep pace with the intensity of the activity. This is also the energy pathway used to complete the entire breakdown of glucose to water and CO_2, which during use of the anaerobic system ends with the temporary by-product of lactic acid.

Training the appropriate energy system results in physiological changes which will allow for greater energy production in the manner most suitable for the sport. Wrestling is an intense, short burst, explosive sport using predominately anaerobic energy sources (early in the match from the immediate system, then predominately from the glycolytic, or lactic acid system). However, it is a "mixed" sport, in that all three systems are used in both competition and training. While wrestlers do not need the endurance of a distance runner, a well-developed aerobic system will allow for some recovery of the lactic acid system following a flurry, or a break in the action. It also will allow for the most effective use of practice time.

Defining the needs of the sport is the first step in designing a good training program. We need to identify the factors that contribute towards success in wrestling. The next step would be to plan training activities that develop these factors, along with training the appropriate energy system. Some important components for wrestling are:

- Technique
- Aerobic Capacity –CV Endurance
- Anaerobic Capacity – high intensity actions
- Strength-both static and dynamic
- Strength Endurance
- Explosive Power
- Power Endurance
- Tactics & Strategy
- Flexibility
- Speed & Quickness
- Balance and Kinesthetic Awareness

Components of the Training Program are the variables that the coach can manipulate in planning workouts. These are **frequency** (the number workouts per week), **intensity** (the difficulty or pace of the training), and **duration** (the length of time of the training activity). **Volume** is a function of frequency and duration and gives the overall amount of training. **Interval Training** is a technique used by coaches to vary these components in individual workouts, and as the season goes on. This can mean lengthening the length of live wrestling, decreasing the rest interval, and increasing the intensity of the wrestling. This can be accomplished through using more challenging partners, rotating rested wrestlers onto the targeted wrestler, wrestling when pre-fatigued, and establishing the number of attacks that must be initiated in a particular time, to name a few methods.

Principle of Hard/Easy and Variability
Many athletes train hard every time they workout. Many coaches follow this regimen as well. Sport scientists are finding that continual hard training with little variation from high intensity and high volumes can lead to less than optimal adaptation, or worse yet, a decrease in performance. This can also explain the success and popularity of "cross-training" used to break up the routine.

Principle of Periodization is defined as the gradual cycling of the components of the training program so as to achieve top levels of fitness/performance at the right time of the year. The term **peaking** is used to describe this situation. It makes no sense to be in this peak state for early season dual meets and to be worn out by the time important tournaments come towards the end of the season. Application of periodization requires planning in advance. Some coaches of elite athletes begin their planning around the four-year Olympic quadrennium. More frequently, one begins with an annual cycle. In periodization terminology, this is referred to as a **macrocycle**. This macrocycle is further divided into 1-3 **mesocycles** which represent the most important competitions. Because of a shorter season, a plan for high school team might have just one mesocycle, built around the end of the season state tournament series. It could also add an additional mesocycle that builds towards important summer competitions. The guiding principle is to begin with a high volume of more general activities and gradually move towards a decrease in volume and an increase in intensity with more specific drills and exercises. Each mesocycle is broken down into periods of preparation, competition, and transition. In the **preparation** phase practices consist of a higher number of repetitions in drilling and exercises. There may be more technique work performed at a slower speed. Aerobic work may take the form of distance runs. Volume is gradually built up to high levels. It is important to note that there may be competition during this time, but it is not most important target of the training. As the **competition** phase is begun, the intensity is elevated. There may be less work on presenting new technique, drilling is faster, there is more live wrestling, sprints replace distance runs. There may be reductions in rest intervals and fresh partners are rotated onto one wrestler. All of these methods increase the intensity.

What happens if the practices and training continue with both high volume and high intensity? A decrease in performance is a likely result. This phenomenon is called **overtraining**. An older term that used to describe this condition was "staleness." How can overtraining be avoided? Coaches must plan for allowing the wrestlers to recover. One technique is to apply the **principle of hard/easy**. Within the weekly cycle there can be a variation of intensity and volume, so that hard workouts are followed by an easier day, allowing for recovery from the breakdown that accompanies high intensity training and subsequent adaptation. Another training concept is that of **tapering**. This is part of the process discussed earlier, where volume is reduced and intensity is increased, but it is employed a bit closer to the actual important competitions. During a taper, practices can still be intense, but they are shorter. The morning workout may not be held. Recovery therapies, while always important, are now emphasized. These may include ice, massages, relaxation activities, more post-practice stretching, increased sleep, and optimal nutrition and hydration

schedules. The need for wrestlers to make weight, makes the more dramatic pre-competition resting, seen in some runners and swimmers, more difficult to employ.

The **transitional phase** follows the competition and in an annual cycle where there is only one peak, or mesocycle, might be called the off-season. In a plan where there is to be another mesocycle or peak, this period is highlighted by less intense training, a higher volume of general training, and "active rest." Active rest could include playing other sports, light lifting, and rehabilitation from any nagging injuries.

An important note when discussing the cycling of intensities and the volume of the training load in a periodized scheme is that even though the plan may call for an easier period following one of high intensity, training does not return to the level of the previous cycle. It is more of a staircase model, where the training load builds on the previous level of adaptation, and goes to a higher level.

The final training principle, which makes us come back to the realization that coaching is still as much an art, as a science, is the **Principle of Individuality.** Because of our genetic make ups, not every person responds to training in exactly the same way. The adaptation response to a particular training regimen will not always be the same. Scientists have identified the concept of "responders" and non-responders" in an athlete's adaptation to particular training programs. Ultimately, coaches must take into account the specific needs and abilities of their wrestlers as they plan their training programs.

Suggested References

Wilmore, J.H., & Costill, D.L. (2005). *Physiolgy of exercise and sport* (3rd ed.). Champaign, IL: Human Kinetics.

Bompa, T.O. (1999). *Periodization-Theory and methodology of training* (4th ed.). Champaign, IL: Human Kinetics.

Chapter 4

Doping in Wrestling

The drug revelations of the past year have shocked the entire sports world. The use of the previously undetectable steroid THG has been widespread-from baseball, to football to track and field. Allegations are rampant and drug testers have handed out numerous suspensions. Drug testing agencies seem to be making some gains in cleaning up sport. Here is some information concerning drug testing and drug use in sport, and wrestling in particular.

History of Drug Use

In international sport, the term doping is used to describe the use of illegal substances or processes used to enhance performance. Doping in sport has a long history. Strychnine, caffeine, cocaine, and alcohol were used by endurance athletes, especially cyclists in the late 19th century. Restrictions were adopted by the track and field federations, but because there was no testing, these were ineffective. The types of stimulants used expanded to include amphetamines, and after the death of a cyclist in the 1960 Rome Olympics whose autopsy revealed amphetamines, there were increased calls for testing. During the 50's and 60's there was also growing use of synthetic hormones-anabolic steroids. The abuse was seen most readily in strength and power sports.

History of Testing

The first testing in the summer Olympics was done in Mexico City in 1968 and mainly included stimulants. Testing for anabolic steroids began in 1976. Early testing was done only at the competition.

Doping scandals in cycling, the exposure of the East German systematic doping program, along with the need to develop a unified and consistent approach to doping in all sport, led to the establishment of an independent, international organization- the World Anti-Doping Agency (WADA). WADA took over the testing of athletes at the Sydney Olympics. It is in a better position to conduct the all–important out of competition testing of athletes. Without unannounced testing during training, athletes could easily avoid detection by discontinuing use of drugs in enough time for the body to clear these substances and yet still have the desired effects for competition. This organization is in a more powerful position to avoid the legal entanglements that put the decisions of sport federations into civil courts and often made the program ineffective.

FILA

The history of testing in international wrestling is contained in the Chart 1. Except for the use of the pain-killer xylocaine and furosimide, all illegal substances were anabolic steroids. Furosimide is a diuretic that can help to "mask" the use of steroids. Three golds and one silver medal have been lost because of drug use. It is worth noting that in the first Olympics with women's wrestling, a wrestler tested positive. Obviously, these are just the athletes who were caught. Before out of competition testing, there were several countries where the use of steroids was suspected.

USADA and USA Wrestling

The agency responsible for testing in the U.S. is the United States Anti-Doping Agency. Since 2000, USADA has been responsible for managing both, In- and Out-of-Competition testing for athletes in U.S. Olympic sports including Olympic, Pan American, and Paralympic athletes. Wrestlers are tested at the Senior Nationals and World/Olympic Trials. Out of competition testing is performed on wrestlers from a list provided by USA Wrestling. This is generally the National team or top three rated wrestlers. Some of our top wrestlers have been tested five times per year. There have been very few positives by US wrestlers. Since USADA took over testing there has been one positive for steroids (out of competition testing) and one for stimulants (in competition). There was also one positive for steroids by an American wrestler in the 1995 World Cup.

Drug use by American wrestlers does not seem too much of a problem. The biggest problems are at the administrative end. Mitch Hull, Director of National Teams for USA Wrestling, says that his biggest worry is not a positive test on a drug test, but rather the quarterly filing of athlete location forms for out of competition testing. Failure to file counts as a missed test. Three missed tests counts as a positive test!

NCAA Competition

The testing of NCAA athletes is done by the National Center for Drug Free Sport. It grew out of the NCAA's Dept. of Sport Sciences. The NCAA's first testing was done with football bowl games in 1986. In 1990 it was expanded to year round testing of football players.

Today, the NCAA tests at selected championships and year-round random testing of all athletes in Division I and II. 13,000 athletes were tested last school year. Not all championships events have testing. There is a rotation that is random and not announced in advance. In 2003, testing took place at the nationals in wrestling for Division I, II, and III. Out of 88 tests, there was one positive test. This was at Division III where a wrestler tested positive for the banned stimulant ephedrine.

High Schools

Testing at the high school level is almost nonexistent. There are only a handful of schools which test athletes. Most of these focus on recreational drug use and not performance enhancers such as steroids. Steroid testing is much more expensive.

Therapeutic Exemption

What if an athlete needs a drug that is on the banned list (asthma medication for example)? In some cases, doctors can prescribe another drug that is not banned. If this is not possible, an exemption form is filed with the governing agency. Lists of banned substances are available for the NCAA at www.ncaa.org/health-safety. The WADA list for other amateur competition is available at: www.usantidoping.org

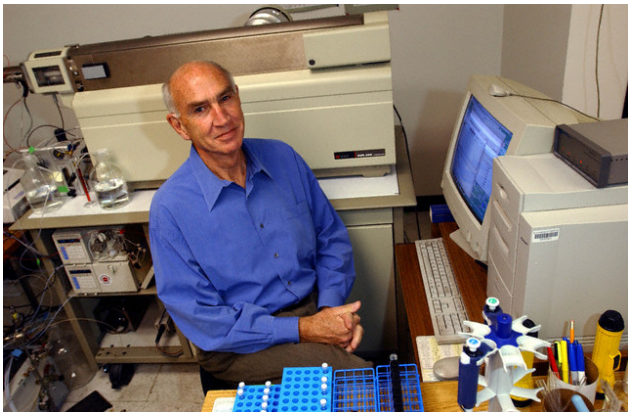
Supplements

Each wrestler is responsible for what goes into his/her body. The use of nutritional or dietary supplements poses some risk. There are many products available in health food stores or vitamin shops which will cause a positive test. There is the additional problem that many of these products may contain very small amounts of banned substances not listed on the label. BE CAREFUL! Talk to your trainer, dietician or team doctor.

Future

Both the USADA and WADA are funding research. In order to stay ahead of drug cheats, tests for drugs currently abused, along with others on the horizon, need to be developed. For instance, there is good news; there is now a test available for human growth hormone (hGH). It is more difficult to detect the use of drugs that occur naturally in the body. 10% of the over 3,000 drug tests performed in Athens included testing for hGH. There were no positives.

Train hard, stay healthy, compete clean and have a great career!



Dr. Donald H. Catlin, director of the Olympic Analytical Laboratory, sits in front of a LC/MS/MS system, one of the instruments used in analyzing extracts from urine samples, at the drug-testing UCLA Olympic Analytical Laboratory. Dr. Catlin headed a team of eight chemists that cracked the code of the undetected steroid tetrahydrogestrinone, or THG, using high tech screening devices and developed a test to detect it in users.

Chart 1: Drug Violations in World and Olympic Competition
(information provided by FILA)

Competition	Year	Name	Wt. Class	Country	Drug	Result
Los Angeles Olympic Games-GR	1984	Tomas Johanssen	+100kg	Sweden	Primobolon/Methenolone	Loss of Silver Medal, 18 month suspension
Seoul Olympic Games	1988	Alidad	62 kg	Afghanistan	Furosimide	
World Championships-FS	1993	Abbas Jadidi	90 kg	Iran	Nandrolone	Loss of Gold medal-2 year sanction
Junior World Championships-FS	1998	Mazid Kodaei		Iran	Nandrolone metabolites	2 year sanction
World Championships-FS	1999	Joel Romero	85 kg	Cuba	Xylocaine	Warning
Junior World Championships-FS	1999	Bahram Abeddi	76 kg	Iran	Anabolic steroids	2 year sanction
Junior World Championships-FS	1999	Mehdi Nikmanesh	58 kg	Iran	Anabolic steroids	2 year sanction
World Championships-GR	1999	Jamshidi Behrouz	85 kg	Iran	Nandrolone metabolites	2 year sanction
Sydney Olympic Games-FS	2000	Alexander Leipold	76 kg	Germany	Norandrosterone/ norethiocholanolone	Loss of Gold Medal-2 year sanction
Sydney Olympic Games-FS	2000	Oyunbuleg Purevbaatar	58 kg	Mongolia	Furosimide	2 year sanction
Sydney Olympic Games-GR	2000	Fritz Aanes	85 kg	Norway	Norandrosterone/ noretiochlanolone	2 year sanction
World Championships-FS	2002	Harun Dogan	60 kg	Turkey	Norpseudoephedrin	Loss of Gold Medal-2 year sanction
World Championships-FS	2002	Ahmet Gulhan	74 kg	Turkey	Norpseudoephedrin	2 year sanction
Athens Olympic Games-Women	2004	Mabel Fonseca	55 kg	Puerto Rico	Stanozolol	2 year sanction

Suggested Reference

World Anti-Doping Agency: http://www.wada-ama.org/en

Chapter 5

Ringworm (Tinea Corporis) - What's New?

Skin infection is a very important topic in sports medicine for wrestling. It can have a huge negative impact on individual wrestlers, who can be held out of competition, and also, can create a negative impression of our sport in the general public. The organisms causing skin infections are found every where, but the conditions under which we train and compete, make the prevalence of skin infections higher than in many other sports. There are three groups of microorganisms that cause the vast majority of skin infections in wrestling. These are viruses (responsible for herpes), bacteria (responsible for impetigo and boils), and fungi (responsible for ringworm). This chapter will focus on ringworm and its treatment and prevention.

Typical Tinea Corporis Infection

Despite the name, ringworm is a plant. There are no worms! This type of fungi that grows in skin, are called dermatophytes. They digest a protein in the skin called keratin. Growth of these fungi begins when the spores, which are like the microscopic "seeds" that enter the skin and begin to grow. The growth pattern for ringworm infections are circular patches with scaly, raised borders. Healing in the center produces the typical ring effect. However, rings are not always present. Some people can carry the spores without any itch or rash appearing.

In medical terms we use the word tinea to mean a fungal infection of the skin. There is tinea corporis (body), tinea capitis (head), tinea pedis (athlete's foot), and tinea cruris (jock itch). Ringworm in wrestlers is also referred to as tinea corporis galdiatorum. The conditions necessary for the growth of tinea include: a warm, moist, and dark environment; abrasions; and direct skin to skin contact. Sounds like a wrestling room! The results of a study of high school wrestling teams in Pennsylvania, showed 87% with at least one wrestler with ringworm. Historically, ringworm was often ignored or tolerated. Most cases do not have serious effects, but there has been, and rightfully so, a heightened awareness of the possible transmission of all diseases through competition.

The guidelines set forth by the National Federation of High School Associations require that a wrestler with a skin lesion (sore or rash) have a doctor's authorization to compete. This form states that the condition "is not communicable." The NFHS recommends that standard for this non-communicable state is reached after one week of treatment (two weeks if in the scalp). The NCAA has a standard of 72 hours post-treatment before return to competition. The NCAA also allows the covering of a single lesion, whereas this is not allowed in high schools. The facts are that we do not know at this time with certainty when this non-contagious stage is reached. It seems to be quite variable. Adding to this uncertainty is the fact that there are some people who carry the spores and do not show any outward symptoms, but can be the source of infection in others.

Thankfully, there are a variety of effective drugs. There are over the counter topical creams. Some of these anti-fungals include Desenex, Aftate, Cruex, and Tinactin. More recently, Lotrimin and Lamisil have been added to the arsenal. Lamisil is the medicine of choice given to me by a number of well-respected dermatologists. Wrestlers and trainers would be smart to have a tube in their sport bags. According to Dr. Lawrence Johnson, a dermatologist from Geneva, IL who has worked with USA Wrestling, early lesions of the skin may be difficult to distinguish between herpes, dermatitis, early impetigo, or ringworm. Treatment by these medications are extremely safe, so even if the condition is misdiagnosed for a day by the wrestler, there is no risk posed by using the ointment. It is very important to obtain a definite diagnosis by a dermatologist. There have been cases when, because of the itch involved, wrestlers will use a hydrocortisone cream. This drug can diminish the symptoms for a while, but the next flare-up will be severe. Oral medications are also available. These are prescribed in cases involving the scalp, where there are multiple lesions, or sites of infection, in cases of multiple infections on a team, and use to prevent

outbreaks in wrestlers who have a history of infection. Dr. BJ Anderson of Minneapolis, has written extensively on this subject and works with many wrestlers, recommends oral Lamisil. He feels that drugs like griseofulvin and fluconazole (Diflucan) are also effective, but for the combination of effectiveness and safety, it is hard to beat Lamisil. If these drugs are prescribed for a period greater than several weeks, liver function is monitored, as there can be some toxicity. Finally, none of these medications are cheap!

The prevention of ringworm infections includes regular screening of wrestlers by a dermatologist, or an athletic trainer who has experience with skin diseases. While the use products such as Kenshield may provide some benefit by providing an actual barrier to the spores, there is no evidence to suggest that it is superior to a program of inspection and quick response. Personal hygiene is of course important. This includes clean workout gear, and showering (including the scalp) right after wrestling. The mat surface should be kept disinfected. This includes reducing the tracking of spores into the area with foot traffic. Some coaches and trainers have their athletes put on their wrestling shoes at matside. To minimize the chance of abrasion, some coaches make sure that the practice gear is smooth and non-abrasive.

While mat surfaces have traditionally received a great amount of attention, studies attempting to cultivate cultures from the surfaces of mats have not been conclusive. Most research stresses the role of skin to skin contact. The vast majority of ringworm infections are found on the upper body. If the mat was the primary mode of transmission, this would not be the case. Anderson attributes the rise in cases of ringworm to the changes we have seen over the last generation, with more emphasis on wrestling on the feet in a contact position. He reviewed old footage and compared to recent matches and found approximately a 30% increase in the amount of head to head, or tie-up contact.

Dr. Tom Kohl, of Reading, Pennsylvania has also done extensive research on skin infections in wrestling. Some of his most recent work has been in the area of ringworm "carriers." These are the people who do not exhibit infections, but carry the spores in their scalp, and can be big time transmitters of ringworm. In my conversation with Dr. Kohl, he stated that he is recommending the periodic team use of Nizoral AD® shampoo. This shampoo is now available over the counter, and has the anti-fungal medicine ketoconazole. He feels this may be effective with these "carriers" with teams experiencing persistent outbreaks.

Prophylactic drug therapy (this is the medical term used to describe the use of a drug to prevent contracting a disease) is being used by some dermatologists. Anderson uses Lamisil, whereas Kohl uses a one time per week "pulse" dose of Diflucan. This prophylactic medication is used as teams approach tournament season.

Teams must align themselves with a dermatologist. Dr. Johnson is a great example of a dermatologist who works with local wrestlers from surrounding teams. The high school trainers know that they can refer wrestlers to him and he will see them at the end of regular office hours. Dr. Johnson stresses the need for informed, expert judgment in deciding on the appropriate course of action for individual wrestlers. The time in the season, the level of the wrestler, medical history, family concerns-all of these factors and more go into a decision. Early in the season, he says he is more conservative. Some wrestlers may think that a lesion is ringworm, when in fact it is something else. There is also the possibility of infections with more than one type of organism. Go with an expert who is familiar with wrestling!

Maybe in the future there will be a vaccine or immunization for tinea. At this time, cleanliness, frequent inspections, rapid diagnosis and treatment by a dermatologist, and perhaps even the implementation of some preventative drug therapy, are all weapons to control this problem.

Possible Antifungal Medications for Use With Tinea Corporis (Ringworm)

Drug	Trade name
Tolnaftate	Tinactin - OTC Aftate - OTC
Undecylenic acid	Desenex - OTC Cruex - OTC
Griseofulvin	Grifluvin V ℞ Gris-PEG ℞
Itraconazole	Sporanox ℞
Ketoconazole	Nizoral ℞ Nizoral Shampoo OTC
Oxiconazole nitrate	Oxistat - ℞
Sulconazole	Exelderm - ℞
Fluconazole	Diflucan ℞
Miconazole	Micotin - OTC
Clotrimazole	Lotrimin -OTC Lotrisone (also contains a steroid betamethasone for inflammation - ℞
Econazole	Spectazole Cream - ℞
Butenafine	Lotrimin Ultra - OTC
Naftifine	Naftin - ℞
Terbinafine	Lamisil Topical Cream-OTC Oral - ℞

OTC - over the counter
℞ – by prescription

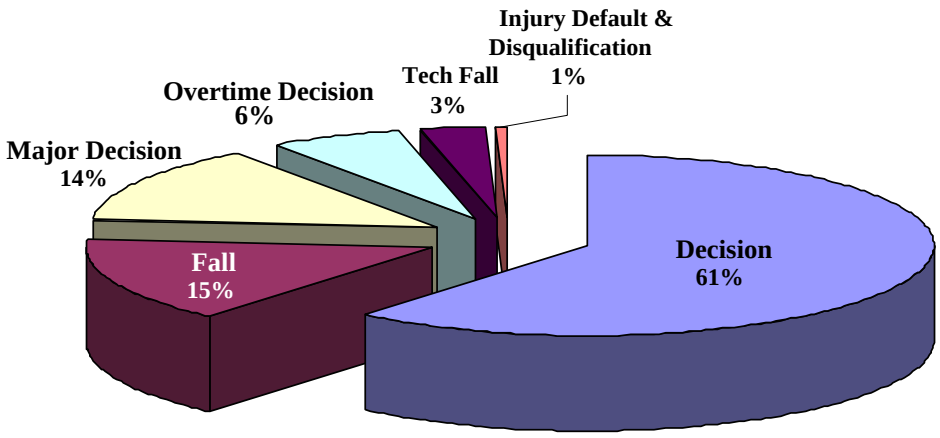
Chapter 6

Scoring Patterns in High School Wrestling

What are the trends in scoring in high school wrestling? What is an "average" score? What percentage of matches end in a fall? How often is the wrestler who gets the first takedown, the winner of the bout? What is the percentage of matches going into overtime? I am in the middle of an analysis of high school wrestling that includes a breakdown of the scoring. I obtained the bout sheets from the 2004-05 Illinois Individual State Championships and entered them into an excel database for analysis. I have looked at all of the championship bouts from the larger of the two classes – AA. Illinois is a strong wrestling state with a rich tradition. The earliest dual meet on record dates back to1926. The Illinois State Tournament started in 1937, and until 1983, the state team champion was determined from the individual state finals tournament. Since that time a dual meet tournament winner has been crowned the state champion. This of course, can have an impact on the results obtained, since there is not the same incentive to go for the extra points for a fall or a major decision. Despite this limitation, the following data should be quite representative of high level high school wrestling.

The scoring from 322 bouts was broken down and yielded the following information shown in Chart 1.

