

# Science of Wrestling



**Annual Review of Wrestling Research - 2010**

David Curby, EdD

## Preface

This annual publication, first published in 2005, 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. Rich Bender, Mitch Hull, Steve Fraser, Momir Petkovic, Ike Anderson, Terry Steiner, Vladislav Izboinikov, Shannyn Gillespie, Anatoly Petrosyan, Zeke Jones, Bill Zadic and Brandon Slay always respond to my requests for information.

Thanks to my wife Lynne, and my wonderful children Nicholas, Jacob and Courtney, who have been a big part of my work in the sport, and have patiently supported me. Tony Rotundo has provided the action photographs from the 2010 World Championships found on the cover. These are American 63 kg silver medalist Elena Pirozhkov battling the great Kaori Icho from Japan; Khetag Gazumov of Azerbaijan, 96 kg world champion and named the FILA FS Wrestler of the Year; and Hasan Aliyev of Azerbaijan, the 60 kg world champion who was named the FILA GR Wrestler of the Year.

David G. Curby EdD  
LaGrange, IL USA  
708-217-7818  
davcurb@gmail.com  
Website: [www.curbywrestling.com](http://www.curbywrestling.com)



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# Annotated Bibliography of Wrestling Research in 2010

Andrade RA, Evans PL, Almeida AL, da Silva Jde J, Guedes AM, Guedes FR, Ranalli DN, Modesto A, Tinoco EM. Prevalence of dental trauma in Pan American games athletes. *Dent Traumatol.* 2010 26(3):248-53. *Faculty of Dentistry-State University of Rio de Janeiro, Rio de Janeiro, Brazil.*  
Keywords: injuries, injury prevention, teeth

**Abstract:** The aim of this cross-sectional epidemiological survey was to assess the prevalence of dental trauma in athletes representing 42 countries competing at the most recent Pan American Games (XV Pan Am) held in Rio de Janeiro, Brazil in July of 2007, and to determine prior use and type of mouthguard among this group of athletes. The examiners participated in standardization and calibration training sessions before the field phase began. Invitations were sent to >5500 participating athletes competing in 41 sports and to the Medical Committee of the Pan American Sports Organization before and during the XV PAN. A convenience sample of 409 athletes was recruited. After signing an informed consent, all athletes answered a questionnaire. Data were collected at the clinical examination and recorded on a specific trauma form. The mean age of the athletes was 24.4 +/- 5.3 years. Males comprised 55% of the sample; females 45%. The prevalence of dental trauma among the athletes was 49.6% (n = 203) with no gender-based differences. Most of these injuries (63.6%) were related to activities during training or competition. Sports with the highest injury prevalence were wrestling (83.3%), boxing (73.7%), basketball (70.6%) and karate (60%). The most common injury was enamel fracture (39.8%); root fracture was the least common (0.4%). The teeth most affected were the maxillary permanent central incisors (n = 113), followed by the mandibular central incisors (n = 19). Based on the results of this study, nearly one-half of the subjects had experienced previous dental trauma; the majority related to sports activities. Furthermore, only 17% of the athletes reported prior mouthguard use; the most frequent mouthguards reported were boil-and-bite. These results suggest the importance of enhanced educational efforts and the use of properly fitted mouthguards to reduce dental trauma among athletes in international sports competition, especially in sports where mouthguards are not mandatory.



*Editor's Note: For the 2007-08 season the NFHS mandated that all wrestlers with braces or other orthodontia must wear a mouthguard (Sec 2 article 5). The NCAA only recommends that all wrestlers wear a protective mouth guard. There is no convincing scientific data that their use will prevent concussions. Because mouthguards have a natural ability to become a breeding ground for bacteria, fungi, and mold, they should be sanitized on a daily basis using a commercially available antimicrobial denture-cleansing solution. The acceptance of mouthguards seems to have grown amongst the younger wrestlers. This could, in part, be attributed to seeing some of the top stars in the sport using them, not to mention the availability of some interesting custom colors/patterns.*



Apti, A., Yildiz, S., Apti, DA. The relationship between aerobic capacity and somatotype in elite male Turkish wrestlers. 15<sup>th</sup> Annual ECSS-Congress, Antalya 2010

**Introduction:** Several researchers have examined the factors associated with success in sports such as aerobic capacity, suitable body type, technical and tactical skills. It has been accepted that a suitable body type is essential for success in a particular sport. The aim of this study was to examine the relationship between somatotype and aerobic performance in elite Turkish wrestlers. **Methods:** The sample consists of 18-26 year old 52 elite wrestlers.