Chart 1. Match Outcomes by Percentage



Match Outcome	#	%
Decisions (regulation)	198	61%
Falls	49	15%
Major Decisions	44	14%
Overtime Decisions	20	6%
Tech Falls	9	3%
Injury Default	1	-
Disqualification	1	-

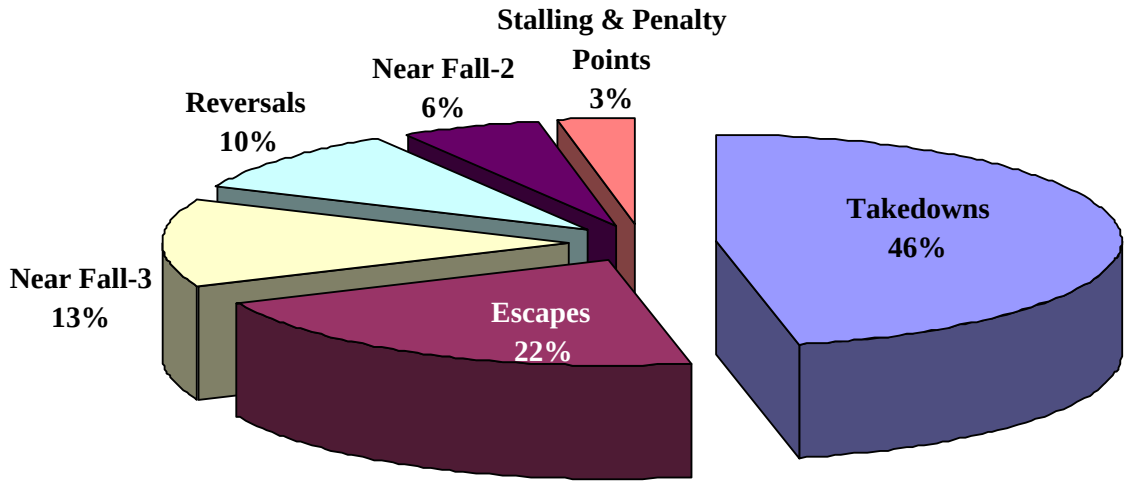
Of the 20 overtime matches, 15 ended with a takedown in the first overtime period. In the remaining five bouts that moved to the 30 second tiebreaker, all of the wrestlers who had the choice of starting position, chose down; of these matches, 3

wrestlers escaped, 1 gained a reversal, and one wrestler rode for the win.

Looking at the bouts broken down by the various types of scores is shown in Chart 2. The importance of takedowns is obvious. One does not see the variety of rolls and other reversals from past generations. Near fall points combine for just under 20% of all points. There were 174 warnings for stalling, with the majority given in the 3rd period. 42 of 60 points for stalling were given in the 3rd period. Some coaches feel that officials penalize a wrestler in the 3rd period for what was allowed in the earlier periods. While not listed on the chart, trainers and administrators should be aware that blood time was taken in 15% of the bouts and injury time in 17% of the bouts. A good training staff and blood cleanup crew are necessary for the smooth conduct of all wrestling competitions.

Most coaches stress the importance of the first takedown. The only published data I could find on this is an article written in the 1977 by Richard Maertz in ***The Athletic Journal*** *(The initial takedown and wrestling outcome, pp 54-55)***.** He summarized his master's thesis in this article on initial takedown and match outcome and found that 76% of matches were won by wrestlers who got the first takedown. I was interested to see if this percentage has grown since this research was done, especially in light of the increased emphasis on takedowns since that time. While I was expecting a higher number, my data from Illinois showed a 79% win rate for the winner of the first takedown.

Chart 2. Distribution of Total Match Points

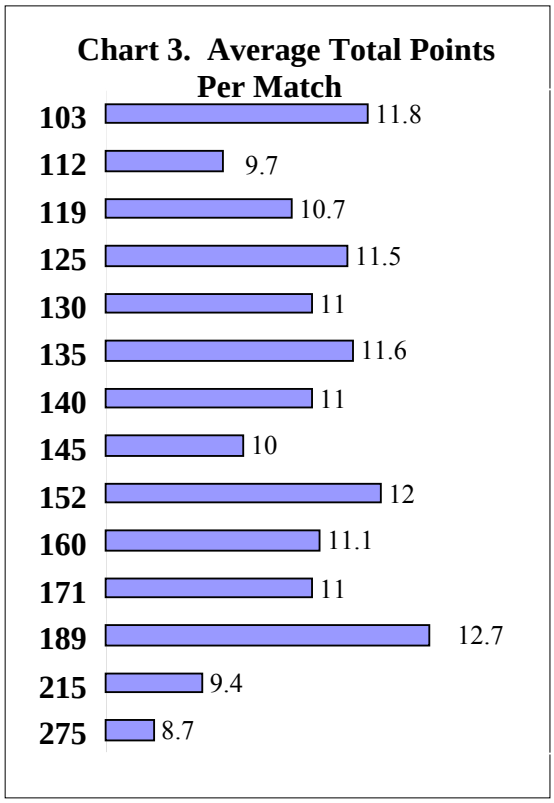


Type of Score	Percentage of Total Points
Takedowns	47%
Reversals	9.7%
Escapes	22%
Near Fall-2	5.7%
Near Fall-3	13.5%
Stalling Points	2%
Penalty Points	1%
Cautions	0nly 4 for .01%

Scoring by period in regulation gave the following results: 1st period -30% of match points; 2nd period – 35% of scoring; and 3rd period – 35%. This probably reflects a stronger defense while the wrestlers are fresh.

The average score of all matches was approximately an 8-3 result.

Scoring by weight class is shown in Chart 3. It lists the average total points for the matches in each weight class.



The 189 pound class leads the way with 12.7 points per match. I was a bit surprised to see this result, along with the lower average of the 112 pound class, as the lower weight classes are usually associated with high scoring bouts.

Scoring by Champions

Scoring analysis done for FILA World Championships by Dr. Harold Tünnemann of the Institute of Applied Training in Germany, uses a scoring coefficient which is based on points scored, minus points given up, divided by the elapsed time. I applied this to the champion's performances for each weight class and came up with the following results.

Weight Class	Scoring Coefficient
103	.73
112	1.29
119	1.13
125	.77
130	1.10
135	1.18
140	.79
145	.63
152	1.14
160	.94
171	.85
189	.79
215	**2.24**
275	.71

The 2.24 scoring coefficient by the 215 pound champion indicates a dominating performance which included scoring 50 points in 4 matches, while giving up only 7 points. Another performance of note is the 1.10 value in the 130 pound class, where a tremendously stable defense did not yield a single point in four matches!

While I feel that these results are fairly representative of our sport, more work can be done. We can do these studies in other parts of the country to see how they compare-maybe using the results from the Senior Folkstyle Nationals. By establishing some baselines, we can see the impact of rules changes and follow the evolution of our sport. This is fertile ground for some of you coaches out there who are looking for thesis topics for advanced degrees. Charting the use of the actual techniques used in scoring points is another needed line of research.

Chapter 7

Wrestling Weight Classes – Providing a Scientific Rationale

Wrestling is one of several sports employing weight classes for competition. Recently, the international governing body of wrestling (FILA) has been under pressure from the International Olympic Committee to reduce the number of classes. The number of classes was reduced in 1997 from 10 to 8, with a further reduction to 7 in 2001. This paper will review the history of weight classes in the sport, and attempt to put forth a rationale means for the establishment of a weight class model for the future. Weight classes are used in several sports. These include the combat sports of wrestling, boxing, judo, taekwondo, and also weight lifting and rowing. They are used to provide athletes fair competition, opportunity for athletes of various sizes, and safety. The following section lists these sports and the weight classes currently used in competition.

Rowing (2 weight classes) The Olympic rowing program underwent a change beginning at the 1996 Olympics, with the introduction of lightweight events. The men's events include e lightweight double sculls and lightweight coxless fours and the women's events have lightweight double sculls. The weight limits for lightweight events are as follows: individual women must not weigh more than 59 kg, with the average crew weight no more than 57 kg; individual men must not weigh more than 72.5 kg, with the average crew weight being no more than 70 kg.

Table 1: Olympic Combative Sports, plus Weightlifting that Utilize Weight Classes (all weights in kg)

Boxing	
Men only (12)	48, 51, 54, 57, 60, 63.5, 67, 71, 75, 81, 91, +91
Judo	
Men (7)	60, 66, 73, 81, 90, 100, +100
Women (7)	48, 52, 57, 63, 70, 78, +78
Taekwondo	
Men (4)	58, 68, 80, +80
Women (4)	49, 57, 67, +67
Weightlifting	
Men (8)	56, 62, 69, 77, 85, 94, 105, +105
Women (7)	48, 53, 58, 63, 69, 75, +75
Wrestling	
Men (7)	55, 60, 66, 74, 84, 96, 120
Women (7)	48, 51, 55*, 59, 63*, 67*, 72*

The next chart shows the evolution of weight classes used since the first organized world championships in Greco-Roman wrestling in 1904. In the first modern Olympics held in Athens in 1896, there was only a single class, without limits. The number of classes grew incrementally, reaching a high of 10 classes in 1969. Wrestling is the only sport that imposes a limit on the highest weight class. It was first imposed in 1985 with a limit of 130 kg. It has further been reduced to 120 kg in 2002. The number of classes remained at 10 until 1997, when the classes were reduced to 8. This was further reduced to 7 classes in 2002. The impetus for this reduction has come from the IOC in an effort to stem the growth of the Olympic Games. During this time period, women's wrestling has been recognized, with the first FILA sponsored World Championships held in 1987. Women's wrestling will be included in the Olympics for the first time in Athens, 2004.

The reduction in the number of weight classes has been met with concern within the wrestling community and has focused attention on the rationale behind the changes, and ultimately in this paper, the identification of a scientific rationale for the establishment of a weight class system.

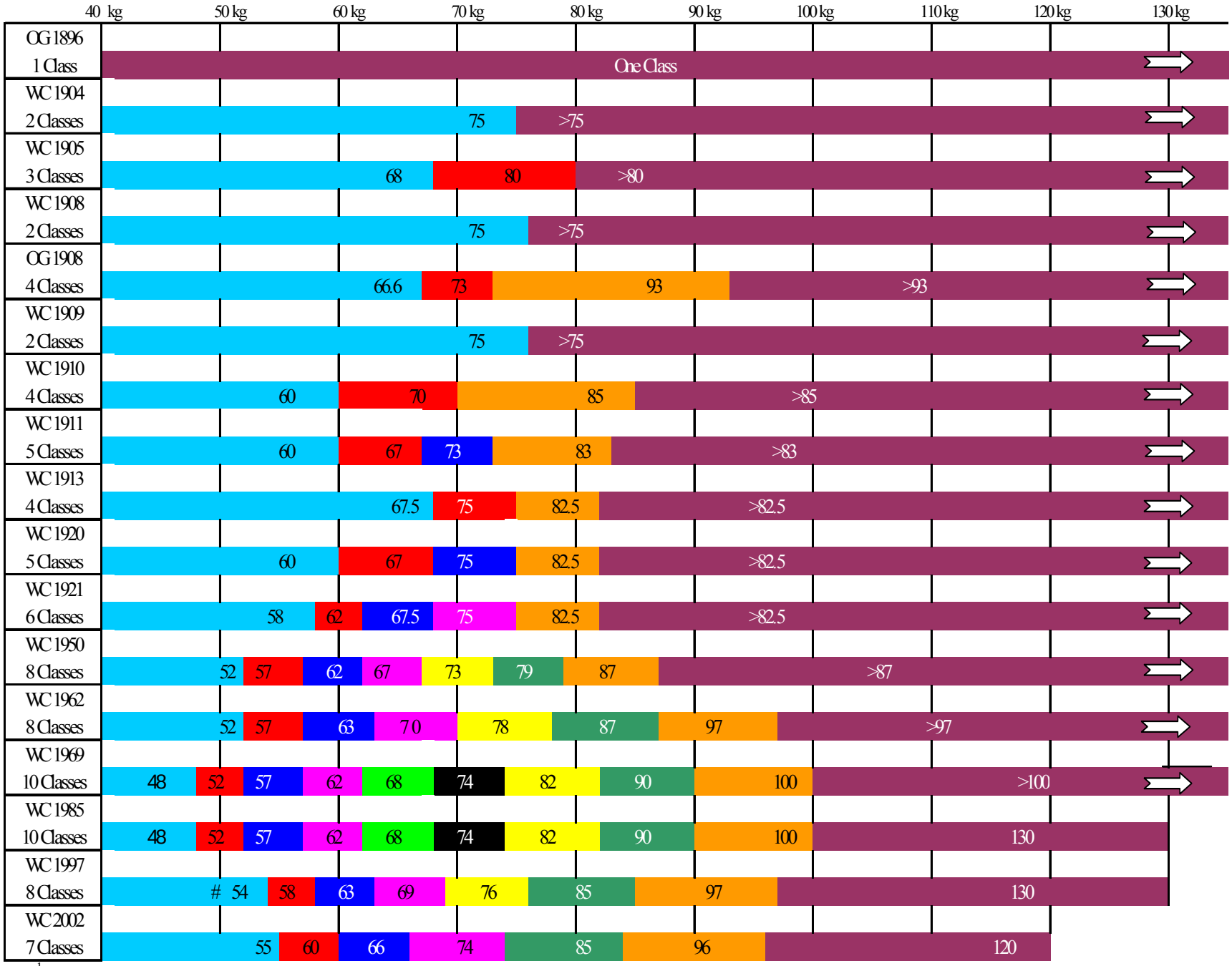
The use of weight classes is based on an assumption that differences in body weight can create an unfair advantage for the larger wrestler, and therefore the establishment of weight classes is a rationale solution to this inequity created by differences in size. In order to address the problem from a scientific standpoint, it seems that the establishment of weight classes for world class competition for mature men and women requires two sets of information. These were distilled from comments requested from several experts in the field of wrestling and body composition and anthropometry. There are two major approaches: (1) Use population distributions to ensure fairness of access; and 2) Determine a means of scaling the effects of differences in body weight to equilibrate these effects in a competitive situation. This second approach is not easily defined.

The first modern Olympic wrestling champion was Karl Schumann of Germany. There was only one class. Schumann also won three gold medals in the gymnastics competition.

Heavyweight Limits

Beginning with the 1985 world championships, FILA instituted a maximum weight of 130 kg (286 lbs.) for the highest weight class. A similar limitation was made for U S collegiate wrestlers in 1986, when the NCAA established the 275 lb. class (123.8 kg). Health and safety of the participants was cited by the NCAA Committee on Competitive Safeguards and Medical Aspects of Sports in the development of this rule change. This entailed concern for the potential mis-matches in size, as well as the health risks present in when an athlete is in the 300-400 pound range. In regard to the former, there was no data cited that documents excessive weight difference causing injuries in the heavyweight class. The concern for the health of the athlete outside of competition centered around the following: 1) encourage the athletes who were obese to move towards a lower, and healthier weight and lifestyle; 2) discourage the practice of artificially inflating the athletes size by way of tremendous caloric intake; and 3) discourage the use of ergogenic aids, such as anabolic steroids, in their quest to become larger. There is no data that has tracked the success of the rule change in achieving the goal in #1. While there are some athletes who have lost weight to wrestle in this class, many of these huge athletes probably just quit the sport. It is not clear how the limit was established by FILA. A review of the heavyweight class is found in chapter 9.

Chart 1: Evolution of Weight Classes Used in Olympics (OG) and World Championships (WC)[1]



[1]Weight Classes from FILA Database Provided by IAT, Leipzig

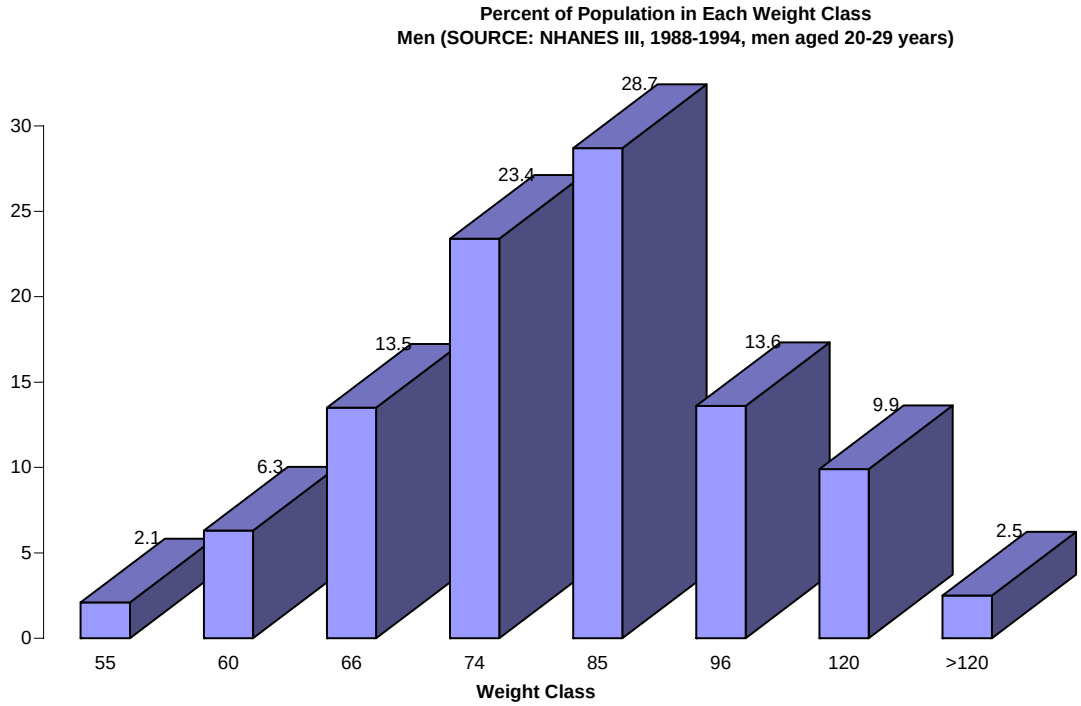
Use of Population Distributions to Create Fair Access to the Sport

Statistics from the NHANES III 1994 Survey are available for the United States. The National Health and Nutrition Examination Survey (NHANES) is a survey conducted by the National Center for Health Statistics (NCHS). Data listing the distribution of body mass (weight) for the age range of the competitors was studied. Since the mean age of the wrestling champions in the 2000 Olympic Games was 25.5 (FS) and 26 (GR), the range of data selected was for the span of 20-29 years of age and is listed in Table 2. One can then examine the current weight classes and see the percentage of the population that falls in each weight class. This was done using the current FILA weight classes for senior competition. The results are shown in Charts 2 and 3 for men and women, respectively.

Table 2: Weight (kg) at each centile for U.S. men and women aged 20-29 years

Centile	Men	Women	Centile	Men	Women	Centile	Men	Women
1	52.95	42.40	34	69.95	56.30	67	82.05	66.45
2	54.95	44.05	35	70.25	56.45	68	82.35	67.23
3	55.95	45.00	36	70.50	56.65	69	82.80	67.70
4	57.20	45.95	37	71.10	57.05	70	83.05	68.05
5	57.70	46.65	38	71.45	57.30	71	83.80	68.45
6	58.50	47.25	39	71.81	57.55	72	84.05	69.25
7	59.40	47.80	40	72.15	57.65	73	84.35	69.65
8	59.90	48.10	41	72.40	57.85	74	84.90	70.70
9	60.35	48.55	42	72.65	57.90	75	85.60	71.55
10	60.95	49.10	43	73.20	58.35	76	86.30	72.30
11	61.80	49.55	44	73.60	58.60	77	86.70	72.90
12	62.00	49.75	45	73.90	58.85	78	87.45	73.65
13	62.40	49.80	46	74.15	59.15	79	88.35	74.60
14	62.75	50.45	47	74.25	59.45	80	89.60	75.20
15	63.10	50.55	48	74.65	59.75	81	90.25	75.95
16	63.85	50.80	49	74.85	59.85	82	90.75	76.50
17	64.15	51.20	50	75.35	60.50	83	91.90	77.75
18	64.70	51.55	51	75.70	60.80	84	92.50	78.50
19	65.00	52.10	52	76.15	61.10	85	93.65	79.85
20	65.50	52.35	53	76.60	61.65	86	94.45	80.45
21	65.70	52.45	54	76.95	62.00	87	95.45	81.05
22	66.05	52.75	55	77.25	62.65	88	96.60	82.90
23	66.40	53.20	56	77.60	63.05	89	98.05	84.35
24	66.80	53.40	57	77.90	63.30	90	99.40	86.60
25	67.10	53.60	58	78.05	63.55	91	101.10	88.65
26	67.50	53.90	59	78.45	63.80	92	102.85	90.65
27	67.75	54.30	60	79.05	64.15	93	104.70	91.80
28	67.90	54.75	61	79.60	64.55	94	105.95	94.55
29	68.10	55.05	62	80.00	64.95	95	107.70	99.05
30	68.55	55.25	63	80.35	65.10	96	112.40	100.15
31	69.10	55.50	64	80.75	65.45	97	115.50	102.05
32	69.30	55.75	65	81.05	65.90	98	123.00	105.05
33	69.70	56.15	66	81.30	66.25	99	130.45	114.65

Chart 2: Percentage of U.S. men aged 20-29 years classified by wrestling weight categories

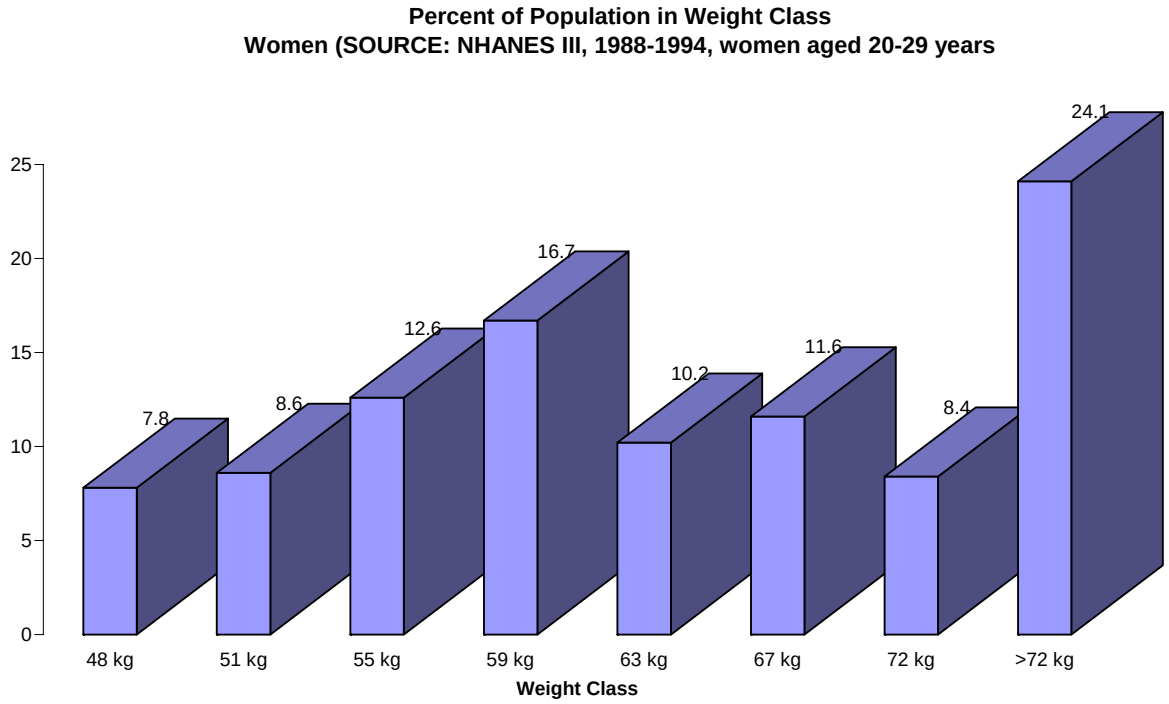


Men's Weight Classes	Percentage of Men
55 kg	2.1
60 kg	6.3
66 kg	13.5
74 kg	23.4
85 kg	28.7
96 kg	13.6
120 kg	9.9
(>120 kg) Outside competition limits	2.5

SOURCE: NHANES III, 1988-1994, men aged 20-29 years (n = 1,639)

One can see that the potential number of athletes is much higher in the middle weights. The 85 kg class has the highest potential with almost 29% of the population. The heavyweight limit theoretically eliminates 2.5% of the population. More weight classes in this region is called for to make the access to competition more equitable. While there are only 2.1% of this population in the lowest weight class, one must remember that this is U.S. data. Other data sets need to be investigated. It is likely that some countries have body mass distributions that have smaller people. For instance, athletes from the Peoples Republic of Korea won the FS 48 kg weight class in the 1986 and 1987 World Championships, and also the 1992 and 1996 Olympic Games.

Chart 3: Percentage of U.S. women aged 20-29 years classified by wrestling weight categories

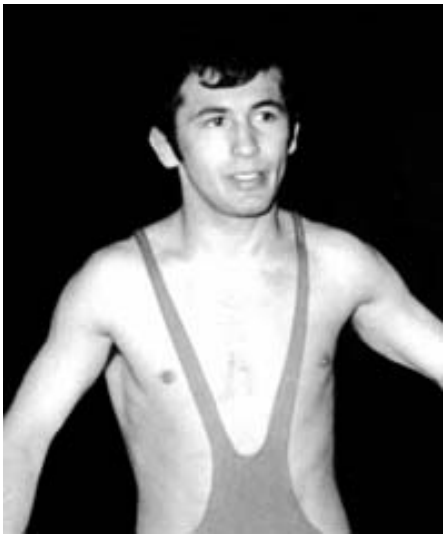


Women's Weight Classes	Percentage of Women
48 kg	7.8
51 kg	8.6
55 kg	12.6
59 kg	16.7
63 kg	10.2
67 kg	11.6
72 kg	8.4
>72 kg (outside competition limits)	24.1

SOURCE: NHANES III, 1988-1994, women aged 20-29 years, excluding those who were pregnant and/or lactating at examination (n = 1,625)

There is a better dispersion of athletes in women's wrestling. It is interesting to note that the largest proportion of women in this population fall outside of the competitive limits of 72 kg. Discussion needs to be focused on the question of whether the population data is truly representative of the pool of potential athletes. If the people above 72 kg are not likely to be athletes, it would not be appropriate to add an additional weight class.