Somatotypes were estimated with the Heath-Carter anthropometric somatotype method. The subjects performed incremental exercise tests on a treadmill. Ventilatory and gas exchange responses were measured with a turbine volume transducer and processed breath-by-breath. VO<sub>2</sub>max was measured and anaerobic threshold (AT) was estimated non-invasively using the V-slope method. SPSS 17,0 was used for statistical analysis. Results The mean age of the athletes was 21,08±2,42, the mean height was 170,78±8,25 cm, the mean weight was 78,42±16,35 kg, the mean maximal oxygen consumption was (VO<sub>2</sub>max) 54,60±5,88 ml/kg/min and the mean corresponding heart rate at the AT was 174, 79±11,08. The mean somatotype was 2,22±0,87 endomorphy, 6,48±1,37 mesomorphy 1,29±1,01 ectomorphy. A negative correlation was found between endomorphy and VO<sub>2</sub>max (p<0,001), also between mesomorphy and VO<sub>2</sub>max (p<0,05). There was no significant relation between somatotype and corresponding heart rates at the AT. Subjects who have higher VO<sub>2</sub>max values than the mean value had significantly lower endomorphy, higher ectomorphy ratings (p<0,05) whereas no significant difference was found in somatotype between subjects who have higher corresponding heart rates at AT than the mean value and those who have lower corresponding heart rates at the AT than the mean value. Discussion The somatotype of wrestlers in our study was endomorphic mesomorph which is similar to that have been reported in previous studies (1). Studies have shown international wrestlers to have VO<sub>2</sub>max scores of 53-56 ml/kg/min. (2). The mean VO<sub>2</sub>max in our study was 54,60±5,88 which is slightly lower than those reported in previous studies. The low VO<sub>2</sub>max values could be explained by high standard deviations and wide age range in our study.

*Department of Sports Medicine (İstanbul, Turkey)*

ARTIOLI, G. G., B. GUALANO, E. FRANCHINI, F. B. SCAGLIUSI, M. TAKESIAN, M. FUCHS, and A. H. LANCH. Prevalence, Magnitude, and Methods of Rapid Weight Loss among Judo Competitors *Med. Sci. Sports Exerc.*, Vol. 42, No. 3, pp. 436-442, 2010.  
*Laboratory of Applied Nutrition and Metabolism, School of Physical Education and Sports, University of Sao Paulo, Sao Paulo, BRAZIL*

**ABSTRACT: Purpose:** To identify the prevalence, magnitude, and methods of rapid weight loss among judo competitors. **Methods:** Athletes (607 males and 215 females; age = 19.3 (5.3) yr. weight = 70 (7.5) kg. height = 170.6 (9.8) cm completed a previously validated questionnaire developed to evaluate rapid weight loss in judo athletes, which provides a score. The higher the score obtained, the more aggressive the weight loss behaviors. Data were analyzed using descriptive statistics and frequency analyses. Mean scores obtained in the questionnaire were used to compare specific groups of athletes using, when appropriate, Mann-Whitney (7-test or general linear model one-way ANOVA followed by Tamhane *post hoc* test. **Results:** Eighty-six percent of athletes reported that have already lost weight to compete. When heavyweights are excluded, this percentage rises to 89%. Most athletes reported reductions of up to 5% of body weight. the most weight ever lost was 2%-5%, whereas a great part of athletes reported reductions of 5%-10% . The number of reductions underwent in a season was 3 - 5. The reductions usually occurred within 7 d. Athletes began cutting weight at 12. No significant differences were found in the score obtained by male versus female athletes as well as by athletes from different weight classes. Elite athletes scored significantly higher in the questionnaire than nonelite. Athletes who began cutting weight earlier also scored higher than those who began later. **Conclusions:** Rapid weight loss is highly prevalent in judo competitors. The level of aggressiveness in weight management behaviors seems to not be influenced by the gender or by the weight class, but it seems to be influenced by competitive level and by the age at which athletes began cutting weight.

**Key Words:** WEIGHT CONTROL, WEIGHT LOSS, WEIGHT CLASSES

*Editor's Note: The patterns and methods of weight loss seem to be similar to wrestling. The use of a standardized and reliable survey instrument can be helpful in charting changes in behavior because of rules or education programs, as well as comparing sports. See subsequent Artioli article from Scandinavian Journal of Medicine & Science in Sports.*

ARTIOLI,GG RODRIGO T. IGLESIAS<sup>1</sup>, EMERSON FRANCHINI, BRUNO GUALANO<sup>1</sup>, DANIEL B. KASHIWAGURA, MARINA Y. SOLIS, FABIANA B. BENATTI, MARINA FUCHS, & ANTONIO H. LANCH. JUNIOR Rapid weight loss followed by recovery time does not affect judo-related performance *Journal of Sports Sciences*, January 1st 2010; 28(1): 21–32.