Prior to the contraction of weight classes, the weight classes at the extremes, while having fewer entrants, were still represented with seemingly sufficient number of competitors (see Table 5). These competitors have distinguished themselves in the annals of wrestling lore-Issaev (Bul), Javadi (IRI), Dimitriev and Kornilaev (URS), Kim (PRK) and Berceanu (Rom) all at 48 kg. It is worth noting that the highest points per match in the 1995 WC were from the 48 kg weight class. There is a world-wide secular trend towards larger people. However, many athletes may be lost to the sport of wrestling because of the elimination of the 48 kg weight class and this is an area that deserves additional research. Further study should include population data from other countries.



A great 48 kg wrestler from Bulgaria: Hasan Isaev Olympic Games champion in Montreal, 1976. Two time world champion - in Istambul, 1974 and Minsk, 1975. Silver medal winner at the 1973 World Championship in Teheran.

Table 5: Participation rates per weight class in 1993 FS and GR World Championships

Weight Class Kg	# GR Athletes	# FS Athletes
48	24	22
52	25	23
57	34	26
62	33	29
68	29	33
74	31	28
82	30	31
90	27	25
100	23	19
130	19	17

Another use of these data is to create a model based on an equal distribution of the population within the weight class system. This approach would be an attempt to address the issue of fairness. If one were to create a fair system, a first approach could be to divide the population into the number of classes deemed necessary. For this hypothetical model, ten weight classes were developed. The procedure was to divide the distribution into eight classes (each class containing approximately 12% of the distribution) and also add a class at each tail of the distribution. The results of this model are shown in table 6.

Table 6: Weight Class Model Built on Equality of the Distribution of Population

Percentile	Men	Women
2	55	44
12	62	50
24	67	53.5
36	70.5	56.5
48	74.5	60
60	79	64
72	84	69
84	92.5	78.5
96	112	100
98	123	105

Use of Performance Factors: At what point does a difference in weight make a difference in the competitive outcome?

If one looks at the span from one weight class to the next, it can be expressed in absolute terms (kg), or as a percentage of the preceding weight class. The absolute difference between classes continually increases as one moves from lower to higher weight classes.

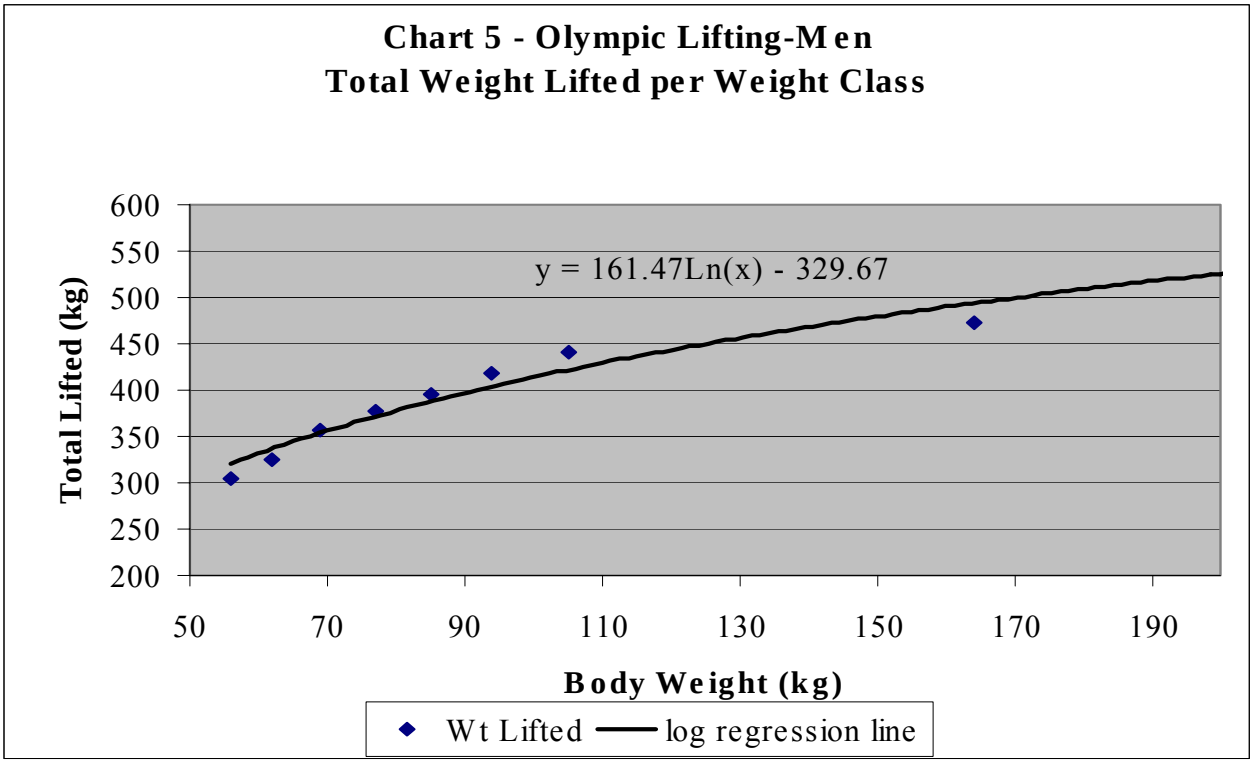
Table 7: Comparison of Weight Class Systems from 1969, 1997, & 2002

Weight Classes **1969**	Absolute difference between classes (kg)	Relative difference (% increase)	Weight Classes **1997**	Absolute difference between classes (kg)	Relative difference (% increase)	Weight Classes **2001**	Absolute difference between classes (kg)	Relative difference (% increase)
48	4	8.3	54	4	7.4	55	5	9.1
52	5	9.6	58	5	8.6	60	6	10.0
57	5	8.8	63	6	9.5	66	8	12.1
62	6	9.7	69	7	10.1	74	11	14.9
68	6	8.8	76	9	11.8	85	11	12.9
74	8	10.8	85	12	14.1	96	24	25.0
82	8	9.8	97	33	34.0	120		
90	10	11.1	130					
100								
>100								
Average	**6.5 kg**	**9.6 %**		**7.2 kg**	**10.6 %**		**8.2 kg**	**11.8 %**

Excluding the highest weight class, the average weight between classes have increased from 6.5 kg in 1996, to the present 8.2 kg. When expressed as a percentage of the preceding weight class, the average increased from 9.6% to 11.8%. What is the role of mass in wrestling? The muscle tissue in the fat-free mass is the source for the generation of force and power to execute holds and overcome the forces and mass of the opponent. What percentage difference creates a competitive advantage? In competitions decided by the narrowest of margins, small differences in strength, power, inertia, and leverage could make difference in the outcome

One focus of attention can be on the relationship between strength and body mass. Studies have shown that the increase in strength as the subject increases in mass is not linear. An increase in size does not allow for the proportional increase in force generation.

A simple examination of the world record totals in Olympic weightlifting (Chart 1) shows a curvilinear relationship, with the strongest athletes, “pound for pound” at the lowest classes. Some of this relationship may be explained by the fact that in weightlifting, as well as in wrestling, one sees progressively higher percentages of body fat as the classes increase in size. This can be used as an argument for larger spans between the upper weight classes.



This suggests that one could employ an approach to the normalization of strength in relation to size. Jaric (2003) in his review of the role of body size in the relation between muscle strength and movement performance, distinguishes between various types of strength and testing modalities, and lists the resulting allometric scaling equations. However, taking the simplest case of strength (S) measured by a dynamometer, the normalized strength (S_n) in relation to body mass (m) is:

$$S_n = S/m^{2/3}$$

This expression can be used to equilibrate span of weight or size, throughout the range of desired weight classes. For example, if one wanted to establish 10 classes that contain equal spans of estimated strength from size, the following steps would be followed:

1) Calculate the scaling coefficient for each of the lowest and highest weight classes (for this model the range in place in 1995 is used).
   For 48 kg raised to the 2/3 power the coefficient is 13.21
   For 130 kg raised to the 2/3 power the coefficient is 25.66
2) The range defined by these two values is 12.45 scaling units.
3) Since 10 weight classes are desired, 12.45 is divided by 9 to obtain the span for each class. This value is 1.38333
4) This value is added to the coefficient associated with the lowest weight class to establish the next class (13.2100 plus 1.38333) and so forth for the following classes (1st column).
5) These coefficient values are returned to their associated weights by raising to the 3/2 power (2nd column) and are shown in Table 8.

Table 8: Weight Classes from Size and Strength Scaling

Scaling Coefficient	Weight (kg) Associated with Coefficient	Weight Class (kg)
13.21000	48.012	48
14.59333	55.748	56
15.97667	63.860	64
17.36000	72.331	72
18.74333	81.147	81
20.12667	90.294	90
21.51000	99.761	100
22.89333	109.538	110
24.27667	119.614	120
25.66000	129.983	130

Creating a Model from Population Equity and Performance Potential Equity

In the Performance Equity Model, strength to size is the factor being considered. Table 9 contains the set of classes that resulted from each approach.

Table 9: Model Weight Class Systems

Population Model	Performance Model
55	48
62	56
67	64
70.5	72
74.5	81
79	90
84	100
92.5	110
112	120
123	130

A panel of experts could use the above data to most effectively merge the important aspects of each, into one weight class system.

Other Considerations

Lower Weight Classes: It has been known that humans are increasing in size over successive generations. This is called a "secular trend." Possible reasons include better nutrition, immunization among others. The size of athletes has likewise increased. Some of this may be tied to training, dietary manipulation, rule modifications, and the use of illegal ergogenic aids. The nature of the sport of wrestling offers access to many that may otherwise be shut out of many other popular sports because of their size. For example, height has been studied as a factor for success in many sports. Khosla and McBroom (1988) studied the finalists in 47 different female events from the 1972 and 1976 Olympics. They found that 23.3% were greater than 175 cm. in height. If one were to use the US as a reference population, there were only 2.4% of females greater than 175 cm in height.

Khosla (1968) also pointed out the advantages posed to countries of differing average stature. The Japanese won 11 gold medals in individual events, 10 of which were in weight-categorized sports-boxing, wrestling, weightlifting, and judo. Elimination of the population at the extreme low-weight tail of the distribution could be viewed as a bias against cultural groups having a smaller mass. One can see that many sports tend to favor the larger competitor. Can/should sport provide opportunities for the entire span of sizes?

Anthropometry and Weight Loss: The general anthropometric characteristics of wrestlers show a high level of mesomorphy. Studies of studies of elite wrestlers have shown the following somatotypes: 2.4 – 6.7 – 1.5 (Carter et al); Cuban freestyle wrestlers 1.8-6.8-1.4, Greco-roman wrestlers 2.0-6.5-1.5 (Betancourt-Leon et al); and greco-roman competitors from the European Championships 2.7 – 6.2 – 1.7 (Charzewski et al). The brachial index (length of the forearm relative to the upper arm as a %) is low for wrestlers and weightlifters where strength and stability is important. A low brachial index provides the biomechanical advantage of short force arms. Most wrestlers seek to compete in a weight class where their strength (power) to size ratio is maximized. Studies on wrestlers yield low body fat values. In his summary of the characteristics of elite wrestlers, Horswill reports a range of 7.6 – 9.8% body fat. This minimization of body fat-high fits the

description of Norton and Olds, as most weight category sports, as one where the competitors use "size optimization." This classification system of sports is based on the size qualities of the athletes the sport attracts. Additionally, wrestlers will intentionally lose weight to compete at a lower weight class using short-term weight loss methods that can prove to be injurious to health. The American College of Sports Medicine (ACSM), in their position statement on weight loss in wrestlers recommended adding additional weight classes, particularly in the lower and middle classes to reduce the need to use artificial or dangerous means to reach a competitive weight.

Changing High School Wrestling Weight Classes in the USA?

Currently, rules from the National Federation of State High School Associations calls for 14 weight classes in high school wrestling.

There have been changes over the years, some very small, some more significant. I have summarized this history into six general eras, or points of significant change. In the 1930's and early 1940's there were 10 weight classes: 95, 105, 115, 123, 135, 145, 155, 165, 175, and heavyweight (unlimited). For most of the 1950's and 60's there were 12 classes: 95, 103, 112, 120, 127, 133, 138, 145, 154, 165, 175, and heavyweight. From 1971 to 1985, the weight classes were 98, 105, 112, 119, 126, 132, 138, 145, 155, 167, 185, and heavyweight. In 1986, the heavyweight, or unlimited class, had a limit imposed to 275. This was adopted, ostensibly, to prevent injuries due to huge mismatches in size.

In 1989, there was an increase in the number of weight classes to 13. The 98 pound class was dropped, and smaller rages between the middle classes were established (where there are the most wrestlers). The last significant change occurred in 1998, with the addition of a 215 pound class.

Recently, there have been criticisms of the current system with calls to reduce the number of classes, and move up the weight of the lowest class. The concerns voiced by these coaches are time constraints posed by 14 weight classes, the difficulty to fill complete line-ups, and that the lowest weight class is often won by underclassmen who grow out of the class. Jerry Diehl, NFHS assistant director, says that these concerns had been received in coach's surveys and were being reviewed by the wrestling rules committee. Dave Carlsrud, assistant to executive secretary of the North Dakota High School Activities Association and chairperson of the NFHS Wrestling Rules Committee says that his major concern was the length of tournaments created by having more weight classes, along with increased forfeits at both the upper and lower ends of the range of weight classes. He stated, "We do not want to reduce opportunities for participation, especially for the smaller athlete who does not have as many avenues." In order to have concrete data regarding the sizes of our athletes, the committee will use data from the National Wrestling Coaches Association. NWCA Executive Director, Mike Moyer has made available to interested state associations the Optimal Performance Calculator. This data management system provides the determination and coordination of a minimal wrestling weight as part of a state's weight certification program, mandated by the National Federation. The initial weights of all participants are accessible and should provide a good picture of the athletes who are actually coming to the sport. From this we can see what classes are really needed. Moyer's program is currently utilized by 23 state associations and has a data base extending back several years. The data which can be utilized by the rules committee next April will have been gathered from over 200,000 wrestlers. It will also contain important information on the number of forfeits and match outcomes.

Dave Gannaway, an Assistant Director of the Illinois High School Association, will be the new chair of the national wrestling rules committee. His state is one which has overwhelmingly supported the current weight classes in recent coach surveys. He told me that data from his state's weight certification program will also be pooled with that from the NWCA and is looking forward to using actual numbers, "rather than impressions."

Future Work

1) Identify and use additional population studies from other continents, particularly Asia.
2) Do these population distributions reflect the true pool of potential athletes for wrestling?
3) The performance factor used in this paper only dealt with strength as a function of mass. Is this the best allometric scaling equation for wrestlers? For women? Are there other parameters that would be more useful, such as power?
4) There needs to be a discussion among experts, convened for the purpose of establishing a methodology for the "meshing" the population-based model and the performance-based models.

References

ACSM Position Stand on Weight Loss in Wrestlers (1996) Med. Sci. Sports Exerc. 28(2): ix-xii.

Betancourt-Leon, H., Sanchez-Ramirez, G., Martinez-Acosta, M., & Echevarria-Garcia, I. (2002). (Heath-Carter somatotype measurements in elite level Cuban free-style and greco-roman wrestlers.). Lecturas: educacion fisica y deportes Buenos Aires 8(45), Feb 2002., 8:45 1-5.

Carter, J. E. L., Aubrey, S. P., & Sleet, D. A. (1982). Somatotypes of Montreal Olympic athletes. Medicine and Sport, 16, 53-60.

Charzewski, J., Glaz, A., Kuznicki, S. (1991) Somatotype characteristics of elite European wrestlers. Biology of Sport 8(4):213-221.

Horswill, C.A. (1994) Physiology and nutrition for wrestling. In (Eds) Lamb,D.R.; Knuttgen,H.G. Perspectives in Exercise Science and Sports Medicine: Physiology and Nutrition for Competitive Sport, Benchmark, Indianapolis.

Jaric, S. (2003) Role of body size in the relation between muscle strength and movement performance. Exerc. Sport Sci. Rev., 31(1):8-12.

Khosla, T. (1968) Unfairness of certain events in the Olympic Games. Brit. Med J. 4:111-113, 1968.

Khosla, T. (1983) Sport for tall. Brit. Med. J. 287:736-738.

Khosla, T. & McBroom, V.C. (1988) Age, height and weight of female Olympic finalists Brit. J. Sports Med. 19:96-99.

National Center for Health Statistics, Hyattsville, MD National Health and Nutrition Examination Survey (NHANES III-1994). http://www.cdc.gov/nchs/nhanes.html.

Norton, K. & Olds, T. (1996) Anthropometry and sports performance, in Norton, K., Olds, T.Olive, S., & Craig, N. (Eds) Anthropometrica University of New South Wales Press, Sydney.

Chapter 8

Heavyweight Limits

Beginning with the 1985 world championships, FILA instituted a maximum weight of 130 kg (286 lbs.) for the highest weight class. In past days the heavyweight division was also called "unlimited," since there were no upper limits. As a matter of fact, in the first modern Olympic Games, there was only one class for everyone. Throughout the 20th century there was a gradual increase in the number of weight classes used in the Games. It can be a bit confusing since some of the early Games did not always have competition in both Greco-Roman and Freestyle. Sometimes, even when there were both styles, they had different weight classes.

The number of classes grew, as well as the minimum weight used for the heavyweight class. These classes are listed in following table:

Weight Classes in the Olympic Games

Olympic Games		Classes (kg)
1896	1	One Class
1904 FS only	7	47.6, 52.1, 56.7, 61.2, 65.2, 71.6, **+71.6**
1906 GR only	3	75, 85, **+85**
1908 FS	5	54, 60.3, 66.6, 73, **+73**
1908 GR	4	66.6, 73, 93, **+93**
1912 GR only	5	60, 67.5, 75, 82.5, **+82**
1920 WC- same both styles	5	60, 67, 75, 82.5, **+82.5**
1924 & 1928 GR	6	58, 62, 67.5, 75, 82.5, **+82.5**
1924 & 1928 FS	7	56, 61, 66, 72, 79, 87, **+87**
1932, 1936, 1952, 1956, 1960	8	52, 57, 62, 67, 73, 79, 87, **+87**
1964 & 1968	8	52, 57, 63, 78, 87, 97, **+97**
1972, 1976, 1980, 1984	10	48, 52, 57, 62, 68, 74, 82, 90, 100, **+100**
1988, 1992, 1996	10	48, 52, 57, 62, 68, 74, 82, 90, 100, **130**
2000	8	54, 58, 63, 69, 76, 85, 97, **130**
2004	7	55, 60, 66, 74, 85, 96, **120**

Beginning in 1932, FS and GR weight classes were the same in the Olympic Games and World Championships.

Until 1960, the heavyweight class minimum was still less than 200 pounds. Athletes, along with the regular population have gradually grown larger. A similar limitation was made for U S collegiate wrestlers in 1986, when the NCAA established the 275 lb. class (123.8 kg). Health and safety of the participants was cited by the NCAA Committee on Competitive Safeguards and Medical Aspects of Sports in the development of this rule change. This entailed concern for the potential mis-matches in size, as well as the health risks present in when an athlete is in the 300-400 pound range. In regard to the former, there was no data cited that documents excessive weight difference causing injuries in the heavyweight class. The concern for the health of the athlete outside of competition centered around the following: 1) encourage the athletes who were obese to move towards a lower, and healthier weight and lifestyle; 2) discourage the practice of artificially inflating the athletes size by way of tremendous caloric intake; and 3) discourage the use of ergogenic aids, such as anabolic steroids, in their quest to become larger. There is no data that has tracked the success of the rule change in achieving the stated goal in #1. While there are some athletes who have lost weight to wrestle in this class, many of these huge athletes probably just quit the sport. It is not clear how the limit was established by FILA, although a doctor on the FILA Medical Committee stated that it was due to the disparate sizes seen when the huge Chris Taylor wrestled for the US in the 1972 Olympic Games (Nickhah, F., personal communication, 2003).

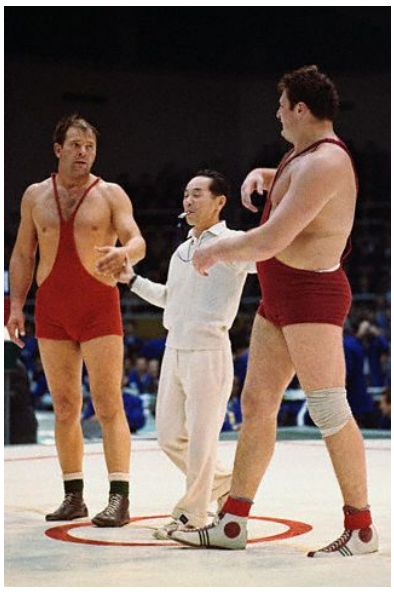
Possible negative effects of this weight class restriction include, 1) a reduced pool of potential athletes, and 2) going against the trend one sees in many sport of larger athletes. One can look at the National Football League and see that 300 pound linemen are quite common. While some of these men are obese, because of sophisticated weight training programs, one can see many who possess minimal fat, along with great speed and quickness.

Mass in open-ended sports (or highest weight classes) provides advantages, especially if the additional mass is fat-free mass. Khosla (1964) cites the 1964 Olympic champions of the Greco-roman, freestyle, and weightlifting in the highest weight division. All champions weighed more than the mean weight of all competitors: GR Champion 135.5 kg - mean 115.5 kg; FS Champion 106.5 kg - mean 102.5 kg; and the Weightlifting Champion 157 kg - mean 113.6 kg. A review of the weights of world and Olympic champions is shown in Table 1.

Table 1: Heavyweight Champions - Sizes in World and Olympic Championships

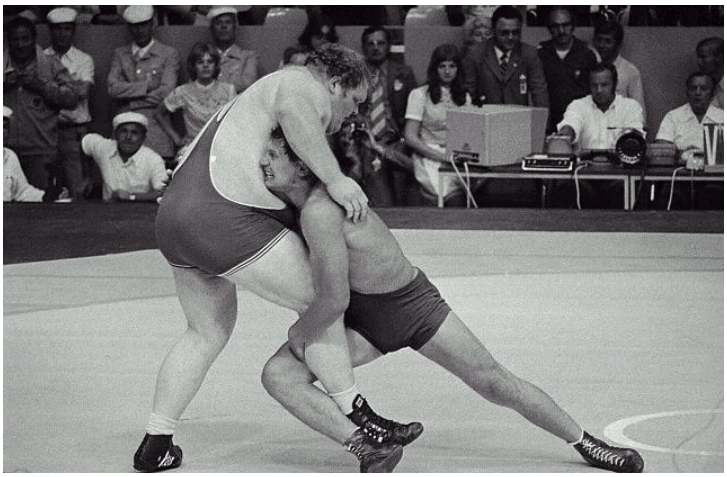
Year	Greco-Roman	Weight	Height	Freestyle	Weight	Height
1896	Karl Schumann (GER)	71	175			
1904	Rudolf Arnold (AUT)			Bernhoff Hansen (USA)		
1905	Soeren Marinus Jensen (DEN)					
1907	Hans Heinrich Egeberg (DEN)					
1908	Hans Heinrich Egeberg (DEN)			George Cornelius O'Kelly (USA)	100	
1909	Anton Schmidt (AUT)					
1910	Gustav Sperling (GER)					
1911	Yrjoe Erik Mikael Saarela (FIN)	91	182			
1912	Yrjoe Erik Mikael Saarola (FIN)	91	182			
1913	Anders Ahlgren (SWE)	82.5 kg in 1912	191			
1920	Heinrich Bock (GER) WC			Robert Roth (SUI)		
1920	Adolf Valentin Lindfors (FIN) OG	95.5	176.5			
1921	Johan Salila (FIN)	100	176			
1922	Ernst Nilsson (SWE)	82.5 kg in 1913	189			
1924	Henri Deglane (FRA) OC	100		Harry Dwight Steel (USA)		
1928	Rudolf Svensson, (SWE)	87 kg in 1928	191	Johan Cornelius Richthoff (SWE)		194
1932	Carl Oscar Westergren, (SWE)	75 kg in 1922	178			
1936	Kristjan Palusalu (EST)	110	185	Kristjan Palusalu (EST)	110	185
1948	Ahmet Mersinli Kirecci (TUR)	79 kg in 1936		Gyula Bobis (HUN)	130	189
1950	Bertil Antonsson (SWE)	93	188			
1951				Bertil Antonsson (SWE)	93	188
1952	Johannes Kotkas (URS)	110	185	Arsen Mekokishvili (URS)	120	186
1953	Bertil Antonsson (SWE)	93	188			
1955	Alexander Masur (URS)	119	183	Arsen Mekokishvili (URS)	120	186
1956	Anatoli Parfjonow (URS)	110	190	Hamit Kaplan (TUR)	115	188
1957				Hamit Kaplan (TUR)	115	188
1958	Ivan Bogdan (URS)	114	186	Ljutvi Dshilber Akhmedev (BUL)	115	180
1960	Ivan Bogdan (URS)	114	186	Wilfried Dietrich (GER)	122	189
1961	Ivan Bogdan (URS)	114	186	Wilfried Dietrich (GER)	122	189
1962	Ivan Bogdan (URS)	114	186	Alexander Ivanizki (URS)	106.5	190
1963	Anatoli Roschtshin (RUS)	125	191	Alexander Ivanizki (URS)	106.5	190
1964	Istvan Kozma (HUN)	135.5	202	Alexander Ivanizki (URS)	106.5	190
1965	Nikolai Schmakow (URS)	120	197	Alexander Ivanizki (URS)	106.5	190
1966	Istvan Kozma (HUN)	135.5	202	Alexander Ivanizki (URS)	106.5	190
1967	Istvan Kozma (HUN)	135.5	202	Alexander Medved (URS)	120	190
1968	Istvan Kozma (HUN)	135.5	202	Alexander Medved (URS)	120	190
1969	Anatoli Roschtshin (RUS)	125	191	Alexander Medved (URS)	120	190
1970	Anatoli Roschtshin (RUS)	125	191	Alexander Medved (URS)	120	190
1971	Alexander Tomov (BUL)	126	192	Alexander Medved (URS)	120	190
1972	Anatoli Roschtshin (RUS)	125	202	Alexander Medved (URS)	120	190
1973	Alexander Tomov (BUL)	126	192	Soslan Andiev (URS)	116	198
1974	Alexander Tomov (BUL)	126	192	Ladislau Simon (TUR)	114	183
1975	Alexander Tomov (BUL)	126	192	Soslan Andiev (URS)	116	198
1976	Alexander Koltschinski (URS)	119	193	Soslan Andiev (URS)	116	198

1977	Nikola Dinev (BUL)	130	184	Soslan Andiev (URS)	116	198
1978	Alexander Koltschinski	119	193	Soslan Andiev (URS)	116	198
1979	Alexander Tomov (BUL)	126	192	Salman Khasimikov (URS)	118	180
1980	Alexander Koltschinski	119	193	Soslan Andiev (URS)	116	198
1981	Refik Memisevic (YUG)	112	188	Salman Khasimikov (URS)	118	180
1982	Nikola Dinev (BUL)	130	184	Salman Khasimikov (URS)	118	180
1983	Jewgeni Artjuchin (RUS)	108	189	Salman Khasimikov (URS)	118	180
1984	Jeff Blatnick (USA)	110	189	Bruce Baumgartner (USA)	126	185
1985	Igor Rostorotzki (RUS)	128	195	David Gobedischvili (RUS)	110	200
1986	Tomas Johansson (SWE)	132	193	Bruce Baumgartner (USA)	126	185
1987	Igor Rostorotzki (RUS)	128	195	Aslan Chadarzev (URS)	110	183
1988	Alexander Karelin (RUS)	128	191	David Gobedischvili (RUS)	110	200
1989	Alexander Karelin (RUS)	128	191	Ali-Reza Soleimani (IRI)	121.5	190
1990	Alexander Karelin (RUS)	128	191	David Gobedischvili (RUS)	110	200
1991	Alexander Karelin (RUS)	128	191	Andreas Schroeder (GER)	105	192
1992	Alexander Karelin (RUS)	128	191	Bruce Baumgartner (USA)	126	185
1993	Alexander Karelin (RUS)	128	191	Bruce Baumgartner (USA)	126	185
1994	Alexander Karelin (RUS)	128	191	Mahmut Demir (TUR)	120	184
1995	Alexander Karelin (RUS)	128	191	Bruce Baumgartner (USA)	126	185
1996	Alexander Karelin (RUS)	128	191	Mahmut Demir (TUR)	120	184
1997	Alexander Karelin (RUS)	128	191	Zekeriya Gueclue (TUR)	125	180
1998	Alexander Karelin (RUS)	128	191	Alexis Rodriguez-Valera CUB)	124	188
1999	Alexander Karelin (RUS)	128	191	Stephen Neal (USA)	120	196
2000	Rulon Gardner (USA)	125	191	David Musulbes (RUS)	113	186
2001	Rulon Gardner (USA)	125	191	David Musulbes (RUS)	113	186
2002	Dremiel Byers (USA)	130	188	David Musulbes (RUS)	113	186
2003	Khassan Baroev (RUS)	120	188	Artur Taimazov (UZB)	110	190
2004	Khassan Baroev (RUS)	120	188	Artur Taimazov (UZB)	110	190
2005	Mijain Lopez Nunez (CUB)	120	191	Aydin Polatci (TUR)	120	185

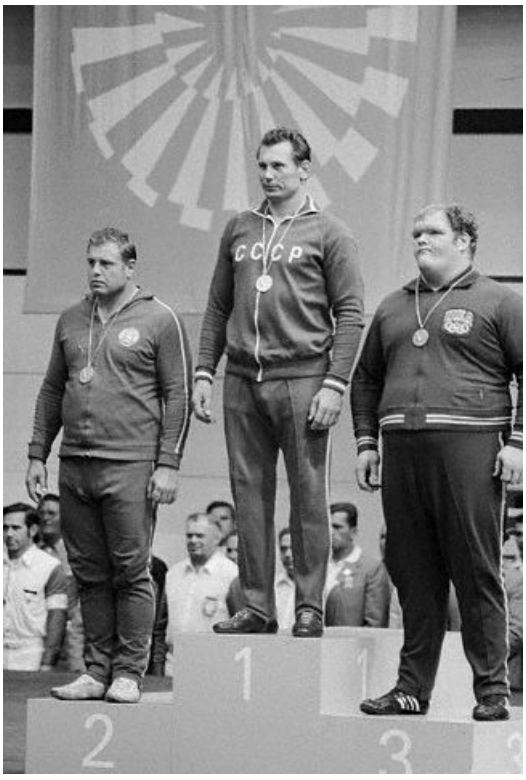


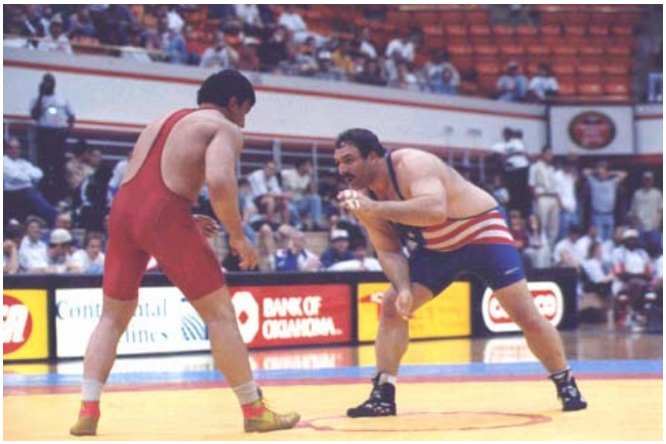
Istvan Kozma of Hungary was the heaviest of champions, weighing 135.5 kg. He is on the right in this photo from the 1964 Olympic Games as he defeated Anatoli Roschtshin (USSR).

Wilfred Dietrich of Germany was a Freestyle wrestling champion and Greco-Roman wrestling silver medalist of the 1960 Olympic Games in Rome, shown above performing a bend-back throw in the bout with American heavyweight wrestler Chris Taylor (196 kg) in the Greco-Roman portion of the 1972 games. All newspapers and journals reported this famous throw, seemingly demonstrating "the impossible," yet it is evidence that mass is not always the most important factor in heavyweight competition.



Chris Taylor (who wrestled both styles) vs Alexander Medved (above) in freestyle competition at the1972 Olympics. Medved won a somewhat controversial decision, when the referee refused to call Medved for passivity. The official was sent home from the games and Medved won the gold and Taylor the bronze (bottom left).





Bruce Baumgartner is America's most decorated heavyweight and leads all FS heavyweights in the number world medals. A stocky athlete, he competed at just under 130 kg. He was 1984 Olympic Freestyle Gold Medalist, 1988 Olympic Freestyle Silver Medalist, 1992 Olympic Freestyle Gold Medalist, & 1996 Olympic Freestyle Bronze Medalist.

While only one champion from the list exceeded 130 kg, 17 champions weighed in excess of the current limit of 120 kg. The average and median values are listed below.

Freestyle	Weight	Height
average	116.1	188.9
median	117	189.5
Greco-Roman		
average	117.4	185.1
median	125	191
Both Styles Combined		
average	116.8	189.2
median	119.5	190

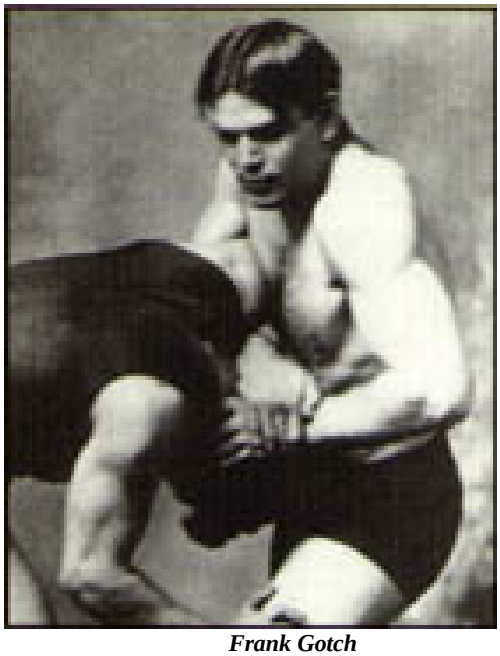
Some of these heavyweight champions wrestled at a lower weight class earlier in their careers. Several of the wrestlers from the early 20th century, for whom their competition weight is missing, wrestled and won championships at the last weight for which there was a limit. For instance, Anders Ahlgren (SWE) and Ernst Nilsson (SWE) both wrestled at the 82.5 kg limit class; Rudolf Svensson, (SWE) wrestled at 87 kg in 1928; Carl Oscar Westergren, (SWE) wrestled at 75 kg in 1922; and Ahmet Mersinli Kirecci (TUR) wrestled at 79 kg in 1936. Alexander Medved won several world championships at the 97 kg weight class before moving up to the unlimited category.

Outside of Olympic and FILA organized competition, there are some notable heavyweight competitors from professional wrestling from the late nineteenth, and early 20th centuries. Prior to the 1896 revival of the Olympic Games, professional wrestling was well established. The early Olympic Games did not always have the best heavyweights represented. Because the professionals won prize money, de Coubertin cast them in a negative light. This, along with disagreements on the rules between French Rules and those used in Great Britain and the US, resulted in the world's best wrestlers ignoring the Athens Games. Schumann of Germany won the wrestling competition and was actually a gymnast.

George Hackenschmidt

In 1900, the Paris Games did not include wrestling, perhaps acknowledging the World Championships that were to take place. Many of the outstanding professional wrestlers were not huge by today's standards and in fact were on the smaller side. Some names of note, for whom we have sizes (Fleisher - *From Milos to Londos: the story of wrestling through the ages*, 1936) are Frank Gotch: 5'11" and 210 lbs; George Hackenschmidt: 5'9½" and 216 lbs.; Ivan Poudubbny: 6'6" 246; Halil Adali ("a Turk of gigantic proportions") 6'2½" and 285 lbs; Paul Pons: 6'4 ½" and 252 lbs.; Stanley Zbyszko: ranged between 240 and 276 lbs.

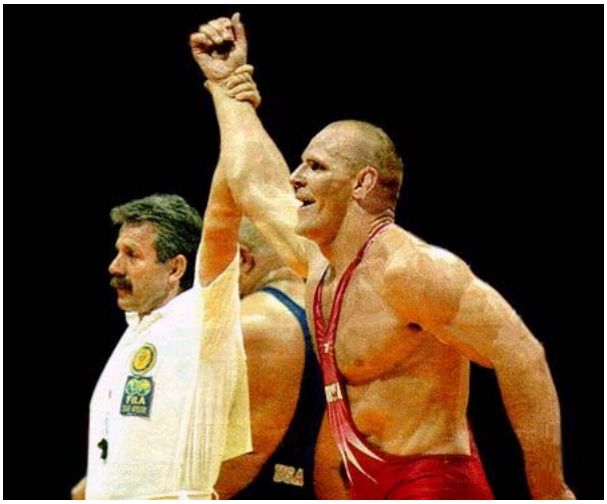
Some recent athletes of interest include: Adam Sandurski (Pol) who weighed 135 kg and was 214 cm tall. Between 1977 and 1986, he earned 2 silvers and a bronze in the freestyle World Championships, and a bronze in the 1980 Olympics (he did make the 130 kg limit in 1985, placing 4th in the WC); and the aforementioned Chris Taylor (USA) who weighed a huge 196 kg.



Frank Gotch

Summary

Athletes adapt to rules changes and we will still have great heavyweights. The sport will lose some potential athletes. Some may have to cut some weight to make the heavyweight limit. It is somewhat of a paradox that in the National Football League the 300 pound lineman is now commonplace, we in wrestling are moving in the opposite direction.



Alexander Karelin of Russia (128 kg) was a 12-time world and Olympic champion. Could he have made the 120 kg limit?

Chapter 9

Evaluation of the Weight Control Plan in Illinois

The Illinois High School Association (IHSA) implemented a new wrestling weight control plan for the 2003-04 season. This plan followed the Wisconsin model that establishes a wrestler's minimum weight class after a body fat analysis is performed. I contacted the administrator in charge of this program and asked if there was any plan to evaluate its effectiveness. He said that he was interested but had no plan in mind. I suggested that weight regain during actual competition was a great indicator of prior weight cutting and recommended a program of re-weighing athletes at the state meet.

The plan set in place called for the re-weighing of competitors on the second day of the two-day state finals. Dr. Craig Horswill spoke to the athletes prior to the official weigh-in and asked that they take a moment to weigh-in with us during the competition. We set up two scales in the tunnel area leading into the arena and quickly weighed in wrestlers during the competition. We established the weights of singlets, shoes, etc. so that the athletes did not have to strip down. We recorded what they wore so that it could be factored out. Along with the official weigh-in data listing actual weights we were able to establish weight regain.

There are several limitations. We did not require participation and had almost 50% participation. We seemed to have a good cross section of participants with medalists and non-medalists alike. One could say that high weight cutters would tend to stay away from us. All in all we have some data that suggests that extreme weight cutting is not present. Previous studies have yielded data that showed wrestlers competing in finals weighing in the next weight class. Our survey showed an average weight regain of just over 2 pounds. This indicates that the new program is successfully cutting down on the practice of potentially dangerous weight loss. The complete data sets are found on the following page.

All- Raw Regain	*Lbs.*	*% regain*
Mean	2.336	1.67
Median	2.300	1.62
Standard Deviation	1.632	1.25
Range	9.700	6.90
Minimum	-2.650	-1.11
Maximum	7.050	5.78
Count	114.000	114.00

Class A Raw Regain		*% regain*
Mean	1.866	1.42
Median	2.050	1.43
Standard Deviation	1.823	1.38
Range	8.600	6.29
Minimum	-2.650	-1.11
Maximum	5.950	5.17
Count	38.000	38.00

Class AA Raw Regain		*% regain*
Mean	2.571	1.79
Median	2.400	1.65
Standard Deviation	1.486	1.17
Range	7.200	5.86
Minimum	-0.150	-0.08
Maximum	7.050	5.78
Count	76.000	76.00

103-135 Classes Raw Regain		*% regain*
Mean	2.588	2.11
Median	2.450	2.04
Standard Deviation	1.649	1.39
Range	7.800	6.47
Minimum	-0.750	-0.69
Maximum	7.050	5.78
Count	53.000	53.00

140-275 Classes Raw Regain		*% regain*
Mean	2.117	1.29
Median	2.150	1.25
Standard Deviation	1.599	0.98
Range	8.500	4.66
Minimum	-2.650	-1.11
Maximum	5.850	3.55
Count	61.000	61.00

All Placewinners Raw Regain		*% regain*
Mean	2.435	1.78
Median	2.500	1.78
Standard Deviation	1.741	1.34
Range	9.700	6.90
Minimum	-2.650	-1.11
Maximum	7.050	5.78
Count	60.000	60.00

Non Placewinners Raw Regain		*% regain*
Mean	2.226	1.55
Median	2.150	1.39
Standard Deviation	1.511	1.14
Range	6.400	5.50
Minimum	-0.450	-0.33
Maximum	5.950	5.17
Count	54.000	54.00

Chapter 10

Adjusting to the New FILA Rules

Changes in rules have occurred throughout the history of modern wrestling. For example, in the first modern Olympic Games in there was only one weight class. We have seen an evolution of international classes summarized in the following table:

Event	# Classes	Classes (in kilograms)
1896 OG	1	One Class
1904 WC	2	75, >75
1905 WC	3	68, 80, >80
1908 WC	2	75, >75
1908 OG	4	66.6, 73, 93, >93
1909 WC	2	75, >75
1910 WC	4	60, 70, 85, >85
1911 WC	5	60, 67, 73, 83, >83
1913 WC	4	68, 75, 82.5, >82.5
1920 WC	5	60, 67, 75, 82.5, >82.5
1921 WC	6	58, 62, 68, 75, 82.5, >82.5
1950 WC	8	52, 57, 62, 67, 73, 79, 87, >87
1962 WC	8	52, 57, 63, 78, 87, 97, >97
1969 WC	10	48, 52, 57, 62, 68, 74, 82, 90, 100, >100
1985 WC	10	48, 52, 57, 62, 68, 74, 82, 90, 100, 130
1997 WC	8	54, 58, 63, 69, 76, 85, 97, 130
2002 WC	7	55, 60, 66, 74, 85, 96, 120

The length of matches has also changed throughout the years. Matches have generally grown shorter. Early in the 20th century there were no time periods. In international competition, before 1957, a bout had a duration of 15 minutes that included two 3-minute periods of par terre, one for each wrestler. From 1957-61 bouts were12 minutes long and the par terre periods were 2 minutes each. From 1962-68 matches were 2-5 minute periods, with no specific periods for par terre. From 1969-77, matches were 3-3 minute periods, with a minute rest/coaching break between periods. From 1978-88 international competition had 2-3minute periods. From 1989-97 there was only one 5 minute period, plus 3 minutes of overtime, if necessary. From 1998-2004 there were 2x3 minutes with a 30 second rest, plus 3 minutes of overtime, if necessary. The newest rules, described below, continue this shortening trend.

Following the Athens Olympic Games, FILA implemented an overhaul of the existing rules. They were first used in the U.S. in the Sunkist International last fall. (USA Wrestling decided to continue with the old rules, for this year, for domestic schoolboy, cadet, and junior competition). The biggest change was to move our sport closer to the scoring seen in tennis, where the wrestler who wins two out of the three, two-minute periods is declared the winner. If, there is no scoring at the end of a period, wrestlers were immediately put into a "clinch" for 30 seconds with the first person scoring declared the winner of the period. If there was no scoring, the person who applied the lock first was penalized and loses that period. The clinch position for freestyle is the winner of the flip taking a head outside single leg.

The WC quarterfinal bout at 74 kg between Joe Williams USA and Soslan Tigiev UZB was decided by a clinch and won by Williams from the defensive position.

For Greco-Roman the clinch began as both wrestlers having the same over and under lock, then was changed during the winter to the advantage wrestler getting double underhooks with hands locked between the shoulder blades of the opponent. The lock could break without penalty, but the person given the lock had to score in 30 seconds or lose the period.

Other changes included the elimination of putting a wrestler into par terre for passivity, and a big change in the conduct of a tournament calling for a weight class to be completed in one day. Some of the purported reasons for these changes were to stimulate scoring from the feet, shorten the competitions, and to make scoring (winning/losing) easier for the general public to understand.

Since then, they were adjusted throughout the season, and for Greco-Roman, were radically adjusted again, just weeks before the World Team Trials in Ames! New Greco rules were tried as an experiment at the 2005 Asian Wrestling Championships, after which FILA published the official notice of the rule changes. In a memo dated May 30, 2005 FILA defined the new Greco rules. A wrestler must still win two out of a possible three periods. The periods now consist of 1 minute wrestling in a standing position, and two 30 second periods in a par terre position. Wrestling starts in the center of the mat in a standing position. After the 1st minute, the referee will stop the match and order a wrestler in the par terre position. The wrestler who has scored a technical point/s, after the one minute will take the hold first. If none of the two wrestlers has scored a technical point, the referee decides by a flip. The winner takes a reverse body-lock and can be on both feet, or one knee. The bottom wrestler has arms straight, feet shall not be crossed, and the thighs forming a 90° angle with the mat. The distance between his hands shall be maximum 30 centimeters. The referee whistles and the top wrestler can execute the hold. During these 30 seconds, both wrestlers can execute all possible actions, in a standing or a par terre position. If there is no winner after the first 30 seconds and/or the top wrestler has not scored any technical points, he will be penalized by a caution and 1 technical point will be awarded to his opponent. The positions are switched for the next 30 seconds.

According to FILA, "This new proposed system puts an end to all the referee's interventions and also to the clinch which only brings problems to GR wrestling and lets the wrestlers be the master of their fate and bring wrestling more spectacular with actions of 3 points and even actions of 5 technical points."

Rules dictate our approach to a sport and how we train. Whether the rules are good for the sport is another question. The job of coaches is to devise training programs to win according to the current rules. I was talking to Rulon Gardner about the new rules and he said that athletes cannot afford using their time to complain, they must adapt and find a way to exploit the rules to their advantage, whatever that may be.

What does this mean for training? The shorter the segments, the more sprint/explosive training must be done. It is harder to break, or wear down an opponent with the new rules. The shorter periods do not allow for many comebacks, especially from wide margins (3+ points). However, good conditioning will be apparent over the course of the tournament, rather than match. After the first match, there may be times that there is only 15-20 minutes between matches.

Forced positions such as clinches and reverse locks mean that these must be practiced, and practiced on the start of a whistle!

These periods must be used in practice to be acclimated to the new psychology of these 2 out of three periods. Here is an example – a wrestler can win the first period with two 3-point takedowns and

win the period 6-0. The second period could be tighter and the opponent gets a push-out out of bounds for a point, and it is now 1-1 in period wins. With the old system, a person is winning 6-1, and now with a two minute period to go, the match is tied!

Kevin Jackson, national freestyle coach summarized his approach to the new rules in a positive letter to coaches and wrestlers. Some of his observations were that the new rules are good for us, because technique and tactics will determine winners. We have to treat each period like a match. Approach a match as if you have to win **two** matches. Athletes must be warm and ready to wrestle their best in the first period. It is important to take advantage of all scoring opportunities. Each match is a **controlled sprint**, working for scores with your offense, defense and mat position.

During a tournament your warm up will not be as long or as hard after your first match. The U.S. has a conditioning advantage over the rest of the world. It shows in the third period and as the tournament moves into its later stages.

Recovery, re-hydration and nutrition are very important during the 1-day tournament. Massages will also help recovery during tournament.

In regard to technique, Jackson feels that wrestlers will defend take downs and scramble harder than in the past, and that this may lead to more belly-to-back suplays. His views on the clinch are very good, "The clinch is important. What more can you ask for than to be in on a leg on your feet to determine the outcome of the period or match? Any time a period, match or title can be determined from one position we must spend a great amount of time in the position. Wrestlers must win all scrambles from the clinch! Wrestle all scrambles out to complete scores. Remember, the defensive wrestler must defend both the finish and the out of bounds line. Scramble for the win from the defensive clinch position!"

I spoke with some of our other national coaches for their viewpoints on how these rule changes have affected their training. Terry Steiner, women's national coach, stated that while they have made quite a few adjustments, it is important to realize that wrestling is still wrestling. He stressed six points. 1) Since every point is crucial, we still emphasize counter offense and defensive skills. 2) We are putting more focus on offensive leg attacks, front headlocks, and par terre defense. Par terre offense has become less important – you have to score to get there. 3) Focus even more on the zone. Practice drive outs and circling back to the center. 4) Clinch starts-getting in good position before locking hands and getting good drive. 5) Conditioning – use more explosive lifting, and in our circuits, use work/rest intervals that simulate the match-2 minutes on 30 seconds off. Once we have base conditioning, then everything is quarter mile or less. 6) Take it out of your opponent, even if you have blown a period. Force your opponent to be effective in the 3rd period.

The situation is quite strange for the Greco coaches. They have found out about further major rules changes just weeks before competition. Steve Fraser, national GR coach emphasizes explosiveness:

1) More par terre – particularly reverses lift defense & offense
2) A lot of explosion off the whistle in parterre.
3) A lot of explosion exercises.
4) A majority of sprint wrestling on feet.

It looks like the master of the "grind match" will now move towards "sprint marathons!"

Justin Ruiz USA successfully counters this reverse lift on his way to the bronze medal at 96 kg
At the 2005 World Championships held in Budapest

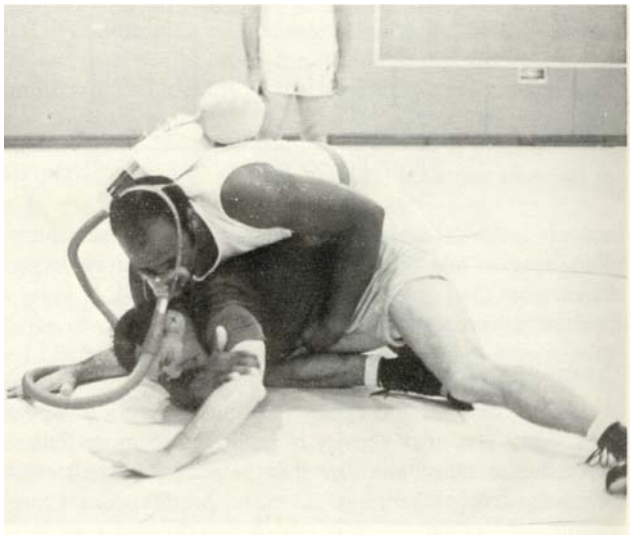
Ivan Ivanov of the USOEC in Marquette, MI, knows that training must be specific to the rules. After months of training in the clinch, often at the expense of par terre wrestling, with the newest rules, the reverse body-lock is a primary position for all Greco wrestlers. The reverse body-lock is not new, but defending it from a starting position off of the mat, is new to wrestling. He is also a bit hesitant about how to make his annual training plan for next year, especially if FILA suddenly change the rules again.

There is the problem for Greco-Roman for the elimination of techncial versatility, with very few takedowns being scored. This is accompanied by the one-sided increase of technique-oriented strength associated with the reverse lift starting position. For many athletes and fans, the World Team Trials in Ames were the first time that they have seen, or even used, the new FILA rules in competition. We will all see this experiment unfold. Coaches and athletes will adjust, but FILA can't just keep them in the dark without an opportunity to plan and train. It is like aiming at a moving target! Every decision cannot center around packaging a sport for television. We will continue to analyze and adapt.

The role of the coach is more important than ever in planning and competing!

Chapter 11

Do You Test Your Wrestlers?



The first step in a testing program is to identify the factors that contribute towards success in wrestling. Some important physiological factors are: How do we know if our wrestlers are ready for the demands of our sport? The physiological testing of wrestlers can help. We see the use of testing by sport scientists in many sports. However, in some respects wrestling seems to lag behind. There are some problems encountered when testing wrestlers- wrestling is an open skill sport, as opposed to single-skill, closed sports such as running, biking or rowing.

The first step in any testing program is to identify the factors that contribute to success in wrestling. Some important physiological factors are:

- Aerobic Capacity or cardiovascular endurance
- Anaerobic Capacity –high-intensity activity
- Strength-both static and dynamic
- Strength Endurance
- Explosive Power
- Power endurance
- Tactics and Strategy
- Flexibility
- Speed and Quickness
- Balance/Kinesthetic Awareness

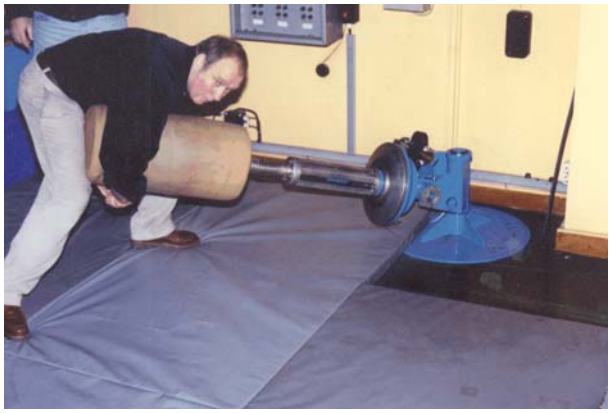
Combative sports such as wrestling must consider the response of an opponent, as well as tactics and strategy. The skill level of the opponent is also an important variable that is not controllable. As seen in the adjacent photo, it can be difficult to test our athletes for oxygen consumption while wrestling!

Sometimes there is a lack of acceptance by athletes and coaches. We certainly do not go for selection of teams by the sport scientists! Typical responses one might hear are: *"Let the wrestling results be my measure."* Or *"I don't care how much he can clean." And "I know what it takes to get me "in shape."* However, a well-planned, systematic, and regularly used testing program can help achieve many goals.

Why Test Wrestlers (or any athletes for that matter)?

We should test what we can modify through training and provide <u>usable</u> information to the coach and wrestler. Examples are:

- Identify strengths and weaknesses in important areas
- Monitor the progress of the wrestler
- Compare to other elite or champion wrestlers
- Check the effectiveness of the training program
- Check the status of injury rehabilitation
- Detect Overtraining



Gut Wrench Machine in IAT Institute, Leipzig

We should select a few that are associated with the demands of the sport and our team's needs and goals. Some coaches routinely assess some of these when they test strength (1 rep max with weights); and muscular endurance (# of pullups); or aerobic power (timed distance runs).

These tests can help chart progress and provide motivation. A review of the literature does not reveal a great deal in the area of wrestling specific testing. The best program matches the needs of the sport with the test. There are three energy systems used in sports.

ATP-CP System ─ This is an **immediate** source of energy already present in the muscles (relatively small amounts of high energy compounds ATP and creatine phosphate), used up within the first 5-15 seconds of intense activity.

Lactic Acid System ─ Sugar is partially broken down to release energy (with an accumulation of lactic acid) for high intensity activity from 15 seconds to two minutes in length.

Aerobic System (also called Aerobic or Long-term System ─ This is the long-term source of energy and can be employed for 2 minutes up beyond 2 hours. For wrestlers it helps to replenish the anaerobic energy systems during a break in the action.

Wrestling is a short burst, explosive sport using approximately 90% anaerobic energy sources (the first two systems). Laboratory testing can be expensive, and is not always practical. Most testing should be what is called "field testing." Some examples from other countries are available. In Russia, Coach J. Shakmuradov prepared performance standards for each weight class for a variety of strength activities (some with weight and some with body weight) incorporating wrestling specific movements. The number of pull-ups required ranged from 38 for 55 kg wrestlers to 22 for heavyweights. They test the time to execute 10 fireman's carries (standards again range from 16 seconds to 22 seconds).

Testing by German coaches is also very sport specific. They have developed sophisticated equipment to test the strength of your gut wrench when you grasp the padded cylinder and twist!

Another unique approach is in their testing with weights, where they test for speed strength by timing the lifting of a weight (75% of your weight class weight) for 8 reps. They also have performance standards for each weight class. Germans also do a great deal of lactic acid testing following a specific test (to be discussed in a future column).

I want to describe the physical testing program I have used with he Greco-Roman wrestlers at the U.S. Olympic Education Training Center in Marquette, MI. This testing program was developed with Coach Ivan Ivanov. We drew heavily from Ivanov's experience as an athlete on the Bulgarian National Team.

The battery items were selected to match the physical demands deemed most important for Greco-Roman wrestling. Not all tests are appropriate for folkstyle and freestyle. During testing we emphasized quality control in the administration of the tests. There must be standardized test conditions so we can compare results. Safety of the wrestler is also very important.

While some of these tests are commonly used in other sports, some, such as the Dummy Throws and Bridging Tests are sport-specific. The Arm Crank Test is a modified Wingate test using eight, 15 s sprints over a six minute span. Special performance indices were generated for the Dummy Throw and Arm Crank Tests. These indices are constructed to account for peak scores, average scores, and score decline.

This is what the battery contains 13 tests over 2½ days. We begin with measures of **body fat** and the two runs. We use the same skinfold test as the NCAA does-the Lohman method.

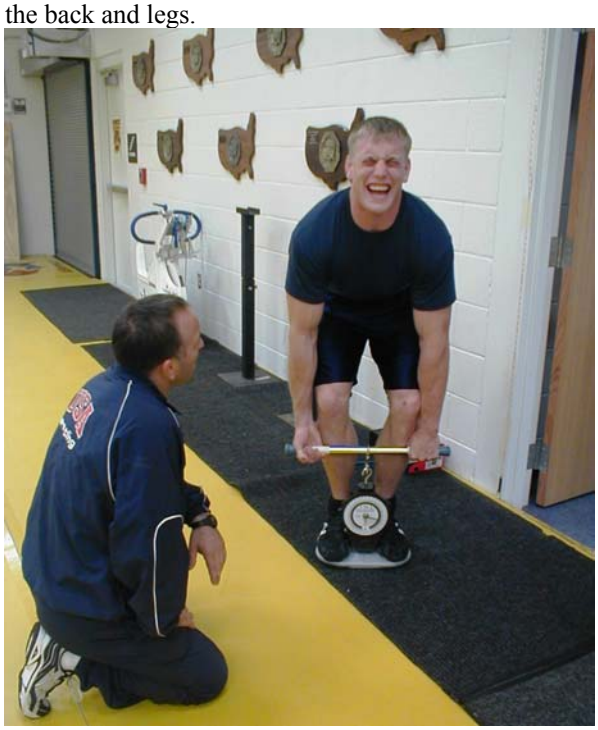
Following a 60 meter sprint for **speed**, we measure **aerobic power** with a 3 x 750 meter run around the perimeter of the Superior Dome Arena. The wrestlers have a 1 minute rest between runs. Most

wrestlers average about 2:25 per run. This structure closely parallels the new FILA match structure.

Sport-specific **speed endurance** is tested with a Dummy Throw Test. The appropriately sized dummy is thrown over the chest with correct form - 3 × 30 sec, with 30 sec break between periods. The number of throws is recorded for each period. A Throw Test Index is calculated.
The throw test index gives the highest weighting (45%) to explosive power (maximum throws), the next highest weighting (35%) to avoiding a big decline, and finally (20%) to the average number of throws.

Bridging ability is very important in Greco, so this sport specific **flexibility and mobility** is measured with two tests. The first is bridge flips. Starting in a front bridge the wrestler flips to a back bridge, and back to a front bridge. The score is the number of flips attained in 30 seconds. The second test is spinning around the head while in a bridge. From a front bridge position, with hands on the mat, the wrestler is timed as he circles his feet completely around the head, six times in each direction without lifting the hands or moving the head.

Strength is measured in several ways. We use a back lift dynamometer to measure the isometric strength of the back and legs.



Adam Wheeler of the USOEC is shown being tested and encouraged by Coach Ivan Ivanov

Static strength endurance of the upper body is measured with a flexed-arm-hang at 90º. Following 10 pullups, the wrestlers lower their body to make the right angle at the elbow. They are timed in how long they can hold this position.

Dynamic strength endurance is measured with a 5 minute rope climb. They are given five minutes to climb a 5 meter rope as many times as possible (no legs on the way up).
Strength endurance is also measured with weights. The wrestlers execute parallel squats to max reps at 110% of body wt., and also do Hang Cleans to max reps with body weight.

Anaerobic power and Power Endurance are measured with a special Arm Crank test. This is a modified Wingate test with eight 15 second all-out sprints over a six minute period. A Monark ergometer with a load basket for holding weight allows for instantaneous loading. The athlete's load is a percentage of their weight. Pedal revolutions during each sprint are recorded. The highest number is an indication of power. The decline is also analyzed via the same type of index described for the throw test to account for peak scores, average scores, and low scores (score decline).

Arm Cranking Test

The battery has been successfully received by wrestlers. Results are returned that are easily interpretable by the athletes. The results from this battery provide a profile of elite Greco-Roman wrestlers that can be used in an on-going manner to establish training targets for these developing wrestlers. We are looking to add a clinch-type measure of strength, tests of reaction and movement time with both a high dive and back-step technique.

The final step in any testing program is to apply what we learn about our wrestlers, what the wrestlers learn

about themselves, and use this knowledge to help wrestlers reach their goals. Good luck in your wrestling testing!

TEST RESULTS		Average
AGE		20.51
BODY COMPOSITION	% body fat (Lohman 3 site method)	12.9
AEROBIC POWER	3 x 750 meter runs	2:33
ANAEROBIC POWER	Arm Crank Power Test Coefficient	66.63
SPEED & POWER	60 meter Sprint (seconds)	8.16
	Standing Long Jump (meters)	2.48
STRENGTH	Back lift-dynamometer (kg)	174
STRENGTH ENDURANCE	Parallel Squats (max reps at 110% of body wt)	35
	Hang Cleans (max reps with body weight)	15
	Rope climbs in 5 minutes (5m)	7
STATIC STRENGTH ENDURANCE	Flexed-arm-hang at 90º (seconds)	44
SPORT SPECIFIC SPEED /ENDURANCE	Dummy Throw Coefficient	64.37
SPECIAL FLEXIBILTY/MOBILITY	Flips from a wrestling bridge	13
	Spinning around head in bridge	28 sec

Dummy Throw Test

The following section contains a description of our Dummy Throw Test, along with a detailed description of the use of the index concept used by German scientists at the IAT in Leipzig. The following is a description of a Sport Specific Speed (Special)/Endurance Measure for Greco-Roman wrestling, A Dummy Throw Test.

Dummy Throws: over chest with correct form - 3 × 30 sec, with 30 sec break between sets. A Throw Test Index will be calculated which allows the inclusion and weighting of initial explosiveness, and power endurance in a single coefficient. It is calculated as follows:

((((Lowest # Throws/Ideal High) * 3.5) + ((Highest # Throws/Ideal High)*4.5) + ((Average # Throws/Ideal Average)*2))/10)*100

Note that the highest weighting (45%) goes to explosive power – the highest number of throws in a segment. The next (35%) was given to the drop off between the lowest throws and the ideal high score. Finally, 20% to the average number of throws for all 3 series. These three parts of the coefficient could have been weighted equally, but the coaches felt that today's rules require maximum power that can be maintained without a huge drop off.

For this throw test, the ideal mean throws and ideal average throws for 30 seconds were set at:

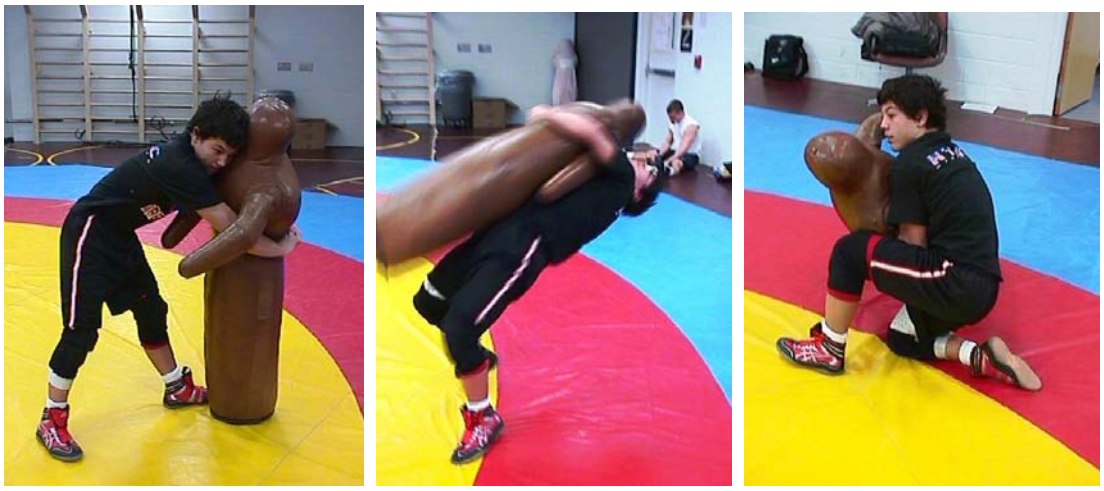
"Ideal High"=16 "Ideal Average"=13

Athlete	1st 30 sec	2nd 30 sec	3rd 30 sec	Max	Min	Ave	Ideal Max	Ideal Ave	Throw Test Index
"Golden Throw"	**16.0**	**13.0**	**10.0**	**16**	**13**	**13.00**	**16**	**13**	**100.00**
Betterman, J. USOEC	14.5	11.0	10.0	14.5	10	12.0**0**	16	13	86.17

Dummy Weight for Weight Class:

55	55 lbs
60, 66, 74	65 lbs
84, 96	85 lbs
120	95 lbs

The pictures on the next page show: Starting Position (Standing with dummy locked with one arm trapped); the throw (Correct performance: Over the chest with locked grip); and the third picture shows the most efficient technique of coming immediately to the feet after the throw.



Half throws: Each throw of the dummy with a slam to the mat counts as 1 throw. A half point will be added to the score if on the final attempt the dummy has left the ground and the athlete has begun his arch.

The throw test index gives the highest weighting (45%) to explosive power (maximum throws), the next highest weighting (35%) to avoiding a big decline, and finally (20%) to the average number of throws. The following shows the results for identical averages (the same number of total throws).

	1st 30 sec	2nd 30 sec	3rd 30 sec	Max	Min	Ave	Ideal Max	Ideal Ave	Throw Test Index
Example 1	13	10	7	13	7	10	16	16	**64.38**
Example 2	11	9.5	9.5	11	9.5	10	16	16	**64.22**
Example 3	12	10	8	12	8	10	16	16	**63.75**
Example 4	11	10	9	11	9	10	16	16	**63.13**
Example 5	10	10	10	10	10	10	16	16	**62.50**

References

E. Peukert, R. Schnell, and H. Tunnemann. (Power endurance dummy test in wrestling). *Leistungssport* 2:18-21, 1992.

Chapter 11

How Do Collegiate Wrestlers Strength Train?

Only a generation ago, weight training was oftentimes limited to the off-season, or done only if the wrestler wanted to do it on his own. Strength training has now become an integral part of the training of wrestlers, with highly developed, year-round programs being used. In order to see what some of these programs were like, last fall I started contacting the top wrestling programs, based on the 2003-04 NCAA Division 1 tournament results. Russ Hellickson, head coach at Ohio State, said that while at Wisconsin in the late 70's, he contacted a wide variety of experts, including athletes, coaches and scientists, and found almost no agreement – machine, free weight, lift fast, lift slow, high rep, low rep. He feels that there is no exclusively perfect system for our sport, but we have to include a variety of methods. Regardless of the method he says, "don't waste time sitting around talking in the weight room, lift with the intensity of our sport!" I sent a survey to these schools and asked that it be forwarded to the person in charge of the strength training. I found that all of these schools have extensive, well-planned programs that are either conducted by a strength and conditioning specialist, an assistant coach in charge of strength, or a combination of the two. As Hellickson suggests, they have all combined a variety of methods in establishing their programs. I have summarized the survey results in the Table 1.

While there is still some variation in these programs, there are many commonalities. They lift year-round. This includes during the season. Most in-season lifting is done in a morning session. Out of season sessions are seen in both am and pm. They all include some large muscle, multi-joint movements such as squats and cleans. For the most part they move from absolute strength gains when out of season, to a focus more on strength endurance and metabolic conditioning while in-season. Several use post-season training to rehab from injuries and to work on weak areas shown from their mat performance. Chris Ayres and Tom Koch from Lehigh cycle through three phases twice in a season This allows for two peaks, one in January and one in mid-March. There is a huge emphasis placed on power and explosiveness. Gary Calcagno of Oklahoma State says he tries to include some explosive aspect into each and every workout.

I asked if there were any "special exercises" they employ. A few programs mentioned grip exercises. At Oklahoma State they "pinch plates," holding two plates together with one hand. Iowa and Iowa State both mentioned the use of "fat" bars for some exercises. Mitch Clark (Ohio State) told me about something that I had never heard before-climbing chains! He said that it requires a total concentration on your grip that goes beyond a rope. At Illinois they flip huge tires for a total body effect. Oklahoma also lists some "strong man" activities such as sled pulls and sandbags.

Regarding any testing of lifting or other performance tests, Iowa tests some lifts for a max every 5 weeks. Brandon Eggum of Minnesota tests some lifts and running performances, but reminds us that there is not always a perfect correlation between strength in the weight room and strength on the mat. Mike Greenfield of Nebraska tests the bench squat and clean. He also tests the vertical jump, 300 yard shuttle run, and pro agility run. He feels that his wrestlers take the testing very seriously because it exposes any weaknesses in front of the team, and echoes Eggum's thoughts when he says, "performance testing is not always the best gauge of your wrestlers, because there are many different ways to be successful in our sport.

Andy Moser of Iowa State, stressed the need for avoiding muscular imbalances (which can lead to injury) by using opposing muscle groups. He along with others discussed the need to train the athletes proper form in cleans and squats. Some of these power movements are used at the end of training and conditioning, so the wrestler learns to produce power when fatigued.

All of these programs accommodate the needs of individuals, especially the need to limit the hypertrophy (increased muscle mass) of some wrestlers who cannot afford to grow out of their weight class. Of course some wrestlers need to gain weight for their weight class. The in-season programs attempt to maintain strength gains made earlier. Mike Greenfield's Nebraska program is fairly typical and uses 60-70% of max and 6-8 reps, in order to reduce muscle loss from wrestling workouts and weight cutting.

Suggested Reference:

William Kraemer et al, "The Physiological Basis of Wrestling: Implications for Conditioning Programs," in the *Strength and Conditioning Journal,* Vol 26: 2 Pages: 10-15, 2004.

Strength Training Survey Results

School	Equipment	How do you Divide the Year	Loading	Times/Wk	Exercises	Philosophy
Illinois	Mainly free weights, power racks, platforms Some machines for legs and cable crossover unit	Post-season (spring) Off-season (summer) Pre-season (fall) In-season (winter)	Heavy: 3-4 sets of 6-10 reps	3 (M, W,F) or 4(M,T,Th, F) Depending on individual	Bench press, rows, overhead press, curls, tricep extensions, towel pull-ups, squats, and cleans	Must lift year round and individualize to meet specific needs of wrestlers
Iowa	Free weights-Olympic and dumbbell	Pre-season In-season Tournament time Post season & Summer	Done individually based on needs	M-W-F	Olympic type lifts And a lot of push/pull work on Hammer and dumbbells	Explosion, quickness, and Power
Iowa State	Barbell and dumbbell in all phases. Very little machine work.	Off-season Pre-season In-season	70-95% 3-5 sets 2-8 reps 80-97% 3-6 sets 1-6 reps 50-85% 4-15 reps	4x week 3x week 2x week-1 day strength/power, I day endurance	Upright row, BB row, High pulls, Mil. Press, Bench, Curls, Reverse Curls, CoreShrugs. Test-Hang Clean, Squat Bench, Weighted pullups	Improve total body strength, power, and endurance
Lehigh	Free Weights Hammer Strength Machines	Hypertrophy 1 Max Strength 1 Conversion to Power 1 Maintenance 1 Hypertrophy 2 Max Strength/Maintenance Conversion to Power 2	3 sets 8-12 reps 5-6 sets 2-7 reps 2-3 sets 4-6 reps	3x week 3x week 1-3x week 0-2x week 2x week 2x week 2x week	Squats, Cleans, Bench, weighted pull-ups, Dumbbell row, Shoulder press, Abs	Hypertrophy-Gain muscle Max Strength-Gain Strength Conversion to Power-Make strength gains functional for wrestling
Michigan	Free Weights Hammer Strength Machines	In-season (from mid Oct to March) Post Season	Generally 3 sets of 10, 8, 6 reps	1-2 x week 3x week	High pulls, squats, bench press, dips w/weight Range of machines includes tricep extensions, rows, curls, pulldowns, leg curl, leg extension, pullups	Maintain Strength Gain strength
Minnesota	Free Weights Hammer Strength Machines	Basically have an in-season and out of season	Depends on if athlete needs strength or endur. – 4x4, or 3x12 2 push days and 2 pull	4x week	Cleans, Squats, Bench, Pullups, Pulldowns, Pushups, Abs, & Neck	Try to meet the specific needs of our wrestlers and increase strength and endurance.
Nebraska	Hammer Jammer, Hammer Push/Pull Circuit, Free Weights, Cable System, Husker Power Transformers	Pre-season In-season Post-season Summer	Metabolic & Explosive Maintenance Metabolic & Explosive Explosive Training	4x week 2-3x week 4x week 4x week	Hang & Power Cleans, Squats, Push/Pull, Bent over rows, Seated rows, Incline/Decline bench, Flys, Curls, Shoulder Press, Rotator cuff workout, Dips, Pullups, Lunges, Abs, Back Ext., Tricep Ext., Explosive Lunges, Box Jumps	Metabolic-Increase muscle mass Must train the body the way you want to compete-Train slow. Perform Slow! Train your muscles explosively since this is how they react in a match.
Ohio State	27 Hammer Strength Units and dumbbells in wrestling area. Free weights, racks and platforms in strength facility	In-season Post-season Pre-season (summer)	Generally low to higher reps as season progresses	4/week-Sun, Tu, Th, Fri 2 days Hammer 2 days Free Wts.	Free Wts-Cleans, squats, bench Machines and dumbbells-lots of push/pull, often with just one arm/leg at a time. 1 week each month bodyweight exercises rather than machines-chinups, climb rope, overhead ladder	Move from absolute strength to strength endurance as we move into the season. Always lift with intensity!
Oklahoma	90 % Free weights 10% Machine	Post Season Pre-Season In-Season	3-5 sets 4-10 reps 2-5 sets 6-12 reps Day 1: 2-6 sets 2-6 reps Day 2: Circuits	3x week 3x week 2x week	Power cleans, hang cleans, snatch, push jerks, front squat, back squat, split squat, lunges, Glute/ham, bench, pull-ups, rows	Pre-teach technique, increase mass, core strength, shoulder stability Season-Explosive power & strength, plus circuits for endurance Post rehab & overall strength
Oklahoma State	Free Olympic Weights Ground Based Hammer Strength Units	Summer Pre-season In-season Post-season	Rotates cycles of metabolic circuits and hypertrophy In-season 10-8-6 - no legs for end of season	3x week 4x week 3x week	Cleans, Squats, Lunges, Step ups, Box Jumps, Plyo Pushups, Rows, Curls, Hammer Ground Based circuit, Core exercises	Get as strong as possible, then change to power. Plyo's are always in for power and explosion

Chapter 12

Women's Wrestling-Some History, Physiology, and Sociology

In the overall history of wrestling, the development of women's wrestling has been dramatic. In roughly one generation, we have come from having the novelty of seeing a very few young girls competing in age-group or high school events, to women competing for Olympic medals. During this same time there have been changes in the views of the scientific and medical fields regarding women and their athletic capabilities. I t was only in the 1984 Los Angeles Olympic Games that women were allowed to run in events longer than 1,500 meters, with the addition of the 3,000 meters and the marathon. With the growth of women's sports, we are finding that there are more similarities in sports training and performance of men and women, than there are differences.

Participation data from the National Federation of High School Associations list the first girls in their survey results for the 1979-80 school-year. These numbers have steadily grown to just over 4,000 for the 2003-04 school year and accounts for 1.7% of the total participants.

Data from USA Wrestling shows a similar pattern. Membership totals, separated by gender, are available beginning in 1995, and lists 1,525 girls and women. This had grown to 3,442 in 2004, out of a total of 135,519. California and Kansas have the most female competitors with 677 and 373, respectively.

Internationally, the roots of women's wrestling are in France. Following the establishment of female wrestling clubs and hosting a first national championship in 1973, female wrestling was adopted by the French Wrestling Federation in 1977. They led the lobbying to establish women's wrestling within FILA, the international governing body of wrestling, which was accomplished in 1982. The first world championships were held in 1987, with France the team champions. While the USA was represented with competitors since this first world championship, USA Wrestling did not hold their first national championships for women until 1990. The USA won the world team championship in 1999. Last fall in Athens we were all proud to watch Patricia Miranda and Sara McMann win the first Olympic medals for the USA in women's wrestling.

My earliest contact with women competing in wrestling came in the early 70's, when as a college student, along with Mark Johnson, I helped to coach the Ann Arbor Wrestling Warriors. I'll never forget Tricia McNaughton (now Saunders) and her long pony-tail, as she and her brother trained and successfully competed. Tricia won four world championships in her storied career. (Zeke Jones also had his start with this club at the same time. There aren't very many kids clubs that can boast two world champions!)

In the USA, the development of female wrestlers is associated with boy's programs. Because of this, there is competition between the sexes, and the concerns for safety and equity, not to mention social, psychological and cultural issues. This is not always the case in other countries. I was in Beijing last summer at a regional sports school for students between the ages of 17-22. There was a training hall with 75 boys and coaches, and next to this gym was another with 75 girls and coaches training their freestyle.

Developmentally, there are not many concerns with competition between the sexes prior to male puberty. At any given chronological age, girls are farther along in their development than boys. Growth curves are more or less parallel until about 9 to 12 years of age, and during this time the body mass of girls is the same or slightly greater than the boys. Height is similar, but usually differences of 1-2 kg in the strength of various muscle groups favor boys. At about 11 years of age, girls have their adolescent growth spurt, and surge ahead of boys in height and weight. Boys will begin their growth spurt at around 13 years of age. It is at this point that the differences

between relative amounts of bone, muscle and fat become most apparent. Increased levels of testosterone in males will cause greater muscularity and skeletal size, while increased levels of estrogenic hormones result in greater body fat deposits in women. These body fat differences are roughly 8-10% higher in women, but often lower when comparing male and female athletes. The amount of "sex-specific" fat that women must have above and beyond the level for good health in men has not been firmly established. It is thought to be around 5%. On the average, males have a greater proportion of this subcutaneous fat in the upper body and abdominal region, whereas women will carry more of their fat on their hips and thighs. This also contributes to the center of gravity being lower in women. The center of gravity is where the mass of the body is balanced in all thee planes. A low center of gravity is associated with greater stability.

Irina Melnik-Merlen UKR-Olympic Champion at 48 kg

Some of the most important differences are seen in the cardiovascular and muscular systems. Women have a lower blood volume with fewer red blood cells (6% fewer) and less hemoglobin (15% less) which results in less oxygen carrying capacity. Because they also have typically smaller hearts, this will result in a higher training heart rate for a given load when compared to men. The ability to deliver oxygen to the exercising muscles is about 20-25% less than in men. Women will have a smaller muscle mass and on average be 40-60% weaker in the upper body and 25% weaker in lower body strength.

Notice that I said "on average" in the preceding sentence. There are some women who are stronger than some men. What is the effect of cultural or sociological expectations on getting the "true" physiological comparison? I like to look at comparisons of elite athletes, because these people are not bound by any social limitations. Their only focus is on doing their best. When I look at the world records in the running events in track from 100 meters to the marathon, women average about 90% of the men's performance. A look at swimming world records gave strikingly similar results, with women at 91% of the men's performance. A look at Olympic weightlifting shows women at about 77% of men's performance, but still closer than the differences cited in some physiology texts.

Dr. Harold Tünnemann of Germany has studied the sport-specific strength of some world champion women and was astonished to find a champion at 55 kg who exceeded the men's national team average force on their gut wrench machine.

When I speak to coaches and wrestlers about differences between wrestling for men and women, the list is not very long. Amy Borgnini and Mary Kelly, both nationally ranked wrestlers in the USOEC resident program at Northern Michigan University, cite strength levels as the biggest difference. I mentioned the concern that I have for young boys when they lose to a girl. Kelly stated, "I've beaten a lot of boys, and I've never noticed this having any long-term psychological effects on them. They didn't quit the sport or anything."

It is important to educate all female wrestlers, their parents, and coaches about the potential health consequences of inadequate energy intake and high levels of exercise. The **female athlete triad** is a syndrome occurring in physically active girls and women. The interrelated components are disordered eating, amenorrhea (disruption in menstrual cycles), and osteoporosis. Pressure placed on young women to achieve or maintain unrealistically low body weight underlies development of the triad. Adolescents and women training in sports in which low body weight is emphasized for athletic activity or appearance are at greatest risk.

Disordered eating refers to a wide range of harmful eating behaviors used in attempts to lose weight or achieve a lean appearance. These behaviors range from food restriction to binging and purging, to anorexia nervosa and bulimia nervosa. Amenorrhea can be the absence of menstruation by age 16 (primary), or an absence of 3 or more menstrual

cycles in a previously menstruating female (secondary or athletic amenorrhea). In some cases, the decrease in estrogen production can lead to osteoporosis and bone fractures. All of our wrestlers must be educated about proper nutrition and safe training practices. However, our women wrestlers must be educated about the warning signs of the triad. They should also be referred for medical evaluation at the first sign of any of the components of the triad.

Sara McMann USA World and Olympic Medalist

The growth of women's wrestling faces more challenges. In the US, we have to find a way to create more opportunities for women to wrestle women during the scholastic years. World-wide, there are over 80 countries with women's programs, but some of the most fundamentalist Islamic countries (Iran and Saudi Arabia) do not allow international competition. While at an international tournament in Morocco, I spoke to the women wrestlers. These Muslim women said that their society sees no conflict between sport participation and their religion. They train with the men, and they often wrestle with the men. When asked when they foresee women from Iran and Saudi Arabia in tournaments, they all answered, "Never!" I think it will be sooner than that.

Innovative techniques (note the deep gut wrench lock) are a part of Women's Wrestling (Sally Roberts, USA)

I see a wonderful future for women's wrestling. It is a great opportunity to get more people involved in our great sport. There is also a large amount of research to be done in this relatively new area of women's wrestling. I invite anyone with insights regarding training, injuries, to become involved with women's wrestling.

Iris Smith winning a world championship in Budapest-2005

Suggested References

Wells, CL ***Women, Sport & Performance 2nd Ed.*** Human Kinetics Books, Champaign, IL (1991).

Shangold, M.M. & Mirkin, G. ***Women and Exercise-Physiology and Sports Medicine*** F.A. Davis Co. Philadelphia (1988).

NOTES

Chapter 13

Bibliography of Wrestling Research from 2005

Anderson, B. J. (2005). Valacyclovir to expedite the clearance of recurrent herpes gladiatorum. Clin J Sport Med, 15, 364-366.

Keywords: dermatology /herpes/herpes simplex

OBJECTIVE: To determine if valacyclovir usage expedites the clearance of recurrent herpes gladiatorum (HG) in wrestlers. DESIGN: Double-blind, placebo-controlled, prospective study using valacyclovir from September 2001 through March 2003. PARTICIPANTS: Twenty-nine wrestlers were recruited from the Minneapolis-St. Paul, Minnesota area. They ranged in ages from 18 to 36, of whom 7 were coaches and 22 active wrestlers. All participants had greater than 2-year history of recurrent HG. MAIN OUTCOME MEASURES: Upon an outbreak, all participants would swab the area on a daily basis for 14 days. Swabs were analyzed for herpes simplex virus 1/2 via PCR. End point was determined as the last sample with measurable PCR detected. Individuals were randomly selected, yet equally distributed, to be in 1 of 3 groups: placebo x 7 days, valacyclovir 500 mg BID x 7 days, or valacyclovir 1,000 mg QD x 7 days. RESULTS: Twenty participants (3 coaches and 17 active wrestlers) experienced outbreaks. All participants were compliant and started medication within 24 hours of developing symptoms. Valacyclovir usage showed significant reduction in mean time until PCR clearance, 8.14 days with placebo versus 6.43 days with valacyclovir 500 mg BID. CONCLUSIONS: A 7-day regimen of valacyclovir 500 mg BID will reduce the length of time until clinical clearance of an outbreak of recurrent HG. Its usage reduced duration of viral presence by 21%.

Editor's note: This information is very important for medical staff working with wrestlers. PCR stands for polymerase chain reaction. This test looks for a small piece of protein on the surface of the virus, then one tags a tail to it that is detectable with certain equipment. The problem with this test is that it is very sensitive in detecting the presence of the virus, but not necessarily when it is still infectious. Comparing cultures, which will only allow viable virus to replicate, and PCR would help establish a comparison to determine how long the virus is truly able to be transmitted. This information would be truly useful; however the cost would be possibly up to $30,000 to $50,000 to do the study.

Austin, Atif The relationship between wrestling weight and success rate
Dissertation: MSE, Southwest Minnesota State University. 69 pages. 2005

The purpose of this research was to determine the difference between win percentages for a NCAA Division II wrestler at Southwest Minnesota State University competing at a weight above the lowest allowable weight verses the lowest allowable weight. Within this chapter, the population and sample, instrumentation, data collection procedures, data analysis, and summary are presented to construct the procedures of this research study. The data for this study were collected on 14 wrestlers during a 3-year time period beginning in 2002 and concluding in 2005. The data collected were lowest allowable weights for each wrestler, the number of matches wrestled at the lowest allowable weight, the number of matches wrestled above the lowest allowable weight, and wins and losses for each. The research concluded that there was no significant difference in wins and losses for those wrestling above the lowest allowable weight versus those wrestling at the lowest allowable body weight.

Publication number AAT 1425212-UMI

Editor's note: This research supports recent efforts to curtail drastic weight reduction among wrestlers.

Aydog, A. T., Tetik, O., Demirel, H. A., & Doral, M. N. (2005). Differences in sole arch indices in various sports. Br J Sports Med, 39, e5.

Keywords: equipment/ feet/injuries/Shoes

BACKGROUND: There are controversial data about the relation between foot morphology and athletic injuries of the lower extremity. Studies in soldiers have shown some relationship, whereas those involving athletes have not shown any significant relationship. The reason for these differences is not clear. OBJECTIVE: To determine the effect of

various sports on sole arch indices (AIs). METHOD: A total of 116 elite male athletes (24 soccer players, 23 wrestlers, 19 weightlifters, 30 handball players, and 20 gymnasts) and 30 non-athletic men were included in this cross sectional study. Images of both soles were taken in a podoscope and transferred to a computer using a digital still camera. AIs were calculated from the stored images. RESULTS: The AI of the right sole of the gymnasts was significantly lower than that of the soccer players, wrestlers, and non-athletic controls ($p<0.01$). The AI of the right sole of the wrestlers was significantly higher than that of the soccer players, handball players, weightlifters, gymnasts, and non-athletic controls ($p<0.03$). The AI of the left sole of the gymnasts was significantly lower than that of the wrestlers and non-athletic controls ($p<0.001$). The AI of the left sole of the wrestlers was significantly higher than that of the soccer players, handball players, and gymnasts ($p<0.007$). The AI of both soles in handball players was significantly lower than those of the non-athletic subjects ($p = 0.049$). The correlation between the AI of the left and right foot was poor in the soccer players, handball players, and wrestlers ($r = 0.31$, 0.69, and 0.56 respectively), but was high in the gymnasts, weightlifters, and non-athletic controls ($r = 0.96$, 0.88, and 0.80 respectively). CONCLUSION: The AIs of the gymnasts and wrestlers were significantly different from those of other sportsmen studied, and those of the gymnasts and handball players were significantly different from those of non-athletic controls.

Department of Sports Medicine, Hacettepe University, Sihhiye, Ankara 06100, Turkey. taydog@hacettepe.edu.tr

Editor's note: One sees that wrestler's have significanfly higher value of sole AI compare to the value of the control group. The reason being prone to be pes planus, might be sports related adaptation in wrestlers. Further research for this finding in wrestlermay be warranted.Coaches should remember that wrestling shoes generally have very little arch support and padding in the sole and should refrain from doing too much work off the mat in these shoes.

Boden, B. P. & Prior, C. (2005). Catastrophic Spine Injuries in Sports. Curr Sports Med Rep.,4, 45-49.

Keywords:Head/catastrophicinjuries/injuries/Neck/ spine/Risk

Catastrophic spine injuries in sports are rare but tragic events. The sports with the highest risk of catastrophic spinal injuries are football, ice hockey, wrestling, diving, skiing and snowboarding, rugby, cheerleading, and baseball. A common mechanism of injury for all at-risk sports is an axial compression force to the top of the head with the neck slightly flexed. We review common mechanisms of injury and prevention strategies for spine injuries in the at-risk sports.

The Orthopaedic Center, 9711 Medical Center Drive, #201, Rockville, MD 20850, USA. BBoden@earthlink.net.

Editor's Note: All of us in the wrestling community should strive to reduce the potential for injury. This work emphasizes the role of coaches and officials. I include the following situation as an example that must be monitored closely. Cuba's Roberto Monzon (R) and Bulgaria's Armen Nazarian (L) wrestle during the 60 kg final in 2005 GR WC and demonstrate the potentially dangerous positions that are commonplace with the new rules. Officials and administrators must be firm in not allowing brutality from the positions shown in this photo.

Bonis, M. P. & Loftin, J. M. Seasonal Body Composition Changes In Elite, Male High School Wrestlers. Med Sci Sports Ex 37[5 (Supplement)], S304. 2005.

Keywords: Body Composition/body fat/Dehydration/DEXA/dual energy x-ray absorptiometry/testing/weight cycling

Abstract: Wrestling is a weight-sensitive sport that involves possible physical liabilities if unhealthy nutritional and physical conditioning practices are utilized. Extreme energy restriction, restricting fluid intake, frequent weight cycling, and over-exercising could possibly place the athlete in a position of increased health risk by causing excessive dehydration and reducing immunity levels (Roemmich and Sinning, 1997). Purpose: Investigate the seasonal body composition changes of elite, high school wrestlers. Methods: 13 male, Caucasian high school wrestlers' (mean age + SD = 15.9 ± 0.9 yrs) bone mineral density (BMD), bone mineral content (BMC), body fat (BF), and lean soft tissue (LST) were measured using dual energy x-ray absorptiometry (DEXA) during preseason and six-months later during postseason. Results: Paired t-test results and body composition changes are shown in the table below.

TABLE: Body Composition Changes (Mean ± SD)

Dependent Variables	Preseason	Postseason	t (12)	p	r
Bodyweight (kg)	68.9 ± 10.5	70.2 ± 10.2	2.24	.045*	.979
Height (cm)	173.7 ± 6.0	175.0 ± 6.0	5.09	.000*	.988
BMI (kg/m*m)	22.8 ± 3.33	22.9 ± 3.08	.418	.683	.985
LST (kg)	56.2 ± 7.0	57.2 ± 6.3	2.65	.021*	.985
BF (kg)	8.0 ± 4.0	10.1 ± 4.3	3.61	.004*	.848
BMC (kg)	3.2 ± 0.5	3.3 ± 0.5	3.88	.002*	.976
BMD (g/cc)	1.22 ± 0.1	1.25 ± 0.1	3.51	.004*	.969

*** Significant (p < .05)**

Conclusion: The wrestlers' mean bone mineral was high (BMD z-score = 1.62) at the preseason testing as compared to the normal population's mean BMD, and increased at the postseason testing (BMD z-score = 1.82). During the course of the season, bodyweight, height, LST, BF, BMC, and BMD increased significantly.

Notes: University of New Orleans, New Orleans, LA. Email: mbonis@uno.edu

Editor's note: This is good news for the sport. An in-season measure of these variables would be helpful, since that is where weight loss generally occurs. We need similar work with women wrestlers, especially bone mineral density data.

Clark R.R., Bartok C, Sullivan JC, & Schoeller DA (2005). Is Leg-to-Leg BIA Valid for Predicting Minimum Weight in Wrestlers? Med Sci Sports Ex, 37, 1061-1068.

Keywords: body composition/body density/body water/bone/hydration/hydrostatic weighing / body water/weight Loss

Background: The National Collegiate Athletic Association (NCAA) and several state associations require prediction of minimum weight (MW) for collegiate and high school wrestlers. The rule requires assessment of body composition before the competitive season to minimize unhealthy weight-loss practices. Leg-to-leg bioelectrical impedance analysis (BIA) has been suggested for use with wrestlers. Purpose: To evaluate leg-to-leg BIA against a four-component (4C) criterion to determine whether leg-to-leg BIA predicted MW within acceptable limits for the sport of wrestling. Methods: Criterion MW was calculated by the 4C equation of Lohman (19) using independent measurement of body density (BD) by hydrostatic weighing, bone mineral content (BMC) by dual x-ray absorptiometry (DXA), and total body water (TBW) by deuterium dilution. Subjects were 57 wrestlers (mean +/- SD; age = 19.7 +/- 1.3 yr, height = 176.6 +/- 7.3 cm, weight = 77.7 +/- 12.4 kg). Hydration was confirmed by the NCAA guidelines. Accuracy, precision, and systematic bias were examined. Results: Comparable mean values (72.2 +/- 9.7 vs 72.2 +/- 10.3 kg), a high correlation (r = 0.94), and a regression line similar to the line of identity were found between BIA and 4C. However, large individual differences and systematic bias were seen across the range of MW. BIA predicted MW within 3.5 kg 68% of the time and within 7.0 kg 95% of the time. MW residuals ranged from -10.4 kg to +6.9 kg. When using 2.0 kg as an acceptable cutoff for error, only 40% of the BIA values were within 2.0 kg of the criterion. Conclusion: Large individual variation was seen, and, by definition, the precision was poor when estimating MW for individuals. In practical terms, the prediction error may span multiple weight classes, thus making leg-to-leg BIA unacceptable for prediction of MW in this sample under the conditions of the study.

Randy Clark - Manager, Exercise Science Laboratory
UW Hospital SportsMedicineCenter

Editor's note: We must continue to look for methods to predict minimal wrestling weights that are easy to use, practical, cost effective, and accurate. Unfortunately, there are limitations with BIA methodology at this time. I conducted a survey of all state associations prior to the 2006-07 season andand was ssurprised to find that 22 states allow the use of BIA. I asked Clark about this situation and he said that the WIAA and Wisconsin coaches were not willing to accept an error of plus or minus 20 lbs (several weight classes) in prediction of minimal weight. Therefore, they do not accept BIA/Tanita results. Some studies that support the use of BIA have not used a criterion method in their study. They simply compare BIA results to skinfolds. Both are predictions. That is not a validation study. There is danger in the approach that "doing something is better than nothing". BIA is quick, easy and requires little tester training.

However, several studies suggest the validity, precision and systematic bias of BIA is unacceptable for correctly classifying minimum weight in wrestlers. This situation deteriorates further if an athlete intentionally manipulates body weight thru dehydration prior to measurement. There is not any data from Tanita regarding female wrestlers.

Cohen, P. R. (2005). Cutaneous community-acquired methicillin-resistant Staphylococcus aureus infection in participants of athletic activities. South Med J, 98, 596-602.

Keywords:
Clothing/dermatology/equipment/Health/hygiene/Infection/Skin/Skin infections/Staphylococcus aureus

OBJECTIVES: Cutaneous community-acquired methicillin-resistant Staphylococcus aureus (CAMRSA) has been identified in otherwise healthy individuals either with or without methicillin-resistant S. aureus (MRSA)-associated risk factors who participate in athletic activities. The purpose of this study was to describe the clinical features of CAMRSA skin infection that occurred in university student athletes, evaluate the potential mechanisms for the transmission of MRSA infection of the skin in participants of athletic activities, and review the measures for preventing the spread of cutaneous CAMRSA infection in athletes. METHODS: A retrospective chart review of the student athletes from the University of Houston whose skin lesions were evaluated at the Health Center and grew MRSA was performed. The clinical characteristics and the postulated mechanisms of cutaneous MRSA infection in the athletes were compared with those previously published in reports of CAMRSA skin infection outbreaks in other sports participants. RESULTS: Cutaneous CAMRSA infection occurred in seven student athletes (four women and three men) who were either weight lifters (three students) or members of a varsity sports team: volleyball (two women), basketball (one woman), and football (one man). The MRSA skin infection presented as solitary or multiple, tender, erythematous, fluctuant abscesses with surrounding cellulitis. The lesions were most frequently located in the axillary region (three weight lifters), on the buttocks (two women), or on the thighs (two women). The drainage from all of the skin lesions grew MRSA, which was susceptible to clindamycin, gentamicin, rifampin, trimethoprim/sulfamethoxazole, and vancomycin; five of the isolates were also susceptible to ciprofloxacin and levofloxacin. All of the bacterial strains were resistant to erythromycin, oxacillin, and penicillin. The cutaneous MRSA infections persisted or worsened in the six athletes who were empirically treated for methicillin-sensitive S. aureus at their initial visit. Complete resolution of the skin infection occurred after the abscesses had been drained and the athlete had been treated with systemic antimicrobial therapy for which the bacterial strain was susceptible. CONCLUSIONS: Cutaneous CAMRSA infection typically presents as an abscess, with or without surrounding cellulitis, in otherwise healthy participants of athletic activities who have or do not have MRSA-associated risk factors. Athletes who have MRSA skin infections include weight lifters and team members from competitive sports such as basketball, fencing, football, rugby, volleyball, and wrestling. Bacterial culture of suspected infectious skin lesions should be performed to establish the diagnosis of cutaneous MRSA infection and to determine the antibiotic susceptibility of the bacterial isolate. Treatment of cutaneous MRSA infection involves drainage of the abscess (either spontaneously or after incision) and appropriate systemic antimicrobial therapy. Direct skin-to-skin physical contact with infectious lesions or drainage, skin damage that facilitates the entry of bacteria, and sharing of infected equipment, clothing, or personal items may result in the acquisition and transmission of MRSA infection in participants of athletic activities. Earlier detection and topical treatment of the athlete's skin wounds by their coaches, avoidance of contact with other participants' cutaneous lesions and their drainage, and good personal hygiene are measures that can potentially prevent the spread of cutaneous MRSA infection in participants of athletic activities.

Editor's note: MRSA is a very serious threat and merits the attention of all people associated with sports. Education and awareness is crucial.

Derya, A., Ilgen,E., & Metin, E.(2005). Characteristics of sports-related dermatoses for different types of sports: a cross-sectional study. J Dermatol, 32, 620-625.

Keywords:dermatology/infection/Skin

Skin lesions are common in athletes. Athletic activities may lead to new skin lesions or aggravate existing ones. We aimed to determine the effects of sport type and participation length on the occurrence of sports-related dermatoses and to identify the localization characteristics of these lesions. A total of 121 licensed athletes (42 swimmers, 23 handball players, 33 soccer players and 23 wrestlers) and 121 sedentary controls were included in the study. A

consultant dermatologist examined all subjects. Lesion types, duration, and localization characteristics were noted. The lesions were categorized as viral, bacterial, traumatic, and non-traumatic. Traumatic lesions were frequently seen in soccer players and wrestlers; fungal infections were more commonly seen in swimmers and in soccer players. Lesion types and localizations varied by sport type. There were no significant relationships between sport type and the incidence of viral and bacterial lesions. The results suggest that athletic activity seems to be a predisposing factor, especially for fungal infections and acute or chronic traumatic lesions. Thus, regular dermatological screening of athletes is critical for rapid identification and treatment of dermatoses disrupting sport performance.

Dixon, C. B., Deitrick, R. W., Pierce, J. R., Cutrufello, P. T., & Drapeau, L. L. Evaluation of the BOD POD and Leg-to-Leg Bioelectrical Impedance Analysis for Estimating Percent Body Fat in National Collegiate Athletic Association Division III Collegiate Wrestlers. Strength Cond Res 19[1], 85-91. 2005.

Ref Type: Abstract

Keywords: air displacement plethysmography/Bod Pod/Body Composition/body density/body fat/hydrostatic weighing/Lung/NCAA/residual lung volume/strength/testing/urine specific gravity

Evaluation of the BOD POD and leg-to-leg bioelectrical impedance analysis for estimating percent body fat in National Collegiate Athletic Association Division III collegiate wrestlers. J. Strength Cond. Res. 19(1):85-91. 2005.-The purpose of this study was to compare percent body fat (%BF) estimated by air displacement plethysmography (ADP) and leg-to-leg bioelectrical impedance analysis (LBIA) with hydrostatic weighing (HW) in a group (n = 25) of NCAA Division III collegiate wrestlers. Body composition was assessed during the preseason wrestling weight certification program (WCP) using the NCAA approved methods (HW, 3-site skinfold [SF], and ADP) and LBIA, which is currently an unaccepted method of assessment. A urine specific gravity less than 1.020, measured by refractometry, was required before all testing. Each subject had all of the assessments performed on the same day. LBIA measurements (Athletic mode) were determined using a Tanita body fat analyzer (model TBF-300A). Hydrostatic weighing, corrected for residual lung volume, was used as the criterion measurement. The %BF data (mean +/- SD) were LBIA (12.3 +/- 4.6), ADP (13.8 +/- 6.3), SF (14.2 +/- 5.3), and HW (14.5 +/- 6.0). %BF estimated by LBIA was significantly ($p < 0.01$) smaller than HW and SF. There were no significant differences in body density or %BF estimated by ADP, SF, and HW. All methods showed significant correlations ($r = 0.80$-0.96; $p < 0.01$) with HW. The standard errors of estimate (SEE) for %BF were 1.68, 1.87, and 3.60%; pure errors (PE) were 1.88, 1.94, and 4.16% (ADP, SF, and LBIA, respectively). Bland-Atman plots for %BF demonstrated no systematic bias for ADP, SF, and LBIA when compared with HW. These preliminary findings support the use of ADP and SF for estimating %BF during the NCAA WCP in Division III wrestlers. LBIA, which consistently underestimated %BF, is not supported by these data as a valid assessment method for this athletic group.

Department of Exercise Science and Sport, University of Scranton, Scranton, Pennsylvania 18510.

Editor's note: Although very expensive, air displacement plethysmography seems to be a viable tool in body composition assessment.

Endresen IM & Olweus D (2005). Participation in power sports and antisocial involvement in preadolescent and adolescent boys. J Child Psychol Psychiatry, 46, 468-478.

Keywords: behavior/selection/strength/values

Background: A limited number of mostly cross-sectional studies have examined the possible effects of power sports on aggressive and antisocial involvement in children and youth. The majority of these studies have serious methodological limitations, and results are partly contradictory. Longitudinal studies with representative, reasonably large samples and adequate dependent variables are lacking. Methods: The relationship between participation in power or fight and strength sports (boxing, wrestling, weightlifting, and oriental martial arts) and violent and antisocial behaviour was examined in a sample of 477 boys, aged 11 to 13 years at Time 1, over a two-year period. Making use of information about different participation patterns over time, the longitudinal design provided an opportunity to examine specified hypotheses about possible causal effects of power sports. Results: The total pattern of results strongly suggests that participation in power sports actually leads to an increase or enhancement of antisocial involvement in the form of elevated levels of violent as well as non-violent antisocial behaviour outside sports. In addition, there were no indications of selection effects; the presence of such effects

would imply that boys who started with power sports were characterised by already elevated levels of antisocial involvement. Conclusions: The results provide strong support for the 'enhancement hypothesis'. The negative effects in boys seemed to stem from both the practice of power sports itself and from repeated contact with 'macho' attitudes, norms, and ideals. The negative effects of participation in power sports represent a societal problem of considerable dimensions which has been largely neglected up to now.

Research Center for Health Promotion (HEMIL), University of Bergen, Norway.

Editor's note: I wonder if these same negative effects are present when these programs are run by an experienced coach/educator?

Hewett, T. E., Pasque, C., Heyl, R., & Wroble, R. (2005). Wrestling injuries. Med Sport Sci, 48, 152-178.

Keywords: epidemiology/equipment /injuries /risk/ sports medicine/training

OBJECTIVE: The purpose of this chapter is to review critically the existing studies on the epidemiology of pediatric wrestling injuries and to discuss suggestions for injury prevention and further research. DATA SOURCES: Data were obtained from the sports medicine and science literature since 1951. Literature searches were performed using the National Library of Medicine, Pubmed, Medline, Grateful Med, Sports Sciences, SportsDiscus. Keywords used included "Wrestling, Wrestle, Wrestling Injuries, Fractures, and Dermatologic". MAIN RESULTS: Only eight prospective or retrospective studies were found dealing with pediatric wrestling injuries and that provided sufficient information to allow the estimation of injury rates. Exposure-based injury rates were between 6.0 and 7.6 injuries per 1,000 athletic-exposures. Injury rates increased with age, experience, and level of participation. The head/spine/trunk was the body region that incurred the greatest frequency of injuries, followed by the upper and lower extremities. CONCLUSIONS: There are several potential areas for decreasing injury risk in wrestlers, including equipment, coaching, officiating and training. However, informed decisions with regard to preventing injuries are dependent upon the quality of the basic epidemiological data available, and at this time, analyses of risk factors and potential preventive measures are lacking.

Editor's note: This is an important and thorough study that can provide baseline data for future work.

Hiruma, M., Shiraki, Y., Nihei, N., Hirose, N., & Suganami, M. (2005). [Questionnaire investigation of incidence of Trichophyton tonsurans infection in dermatology clinics in the Kanto area] [Article in Japanese]. Nippon Ishinkin Gakkai Zasshi (Japanese), 46, 93-97.

Keywords:
dermatology/Infection/Tinea/Trichophyton

We conducted a questionnaire investigation to learn the incidence of T. tonsurans infection. Subjects of this investigation were 1,060 dermatologists in 1,060 dermatology clinics in the Kanto area to whom questionnaires were mailed. We asked each dermatologist whether he/she had experienced T. tonsurans infection cases (including suspected cases) and if so, we further asked; a. time of onset, b. number of cases, c. sexuality of the patient, d. club that the subject had joined (judo club, wrestling club or other), e. age of the subject, and f. number of cases suspected of having familial infection, the response rate was 47.5% (504 of the 1060 doctors), and 25.8% (130 of the 504) had handled T. tonsurans infection cases. The total number of patients was 707 (657 males and 50 females), with 400 (56.6%) of those in the 18 high-ranking clinics. The number of cases had increased rapidly from around 2002; 72.9% of the patients were students in high schools and universities and in 8 cases familial infection was suspected. 96.5% of the patients were in a judo or wrestling club. Our investigation revealed that this infectious disease had spread more than we had expected. It is important to develop more reliable infection control measures and to determine the actual conditions of this infection using mycological examinations.
Department of Dermatology, Juntendo University School of Medicine, 2-1-1 Hongo, Bunkyo-ku, Tokyo 113-8421, Japan.

Iwai, K., Okada, T., Nakazato, K., Fujimoto, H., Yamamoto, Y., & Nakajima, H. (2005). Trunk Muscle Strength And Muscle Cross-sectional Areas In Collegiate Wrestlers And Judo Players. Med Sci Sports Ex, 37, S354-S355.

Keywords: Magnetic Resonance
Imaging/muscle/muscle area/strength/Torque

The importance of trunk muscles in sports has been pointed out and their characteristics should differ depending on types of athletics. Although wrestling and judo have some similar aspects such as contact

sports, the weight-classes system, movement etc., specific characteristics should be emerged. PURPOSE:This study evaluated isokinetic trunk extensor and flexor strength, the cross-sectional areas of trunk muscles and physical characteristics, and compared there between collegiate wrestlers and judo players. METHODS:The subjects were 30 male collegiate wrestlers and 14 judo players. Physical characteristics and isokinetic trunk extensor and flexor muscle strength using a Biodex System 3 (60, 90, 120deg/sec) were measured. The peak torques of trunk extensor and flexor muscle strength by dividing with each subject's body weight in the best trial, and the extensor/flexor ratio were used to evaluate their trunk muscle strength parameters. Magnetic resonance imaging (MRI) was also used to assess the trunk muscle cross-sectional areas obtained through the center of the L3/4 lumbar disc. We assigned five areas to the cross-section of the trunk muscles because the borderlines were unclear (rectus abdominis, internal and external obliques, psoas major, quadratus lumborum, erector spinae and multi.dus muscles). Statistical significance was positive at the 5% level using the unpaired t-test. RESULTS:The sport history of judo players was significantly longer than that of wrestlers ($P<0.001$). The trunk flexor strength of wrestlers was significantly higher than that of judo players at 120 deg/sec ($P<0.01$). The cross-sectional areas of trunk muscles per bodyweight also demonstrated a significant difference between wrestlers and judo players (Rectus Abdominis; wrestling >judo, $P<0.05$, Obliques; wrestling <judo, $P<0.05$, Quadratus Lumborum; wrestling <judo, $P<0.01$). The larger trunk muscle areas in wrestlers probably relate to trunk flexion and/or extension movements. On the other hand, the larger trunk muscle areas in judo players may seem to contribute to trunk rotational movements. CONCLUSIONS:This study indicates that different characteristics of trunk muscles exist even in the two similar sports. Such information should be useful for specific conditionings in each sport.

Hiroshima National College of Maritime Technology, Hiroshima, Japan
Nippon Sport Science University, Tokyo, Japan. Email: iwai@hiroshima-cmt.ac.jp

Kasai T. [Epidemiological survey of Trichophyton tonsurans infection in Tohoku district and its clinical problems] [Article in Japanese] Nippon Ishinkin Gakkai Zasshi. 2005;46(2):87-91

Kasai Dermatological Clinic, 2-40-32-105 Higashitanaka, Tagajo, Miyagi 985-0863, Japan.

To research the current status of Trichophyton tonsurans infection in Tohoku District, I sent out a questionnaire to the main dermatology clinics in the Tohoku district. The results showed this infection was found first in spring, 2001 in Miyagi prefecture, and gradually spread from southern to northern districts; the total number of patients is now 162. The number in each prefecture is as follows: Yamagata; 88, Miyagi; 68, Akita; 4, Aomori; 2. In Iwate and Fukushima, however, no cases were reported. By age distribution high school students accounted for 117 (75%), elder patients for 29 (19%), lower age children only 10, and 6 cases were uncertain. Judo players accounted for 113 (70%) and wrestlers for 39 (24%). Family infections were found in two cases. Latent infections were found in several cases, and in one case the infection continued for 2.5 years without clinical symptoms. In my clinic 30 cases were observed beginning in 2001: high school boys accounted for 11, students of a professional school 14, college student 1, adults 3, and those involved in judo 27, wrestling 2 and mixed grappling sports 2. A family infection between a father and his daughter was found. According to the observations in our cases, this fungus easily invaded the hair roots from the early stage of infection, but was not noticed by common external clinical observations. Thus, microscopic examinations are necessary throughout the therapeutic process and to make certain of a complete cure. I think also necessary is the systemic administration of terbinafine or itraconazole for 4 or 6 weeks or more even for tinea corporis. Additionally, I emphasize that culture study is indispensable to confirm the infection by this fungi.

Khalili-Borna, K. & Honsik, K. (2005). Wrestling and sports medicine. Curr Sports Med Rep., 4, 144-149.

Keywords: injuries/Sports Medicine

The coverage of wrestling events from the perspective of medical personnel is reviewed here. Considerations are made regarding the role of medical personnel, the supplies that are important for wrestling event coverage, and the injuries that are frequently encountered in wrestling. Attention is

given to treatment of injuries and conditions that are largely specific to wrestling.

Notes: Kaiser Permanente Sports Medicine Fellowship, 9961 Sierra Avenue, Fontana, CA 92335, USA.

Kishali, N. F., Imamoglu, O., Kaldiriimci, M., Akyol, P., & Yildirim, K. (2005). Comparison of lipid and lipoprotein values in men and women differing in training status. Int J Neurosci, 115, 1247-1257.

Keywords: anaerobic power/cardiovascular/Cholesterol/Lipids

Abstract: The aim of this study was to compare plasma lipid and lipoprotein concentrations of male and female subjects in different training levels and to examine the risks of cardiovascular diseases. For this purpose, 20 male athletes from the National Turkish Wrestling Team (age 23.5 +/- 1.25 years) and 44 male and 51 female students (ages 21.7 +/- 1.72 and 20.20 +/- 1.68 years, respectively) from physical education and sports department and 40 sedentary females (ages 21.14 +/- 1.72 years) participated in this study. Trigliceride (TG), total cholesterol (TC), HDL-C and LDL-C levels were determined by a Hitachi 717 Autoanalyser. Apo A-l, Apo B, and Lp(a) levels were determined by Behringer Nephelometer 100. Maximum Oxygen Consumption (VO(2) max) values were determined by 12-min run test and the anaerobic power values were measured by Jump Meter Instrument. Energy consumption of basal metabolic rates were for males 1 kcal for an hour and 0.9 kcal for females. There were no significant differences in plasma TC, TG, and small lipoprotein a (Lp(a)) values between four groups ($p > .05$). No significant differences were found in HDL-C, LDL-C, apolipoprotein Al (Apo-Al), and apolipoprotein B100 (Apo-B) values between wrestlers and male students, and between female students and sedentary females ($p > .05$). HDL-C values of female students and sedentary females were significantly higher when compared with the same values of wrestlers and male students (41.52 and 40.93 mg/100 ml versus 51.92 and 50.10 mg/100 ml). However, LDL-C values were found to be lower in females than males (121.83 and 101.10 mg/100 ml as opposed to 97.7 and 98.4 mg/100 ml) but only significantly lower than in wrestlers ($p < .05$). Although the wrestlers' training levels were always higher than male students, the lipid and lipoprotein values were not different. These variables were not different between female groups either. But the lipid and lipoprotein profile of female subjects was found to be better than that of males. These results showed that medium and high level of exercises did not cause significant differences in lipid and lipoprotein levels, but the sex differences were very pronounced. Lipid and lipoprotein values of the four groups have indicated that the individuals in these groups would not be exposed to danger of cardiovascular diseases.

Kohl, T. D., Emrich, R., Moyer, J., Giesen, D. P., Ventresca, T., Sacco, R., Maryniak, J., Bartley, T., Thompson, G., Blimline, M., Harmon, D., & Kohl, K. A. Are There Carriers Of Ringworm Among Competitive Wrestlers? Clinical journal of sport medicine 14[5], 311. 2005.

Abstract
Keywords: Infection/Skin/Tinea

Tinea gladiatorum is a prevalent skin infection among competitive wrestlers. We have sought to prove the existence of asymptomatic carriers of the fungal organism responsible for the outbreaks. A prospective cohort study involving screening examinations and scalp testing for fungal organisms of those found not to have clinical disease was undertaken during preseason (PS), midseason (MS), and post-season (PT) in high school (7 schools) and collegiate wrestlers (one Division 2 school). Boys' basketball players from each of the participating schools provided a control group to determine if wrestling had more carriers. There were no carriers found during PS screening of wrestlers and basketball players. During MS screening there were significantly more wrestlers (22 of 107; 20.6%) than boys basketball players(1 of 54;1.8%) that were carriers ($p<.001$). During PT screening the difference in carrier prevalence approached significance, wrestlers (11 of 107; 10.3%), basketball (1 of 54; 1.8%) ($p=0.06$). There is a modest presence of asymptomatic carriers of ringworm among competitive wrestlers which may act as a reservoir of recurrent and persistent active infection in this population. Further study must determine if treatment of the carrier state will influence the incidence of infection, or if the presence of fungal organisms is a ubiquitous characteristic of the sport. This study was funded by the National Athletic Trainers' Association Research and Education.

Reading Hospital and Medical Center, Reading, PA, Berks County Scholastic Athletic Trainers' Association, Berks County, PA, and Kutztown University, Kutztown, PA.

S. S. Kurdak, K. Ozgunen, U. Adas, C. Zeren, B. Aslangiray, Z. Yazici, and S. Korkmaz. Analysis

of isometric knee extension/flexion in male elite adolescent wrestlers. ***J Sports Science and Medicine*** **4:489-498, 2005.**

Wrestling requires strength of the upper and lower body musculature which is critical for the athletic performance. Evaluation of the adolescent's skeletal muscle is important to understand body movement, especially including those involved in sports. Strength, power and endurance capacity are defined as parameters of skeletal muscle biomechanical properties. The isokinetic dynamometer is an important toll for making this type of evaluation. However, load range phase of range of motion has to be considered to interpret the data correctly. With this in mind we aimed to investigate the lover body musculature contractile characteristics of adolescent wrestlers together with detailed analyses of load range phase of motion. Thirteen boys aged 12 - 14 years participated to this study. Concentric load range torque, work and power of knee extension and flexion were measured by a Cybex Norm dynamometer at angular velocities from 450°/sec to 30°/sec with 30°/sec decrements for each set. None of the wrestlers were able to attain load range for angular velocities above 390°/sec and 420°/sec for extension and flexion respectively. Detailed analyses of the load range resulted in statistically significant differences in the normalized load range peak torque for extension at 270°/sec (1.44 ± 0.28 $Nm \cdot kg^{-1}$ and 1.14 ± 0.28 Nm·kg-1 for total and load range peak torque respectively, $p < 0.05$), and for flexion at 300°/sec (1.26 ± 0.28 Nm·kg-1 and 1.03 ± 0.23 Nm·kg-1 for total and load range peak torque respectively, $p < 0.05$), compared to total peak torque data. Similarly, the significant difference was found for the work values at 90°/sec (1.91 ± 0.23 Nm·kg-1 and 1.59 ± 0.24 Nm·kg-1 for total and load range work respectively for extension and 1.73 ± 0.21 Nm·kg-1 and 1.49 ± 0.19 Nm·kg-1 for total and load range work respectively for flexion, $p < 0.05$), and was evident at higher angular velocities ($p < 0.001$) for both extension and flexion. At extension, load range power values were significantly smaller than total power for all angular velocities except 150°/sec ($p < 0.05$ for 120 and 180°/sec, $p < 0.001$ for others). Finally, load range flexion power was found to be higher than total power with statistically significance ($p < 0.05$ for 60, 120, 150, 180, 210, 270 and 300°/sec, $p < 0.001$ for 240 °/sec). Extra caution is required for correct interpretation of load range data in terms of considering the load range during limb movement. Evaluation of muscle performance of these adolescent wrestlers at regular intervals may give us an opportunity to obtain a healthy maturation profile of these adolescent wrestlers.

Editor's note: Provides some valuable descriptive data for the development of a wrestler profile.

Lian, O. B., Engebretsen, L., & Bahr, R. (2005). Prevalence of Jumper's Knee Among Elite Athletes From Different Sports: A Cross-sectional Study. Am J Sports Med, 33, 561-567.

Keywords:
injuries/Knee/Leg/Male/power/research/speed/weight /women

BACKGROUND: The prevalence of jumper's knee across different sports has not been examined, and it is not known if there is a gender difference. Data from surgical case series indicate that there may be a high prevalence in sports with high speed and power demands. HYPOTHESIS: The aim of this study was to estimate the prevalence of jumper's knee in different sports among female and male athletes and to correlate the prevalence to the loading characteristics of the extensor mechanism in these sports. STUDY DESIGN: Cross-sectional study; Level of evidence, 4. METHODS: The authors examined approximately 50 Norwegian male and female athletes at the national elite level from each of the following 9 sports: athletics (male athletes: high jump, 100- and 200-m sprint), basketball (male athletes), ice hockey (male athletes), volleyball (male athletes), orienteering (male athletes), road cycling (male athletes), soccer (male and female athletes), team handball (male and female athletes), and wrestling (male athletes). The examination included an interview on individual characteristics (weight, age, height, and training background), a clinical examination, and self-recorded Victorian Institute of Sport Assessment score from 0 (worst) to 100 (best). RESULTS: The overall prevalence of current jumper's knee was 14.2% (87 of 613 athletes), with a significant difference between sports with different performance characteristics (range, 0%-45%). In addition, 51 athletes (8%) reported previous symptoms. The prevalence of current symptoms was highest in volleyball (44.6% +/- 6.6%) and basketball (31.9% +/- 6.8%), whereas there were no cases in cycling or orienteering. The prevalence of current jumper's knee was lower among women (5.6% +/- 2.2%) compared with men (13.5% +/- 3.0%; chi(2) test, $P = .042$). The duration of symptoms among athletes with current jumper's knee ($n = 87$) was 32 +/- 25 (standard deviation) months, with a Victorian Institute of Sport Assessment score of 64 +/- 19. CONCLUSION: The prevalence of jumper's knee is high in sports characterized by high demands on speed and power for the leg extensors. The symptoms are often serious, resulting in long-standing

impairment of athletic performance. Notes: Oslo Sport Trauma Research Center, Norwegian University of Sport and Physical Education, PO Box 4014, Ulleval Stadion, 0806 Oslo, Norway. roald@nih.no

Lightfoot, A. J., McKinley, T., Doyle, M., & Amendola, A. (2005). ACL tears in collegiate wrestlers: report of six cases in one season. Iowa Orthop J, 25, 145-148.

Keywords: Anterior Cruciate Ligament/competition/injuries/Knee/rehabilitation surgery

Six NCAA Division I wrestlers at The University of Iowa tore an anterior cruciate ligament (ACL) during the 2002-03 season. In comparison, between the years of 1993 and 2002, only five wrestlers sustained the same injury. Retrospective review and video data analysis were performed. All six were injured while their knee was near terminal extension and in a vulnerable position. Eighty-three percent of all injuries occurred during takedowns. Five of the six wrestlers' mechanism of injury involved rotation and stress on the weight-bearing knee. Eighty-three percent sustained their injuries while their foot was firmly planted on the ground. Five of the injuries occurred in competition. Of the six wrestlers injured, four underwent immediate rehabilitation in hope of wrestling that same season. Three ultimately needed surgery and one continued to wrestle in the same season without having surgery. Of the five wrestlers who underwent surgical reconstruction of their ACL, each had bone-patellar-bone grafts.

Editor's note: I asked Dr. Amendola if I could have a description of the technique being used at the time of the injury and he supplied me with the following information. Wrestler one reported that while in the neutral position, he hyperextended his knee as he backed out of bounds, but really this mechanism can not be verified since there was no video. He was beingpushed out and says he was countering an attempted take down.

Wrestler two was also in neutral when he was countering a take down/being taken down while falling backwards out of bounds. WR #2's foot and leg was blocked to trip him backwards, locking the foot to the mat and the weight of the opponent came down on the same leg.

Wrestler 3 was a practice injury with no film verification, but the move was a knee in the butt/bow and arrow. He was down (on bottom in disadvantage or defensive position). This one the only one where the foot wasn't on the mat at time of injury. The knee was flexed and twisted (probably turned against the joint in wrestling terms and was potentially dangerous position).

Wrestler 4 was in the top position returning his opponent to the mat after he stood up. To return him to the mat he lifted him and then tripped him forward with his right leg. His left leg was his support leg and that knee was injured.

Wrestler 5 was being taken down to his back. He really didn't counter it because it was so good) with an "inside trip." Again, a wrestler reacting to an opponents move (so were 1-3 and 6). The leg that was caught by the opponent with the "inside trip" was the knee that was injured.

Wrestler 6 was countering a head on the inside sweep single takedown. His opponent had a single leg on him and he was trying to cut the corner. His foot was trailing while the knee was twisted out (ala Cary Kolat). This was not the sitting on the butt position where the opponent has head on the inside. This is knee on the mat with leg and foot (the single leg takedown) being rotated out away from the center. This position is often called potentially dangerous unless the person countering puts themselves in this position.

Five of the six occurred during takedowns with the other in down position.

Five of the six occurred to the defensive wrestler, so the injured wrestler was reacting and being acted upon by the offensive wrestler.

Mazzocca, A. D., Brown, F. M., Carreira, D. S., Hayden, J., & Romeo, A. A. (2005). Arthroscopic anterior shoulder stabilization of collision and contact athletes. Am J Sports Med, 33, 52-60.

Keywords: Dislocations/injuries/Shoulder

BACKGROUND: Repair of the anterior labrum (Bankart lesion) with tightening of the ligaments (capsulorrhaphy) is the recommended treatment for recurrent anterior glenohumeral dislocations. Current evidence suggests that arthroscopic anterior stabilization methods yield similar failure rates for resubluxation and redislocation when compared to open techniques. STUDY DESIGN: Case series; Level of evidence, 4 PURPOSE: To examine the results of arthroscopic anterior shoulder stabilization of high-demand collision and contact athletes.

METHODS: Thirteen collision and 5 contact athletes were identified from the senior surgeon's case registry. Analysis was limited to patients younger than 20 years who were involved in collision (football) or contact (wrestling, soccer) athletics. Objective testing included preoperative and postoperative range of motion and stability. Outcome measures included the American Shoulder and Elbow Society shoulder score, Simple Shoulder Test, SF-36, and Rowe scores. The surgical procedure was performed in a consistent manner: suture anchor repair of the displaced labrum, capsulorrhaphy with suture placement supplemented with thermal treatment of the capsule when indicated, and occasional rotator interval closure. Average follow-up was 37 months (range, 24-66 months). RESULTS: Two of 18 contact and collision athletes (11%) experienced recurrent dislocations after the procedure; both were collision athletes. One returned to play 3 years of high school football but failed after diving into a pool. One patient failed in his second season after his stabilization (>2 years) when making a tackle. None of the contact athletes experienced a recurrent dislocation, with all of them returning to high school or college athletics. CONCLUSIONS: One hundred percent of all collision and contact athletes returned to organized high school or college sports. Fifteen percent of those collision athletes had a recurrence, which has not required treatment. Participation in collision and contact athletics is not a contraindication for arthroscopic anterior shoulder stabilization using suture anchors, proper suture placement, capsulorrhaphy, and occasional rotator interval plication.

Department of Orthopaedic Surgery, University of Connecticut School of Medicine, Farmington, Connecticut 06034, USA. admazzocca@yahoo.com

Menenakos, E., Alexakis, N., Leandros, E., Laskaratos, G., Nikiteas, N., Bramis, J., & Fingerhut, A. (2005). Fatal chest injury with lung evisceration during athletic games in ancient Greece. World J Surg, 29, 1348-1351.

Keywords:
chest/culture/history/injuries/Lung/Olympics/surgery

The "Olympic idealism" that dominates modern athletic culture is a myth. The true aims of the athletes in ancient Greece were rewards and life-long appointments to various positions in the military or the city administration. Competitions in the athletic games included, among others, wrestling, boxing, and pangration (a combination of wrestling and boxing). Occasionally, these games resulted in severe trauma or death. Two cases of extreme violence resulting in fatal chest trauma are presented and commented on from both surgical and social points of view.

Mochizuki, T., Tanabe, H., Kawasaki, M., Anzawa, K., & Ishizaki, H. (2005). [Survey of Trichophyton tonsurans infection in the Hokuriku and Kinki regions of Japan]. Nippon Ishinkin Gakkai Zasshi (Article in Japanese), 46, 99-103.

Keywords: dermatology epidemiology Infection Tinea Trichophyton

In June 2004, information was gathered on Trichophyton tonsurans infections, both past and current, in the Hokuriku and Kinki regions of central-western Honshu island, Japan, by questionnaires sent to 185 dermatologists who were members of the local medical mycologist associations Hokuriku Shinkin Kondan-kai and Kansai Shinkin Kondan-kai. Of the 111 (59.4%) who returned the completed questionnaire, 32 (28.8%) had seen patients infected with T. tonsurans including suspicious cases. The earliest recorded cases were linked to an endemic that occurred in 1994 or 1995 among a high school wrestling team in Toyama. The majority of the dermatologists saw their first case between 2001 and 2003. When the patients were grouped according to contact sports, judo players formed the largest group, followed by wrestlers. When grouped according to age, high school students formed the largest group, but the endemic had also expanded among junior high school students and adults, and there was one nursery school child who was a member of a judo club. Seventy-four of the dermatologists were sent sterilized hairbrushes to collect samples from patients suspected as having tinea capitis during July and September 2004. Trichophyton tonsurans was detected in samples from 6 patients. To investigate the molecular epidemiology, 71 of the clinical strains of T. tonsurans isolated from the Hokuriku and Kinki regions were analyzed using restriction fragment length polymorphisms of the non-transcribed spacer regions of ribosomal RNA genes. With the restriction enzyme Mva I, two molecular types were detected among the strains, indicating that the causative agents of the endemic were derived from different origins.

Department of Dermatology, Institute of Medical Research, Kanazawa Medical University, Uchinada-cho, Kahoku-gun, Ishikawa 920-0293, Japan.

Moore, M. J. & Welch, C. E. (2005). Sport and physical activity participation and substance use among adolescents. J Adolesc Health, 36, 486-493.

Keywords: gender/Health/substance abuse/values/youth

PURPOSE: To examine the association between participation in specific school-sponsored sports and out-of-school sports/physical activities and substance use. METHODS: Subjects consisted of 891 8th grade youth from three schools. Baseline data were collected using the Youth Alcohol & Drug Survey (2000) and following standardized protocols. Logistic regressions were conducted to identify associations between the independent variables of school-sponsored sports, and out-of-school sports/physical activities, and each of the four substance use dependent variables, while controlling for race. Additionally, logistic regressions were run separately for males and females to examine gender differences. RESULTS: Participation in any one of seven specific sports/physical activities was associated with increased substance use for one or both genders, whereas participation in any one of four other specific sports/physical activities was associated with decreased use for one or both genders. Those sports associated with increased use differed for males and females, as did those associated with decreased use. Females in school-sponsored dance/cheerleading/gymnastics were at decreased risk of alcohol use, whereas those in out-of-school dance/cheerleading/gymnastics, skateboarding or surfing were at increased risk for using at least one substance. Males in out-of-school swimming were at decreased risk of heavy alcohol use, whereas those in school-sponsored football, swimming, wrestling or out-of-school tennis were at increased risk for using at least one substance. CONCLUSIONS: Educators cannot assume all sports/physical activities have a positive relationship with youth substance use. School-sponsored, male-dominated sports appeared to be associated with an increased substance use risk for males, whereas out-of-school, mixed-gender sports appeared to be for females.

Oppliger R.A., Magnes, S. A., Popowski, L. A., & Gisolfi, C. V. (2005). Accuracy of urine specific gravity and osmolality as indicators of hydration status. Int J Sport Nutr Exerc Metab, 15, 236-251.

Keywords: Dehydration/hydration/hydration status/urine/urine specific gravity

To reduce the adverse consequences of exertion-related and acute intentional dehydration research has focused on monitoring hydration status. This investigation: 1) compared sensitivity of urine specific gravity (Usg), urine osmolality (U(osm)) and a criterion measurement of hydration, plasma osmolality (P(osm)), at progressive stages of acute hypertonic dehydration and 2) using a medical decision model, determined whether Usg or U(osm) accurately reflected hydration status compared to P(osm) among 51 subjects tested throughout the day. Incremental changes in P(osm) were observed as subjects dehydrated by 5% of body weight and rehydrated while Usg and U(osm) showed delayed dehydration-related changes. Using the medical decision model, sensitivity and specificity were not significant at selected cut-offs for Usg and U(osm). At the most accurate cut-off values, 1.015 and 1.020 for Usg and 700 m(osm)/kg and 800 m(osm)/kg for U(osm), only 65% of the athletes were correctly classified using Usg and 63% using U(osm). P(osm), Usg, and U(osm) appear sensitive to incremental changes in acute hypertonic dehydration, however, the misclassified outcomes for Usg and U(osm) raise concerns. Research focused on elucidating the factors affecting accurate assessment of hydration status appears warranted.

Editor's note: Almost all programs developed for the establishment of a minimal wrestling weight depend on testing in a hydrated state. This is critcal research for these programs!

Rezasoltani, A., Ahmadi, A., Nehzate-Khoshroh, M., Forohideh, F., & Ylinen, J. (2005). Cervical muscle strength measurement in two groups of elite Greco-Roman and free style wrestlers and a group of non-athletic subjects. Br J Sports Med, 39, 440-443.

Keywords: Neck/rehabilitation/strength/training

BACKGROUND: Free style and Greco-Roman are two types of wrestling. OBJECTIVES: The aim of this study was to examine the maximal isometric strength of cervical extension (ISCE) and the maximal isometric strength of cervical flexion (ISCF) in two groups of elite wrestlers and a group of non-athletic subjects. METHODS: Fourteen elite Greco-Roman wrestlers (aged 19-25 years), 16 elite free style wrestlers (aged 18-25 years), and 16 non-athletic subjects (aged 18-25 years) participated in this study. All wrestlers competed at international level with the Iranian national team. Maximum voluntary contractions (MVC) of cervical extensor and flexor muscles were measured using a custom made device. The ratios of ISCE to weight (ISCE/weight), ISCF to weight (ISCF/weight), and ISCF to ISCE (ISCF/ISCE) were calculated for group comparisons. Pearson product moment test was used to estimate correlation between maximal isometric strength measurements and anthropometric variables.

A one way analysis of variance was computed to compare ISCE/weight, ISCF/weight, and ISCF/ISCE among groups. RESULTS: There was significant correlation between maximum cervical extension and flexion strengths and weight in all groups ($p<0.05$, $n = 46$). The ratios of cervical muscle strengths to weight were significantly higher in wrestlers than in non-athletic subjects ($p<0.00$). Greco-Roman wrestlers appeared to be stronger than free style wrestlers following comparison of all ratios. CONCLUSIONS: Neck muscle force measurements may be a useful test for athletes in combat sports like wrestling. They can be applied to identify the weakness of a group of muscles in the neck area and to devise a proper training program.

Editor's note: This is some of the first neck strength data from wrestlers that I have seen in the literature. It should be an integral component of wrestler testing batteries.

Sansone, R. A. & Sawyer, R. (2005). Male athletes and eating disorders. Clin J Sport Med, 15, 45-46.
Keywords: Eating/Eating Disorders/Male
Editorial

The vulnerability of male athletes to unhealthy weight management practices and eating disorder symptoms is controversial. A number of authors have suggested such a relationship, and some of the empirical literature supports these conclusions. Among wrestlers, researchers found that 52% reported binge-eating behavior and 11% described symptoms of a sub clinical eating disorder. Several readers describe higher scores on the Eating Attitudes Test (EAT), a self report measure of eating disorder pathology among male athletes. Nearly 5% of male college athletes scored in the EAT range suggestive anorexia nervosa, which is considerable higher then the male population. Some of these abnormal findings may be transient and related to the seasonal demands of the sport rather then persistent and enduring eating pathology. If present pathologic findings may be more common in sports that emphasize a lean body or low body weight.

In contrast to the preceding observations, other investigators do not find a relationship among males between participation in athletes and eating disorder symptoms. Finnish researchers found that male athletes did not want to lose weight. In comparing aesthetic verse endurance and ball game participants, there was no difference on eating disorder measures. Among undergraduates compares with non-athletes, athletes actually relied less on dieting behaviors for weight control and were less likely to preserve themselves overweight. Finally, Jonathan Et-al. surveyed 1445 student athletes and concluded the prevalence of anorexia or bulimia nervosa among males was 0%.

Collectively, the preceding studies suggest that while participation in sports may stimulate eating pathology among some males, few seem to develop bona fide eating disorders. However there appears to be a small risk and the reasons for the occasional intersection between athletic involvement and eating disorders remains unclear. Participation in sports that demand a lean body and low body rate, may be a risk factor; this does not exclude other contributory causes such as a perfectionistic personality; accessing less competitive weight classes though weight-loss and external pressure from coaches teammates and parents for athletic success.

Given that the authentic risk of eating disorders among male athletes warrants further clarification, a meta-analysis of current data would seem to be an initial starting place. However, the samples available in the literature represent diverse ethnic populations and types of sports making robust comparison difficult. A future study of male collegiate athletes might include (1) large numbers of participants from several colleges (for regional comparison) as well as from both lean and nonlean body sports, (2) comparison with nonathletic male controls, (3) interview strategies rather than self-report measures, and (4) examination for the presence of eating pathology during the off-season. In addition to the assessment of eating pathology, additional measures might explore obsessive-compulsive personality, internal versus external loci of control (ie, responsiveness to external versus internal expectations), and general body satisfaction.

If future studies confirm that a substantial minority of male athletes is at risk for eating disorders, several approaches to interventions might be undertaken. First, coaches and their staffs can rely on established guidelines. Such guidelines exist at several levels: the National Federation of High School Associations wrestling rules book states that, "at anytime, the use of sweat boxes; hot showers; whirlpools; rubber, vinyl, and plastic-type suits; or similar artificial heating devices…is prohibited and shall disqualify an individual from competition" (p. 15). In addition, the National Collegiate Athletic Association has adopted new weight control rules that emphasizes competition, not weight control; reduction of incentives for rapid weight loss; and the elimination of tools used to accomplish rapid dehydration. In addition, athletes, coaches, and related staff can

foster an atmosphere in which appropriate nutritional practices and the dangers of eating pathology are emphasized. This canbe readily achieved by providing educational in-services and placing informative posters in practice areas. All personnel need to be alert to the signs and symptoms of an eating disorder(eg, acute and excessive weight loss; light-headedness; cold intolerance; restrictive eating patterns; self-induced vomiting; the use of laxatives, diuretics, or appetite suppressants, intense preoccupation with weight), which can reviewed regularly. Coaching staffs might also encourage young men to share their concerns about body image and weight. Some investigators believe that coaches may benefit from more training in the area of nutrition (there is evidence that only 36% of coaches ever attend a nutrition workshop). Our knowledge of the risks of eating disorder pathology among male athletes is limited. We need to encourage further investigation of the prevalence of these disorders among male athletes and an exploration of interventions that might deter their development. As we prepare athletes for heightened performance, we need to protect them as well.

Editor's note: While my initial feeling is that these pathological behaviors do not persist past the end of the seasonin male wrestlers, it is always best to depend on emprical data. Again, the need is for education and awarenss!

Schmidt, W. D., Piencikowski, C. L., & Vandervest, R. E. (2005). Effects of a Competitive Wrestling Season on Body Composition, Strength, and Power in National Collegiate Athletic Association Division III College Wrestlers. J Strength Cond Res, 19, 505-508.

Keywords: Body Composition/body fat/fat-free mass/power/season/strength/training

The purpose of this study was to investigate the effects of a competitive wrestling season on body composition, muscular strength, and muscular power in National Collegiate Athletic Association (NCAA) Division III college wrestlers. A total of 10 wrestlers were assessed throughout 2 consecutive wrestling seasons in late October, late January (midseason), and late March (postseason). Measurements included body weight, body composition (6-site skinfold), muscular strength (back squats and bench press), and muscular power (e.g., power cleans, vertical jump, seated medicine ball put). A repeated-measures analysis of variance (ANOVA) showed no significant changes in body weight, percentage of body fat, or fat-free mass (FFM) from pre- to mid- to postseason (body weight, 77.9 +/- 12.4, 75.7 +/- 11.0, and 79.9 +/- 12.8 kg; percentage of body fat, 11.6 +/- 3.9, 10.5 +/- 3.0, and 12.0 +/- 3.4; FFM, 68.5 +/- 8.7, 67.5 +/- 8.2, and 70.0 +/- 9.0 kg). A statistically significant main effect of time ($p < 0.01$) was observed for muscular strength, as both the back squat and bench press measures were lower at midseason (back squat, 150.8 +/- 25.2 kg; bench press, 98.3 +/- 25.4 kg) than at pre- and postseason (back squat, 157.9 +/- 25.5 and 161.4 +/- 25.6; bench press, 103.4 +/- 25.5 and 106.4 +/- 26.0). Muscular power did not change significantly throughout the wrestling season. These data indicate that Division III college wrestlers remain relatively weight stable with little change in body composition during a competitive wrestling season. While muscular power is apparently maintained, muscular strength may decline slightly. Our findings suggest that these wrestlers benefit from a training program that emphasizes in-season strength maintenance.

Editor's note: More support for in-season strength training.

Torstveit, M. K. & Sundgot-Borgen, J. (2005). The Female Athlete Triad: Are Elite Athletes at Increased Risk? Med Sci Sports Exerc, 37, 184-193.

Keywords: Female athlete triad/weight/weight classes/Weight Loss/women/Risk

Abstract: Purpose: The aim of this study was to examine the percentage of elite athletes and controls at risk of the female athlete triad.
Methods: A detailed questionnaire, which included questions regarding training and/or physical activity patterns, menstrual history, oral contraceptive use, weight history, eating patterns, dietary history, and the Body Dissatisfaction (BD) and Drive for Thinness (DT) subscales of the Eating Disorder Inventory (EDI), was prepared. The questionnaire was administered to the total population of female elite athletes in Norway representing the national teams at the junior or senior level, 13-39 yr of age (N = 938) and nonathlete controls in the same age group (N = 900). After exclusion, a total of 669 athletes (88%) and 607 controls (70%) completed the questionnaire satisfactorily. Results: A higher percentage of controls (69.2%) than athletes (60.4%) was classified as being at risk of the Triad ($P < 0.01$). A higher percentage of controls than athletes reported use of pathogenic weight-control methods and had high BD subscale scores ($P < 0.001$). However, more athletes reported menstrual dysfunction and stress fractures compared with controls ($P < 0.05$). A higher percentage of both athletes competing in leanness sports (70.1%) and the nonathlete control group (69.2%) was classified as being at risk of the Triad compared with athletes competing in nonleanness sports (55.3%) ($P < 0.001$). Furthermore, a higher percentage of athletes competing in aesthetic sports (66.4%) than ball game sports (52.6%) was classified

as being at risk of the Triad ($P < 0.001$).
Conclusions: More athletes competing in leanness sports and more nonathlete controls were classified as being at risk of the Triad compared with athletes competing in nonleanness sports.

Torstveit, M. K. & Sundgot-Borgen, J. (2005). The Female Athlete Triad Exists in Both Elite Athletes and Controls. Medicine and science in sports and exercise, 37, 1449-1459

Keywords: Age Female athlete triad females

Purpose: To examine the prevalence of the female athlete triad (the Triad) in Norwegian elite athletes and controls. Methods: This study was conducted in three phases: (part I) screening by means of a detailed questionnaire, (part II) measurement of bone mineral density (BMD), and (part III) clinical interview. In part I, all female elite athletes representing the national teams at junior or senior level, aged 13-39 yr (N = 938) and an age group-matched randomly selected population-based control group (N = 900) were invited to participate. The questionnaire was completed by 88% of the athletes and 70% of the controls. Based on data from part I, a stratified random sample of athletes (N = 300) and controls (N = 300) was selected and invited to participate in parts II and III of the study. 186 athletes (62%) and 145 controls (48%) participated in all parts of the study. Results: Eight athletes (4.3%) and five controls (3.4%) met all the criteria for the Triad (disordered eating/eating disorder, menstrual dysfunction, and low BMD). Six of the athletes who met all the Triad criteria competed in leanness sports, and two in nonleanness sports. When evaluating the presence of two of the components of the Triad, prevalence ranged from 5.4 to 26.9% in the athletes and from 12.4 to 15.2% in the controls. Conclusion: Our results support the assumption that a significant proportion of female athletes suffer from the components of the Triad. In addition, we found that the Triad is also present in normal active females. Therefore, prevention of one or more of the Triad components should be geared towards all physically active girls and young women.

Editor's note: This is an area that begs for research among female wrestlers.

Utter A, Nieman, D. C., Mulford, G., Tobin, R., Schumm, S., McGinnis, T., & Monk, J. Evaluation Of Leg-to-leg Bioelectrical Impedance Analysis In Assessing Body Composition Of High-school Wrestlers. Med Sci Sports Ex 37[5 (Supplement)], S298. 2005.

Ref Type: Abstract
Keywords: Body Composition/body density/body fat/fatfree/mass/hydration/hydrostaticweighing/skinfolds/urine/urine specific gravity/methods

PUPOSE:To evaluate the accuracy of leg-to-leg bioelectrical impedance analysis (BIA) in assessing FFM using the TANITA: TBF-300WA in comparison to hydrostatic weighing (HW) and skinfolds (SK) in high-school (HS) wrestlers in hydrated state. METHODS:Body composition was determined by BIA, HW, and 3-site (SK) in 129 HS wrestlers (Mean ± SD, age: 15.5 ± 1.3, height 1.70 ± 0.08 m, body mass 65.6 ± 13.1 kg). For all methods, body density (Db) was converted to percent body fat (%BF) using the Brozek equation. Hydration state was quantified by evaluating urine specific gravity. RESULTS:There were no significant differences for estimated fat-free mass (FFM) between BIA (56.9 ±8.4 kg) and HW (56.2 ± 9.9 kg) or between SK (56.1 ± 8.9 kg) and HW. The standard errors of estimate for FFM with HW as the reference method were 3.64 kg for BIA and 1.97 kg for SK. Significant correlations were found for FFM between HW and BIA ($r = 0.93$, $P < 0.001$), and between HW and SK BIA ($r = 0.98$, $P < 0.001$). The FFM difference between BIA and HW was significantly correlated with the FFM average of the two methods ($r = -0.39$, $P < 0.001$). The FFM difference between SK and HW was also significantly correlated with the FFM average ($r = -0.44$, $P < 0.001$). CONCLUSIONS: This study demonstrates that the TANITA: TBF-300WA BIA analyzer estimates FFM within an acceptable range when compared to HW in a high-school wrestlers.

Email: utterac@appstate.edu

Editor's note: See comments following Clark article.

Yakut, C., Ballat, P., & Miller, L. A. The Influence Of Weight Class, Experience, And Season On Wrestling Injuries. Med Sci Sports Ex 37[5 (Supplement)], S14. 2005.
Ref Type: Abstract

Keywords:competition/Environment/experience/Head injuries/practice/preparation/Risk/season/team/weight classes

Injury an athlete's nightmare, is the worst thing that may happen at unexpected time. It could bring on not only time lost, missing a championship or early retirement but also cause permanent physical damage, such as disabled body function or even death. Among

the college athletes, wrestlers had the second highest injury rate (football ranked first). PURPOSE:To determine the roles of experience, weight class and season in wrestling injuries. METHODS:The injury reports of 31 wrestlers from a NCAA Division I College Wrestling Program were studied. The injury reports were taken by the team physician and filed by the head coach during the practices and matches from September through February. RESULTS:Lighter weights (between 125 - 157 lbs) had more injuries (58%) than heavier weight classes (40%) (between 165 lbs -heavyweight,183-225 lbs). The 157-lbs weight class sustained the highest number of injuries (20%). The second injury percentage was found in 125 lbs class (16%), slightly higher than the 149 lbs (13%). Freshmen suffered significantly more injuries (33%) than sophomores (24%), seniors (24%) and juniors (9%). The wresting team suffered the greatest number of injuries in November (26%), during six-month period. January and October ranked second and third with 23% and 20% respectively. CONCLUSION: Wrestler's weight seems to play an important role in injury because lighter weight classes have much greater injury risk than heavier wrestlers. This may be explained that lighter weight wrestlers are more active and intense during wrestling. They spend much more time during the attack and defense. Therefore their injuries tend to be more severe and force them to drop out of wrestling sooner than injuries in heavier categories. The freshmen wrestlers sustained more injuries than upperclassmen. It is possible that freshmen felt greater obligation to work hard in order to get on the team. It is also likely that freshmen found themselves in a new environment and they might not have been ready yet physically and technically for college level wrestling. The highest injury rate was in November. Injuries decreased in December and increased again in January. It seems obvious that November is the time to work and try hard to get on the team but it should be also noted that the first tournaments of the year occur in this month. The wrestlers find themselves in a match after or 6 months away from competition. Therefore, injuries become unavoidable if wrestlers do not have adequate preparation or physical performance. Recalling the fact that wrestling competitions have a greater risk than practice, it may be concluded that injuries are high in November and January due to the quantity of tournaments.

Lock Haven University of Pennsylvania, Lock Haven, PA.

Editor's note: This information should be included for coaches and administrators as they plan the calendar for the wrestling season. A coach's examination of his athlete's match readiness, and particularly, the readiness of freshmen seems warranted by the data. This of course should be done on a case by case basis.