**Abstract:** In this study, we investigated the effects of rapid weight loss followed by a 4-h recovery on judo-related performance. Seven weight-cycler athletes were assigned to a weight loss group (5% body weight reduction by self-selected regime) and seven non-weight-cyclers to a control group (no weight reduction). Body composition, performance, glucose, and lactate were assessed before and after weight reduction (5–7 days apart; control group kept weight stable). The weight loss group had 4 h to re-feed and rehydrate after the weigh-in. Food intake was recorded during the weight loss period and recovery after the weigh-in. Performance was evaluated through a specific judo exercise, followed by a 5-min judo combat and by three bouts of the Wingate test. Both groups significantly improved performance after the weight loss period. No interaction effects were observed. The energy and macronutrient intake of the weight loss group were significantly lower than for the control group. The weight loss group consumed large amounts of food and carbohydrate during the 4-h recovery period. No changes were observed in lactate concentration, but a significant decrease in glucose during rest was observed in the weight loss group. In conclusion, rapid weight loss did not affect judo-related performance in experienced weight-cyclers when the athletes had 4 h to recover. These results should not be extrapolated to inexperienced weight-cyclers.  
Keywords: Weight loss, weight-cyclers

**Editor's Note:** *That both groups improved performance after the weight loss period is puzzling. Is it because of a learning effect, or an improvement in the level of conditioning? When one looks at the Wingate performance of the two groups, the control group seems to perform better, particularly in the absolute peak power. The decrement of performance is less as well, which is not in agreement with the conclusion that the weight loss does not negatively affect the following performance.*

Artioli GG, Franchini E, Nicastro H, Sterkowicz S, Solis MY, Lancha AH Junior. The need of a weight management control program in judo: a proposal based on the successful case of wrestling. *J Int Soc Sports Nutr.* 2010 May 4;7(1):15.

Laboratory of Applied Nutrition and Metabolism, School of Physical Education and Sport, University of São Paulo, Brazil. [artioli@usp.br](mailto:artioli@usp.br).

**Abstract:** Judo competitions are divided into weight classes. However, most athletes reduce their body weight in a few days before competition in order to obtain a competitive advantage over lighter opponents. To achieve fast weight reduction, athletes use a number of aggressive nutritional strategies so many of them place themselves at a high health-injury risk. In collegiate wrestling, a similar problem has been observed and three wrestlers died in 1997 due to rapid weight loss regimes. After these deaths, the National Collegiate Athletic Association had implemented a successful weight management program which was proven to improve weight management behavior. No similar program has ever been discussed by judo federations even though judo competitors present a comparable inappropriate pattern of weight control. In view of this, the basis for a weight control program is provided in this manuscript, as follows: competition should begin within 1 hour after weigh-in, at the latest; each athlete is allowed to be weighed-in only once; rapid weight loss as well as artificial rehydration (i.e., saline infusion) methods are prohibited during the entire competition day; athletes should pass the hydration test to get their weigh-in validated; an individual minimum competitive weight (male athletes competing at no less than 7% and females at no less than 12% of body fat) should be determined at the beginning of each season; athletes are not allowed to compete in any weight class that requires weight reductions greater than 1.5% of body weight per week. In parallel, educational programs should aim at increasing the athletes', coaches' and parents' awareness about the risks of aggressive nutritional strategies as well as healthier ways to properly manage body weight.

**Editor's Note:** *It must be stressed that while wrestling has weight control programs in place in American high school and collegiate competition, these programs are not used in international competition.*

Artioli, G.G F. Scagliusi, D. Kashiwagura, E. Franchini, B. Gualano and A. L. Junior  
Development, validity and reliability of a questionnaire designed to evaluate rapid weight loss patterns in judo players *Scandinavian Journal of Medicine & Science in Sports* Volume 20, Issue 1, February 2010, Pages: e177–e187

**Keywords:** eating behaviors; assessment; martial arts; athletes

**Abstract:** The aim of this study was to develop a questionnaire to evaluate rapid weight loss patterns of competitive judo players and to assess its validity and reliability. We evaluated the reliability ( $n=94$ ), content validity (evaluation by 10 experts), discriminant validity (differences in scores between athletes with body weight below and above their weight class;  $n=100$ ) and convergent validity (correlation with Restraint Scale;  $n=60$ ). No item was considered unclear or ambiguous by more than 20% of the experts. The intraclass Coefficient Correlation was above 0.90 for all questions whose answers were parametric ( $P<0.001$ ;  $n=94$ ) and no significant differences were found between test and retest scores ( $n=94$  – Wilcoxon's signed rank test). Cronbach's  $\alpha$  was 0.98 for scores obtained between test and retest. Non-numerical questions showed proportions of agreement  $>80\%$ ; Spearman's Correlation between the Restraint Scale and the Rapid Weight Loss Questionnaire was 0.62 ( $P<0.001$ ;  $n=60$ ). Athletes below their weight class ( $n=50$ ) had a significantly lower score compared with athletes above the weight class ( $n=50$ ;  $P<0.001$  – Mann–Whitney  $U$  test). In conclusion, the questionnaire showed good validity and reliability and could be used accurately to assess weight loss patterns of judo players.

**Editor's Note:** *The use of this instrument can also be used by coaches as a launching point into an education program.*

Barbas I, Fatouros IG, Douroudos II, Chatzinikolaou A, Michailidis Y, Draganidis D, Jamurtas AZ, Nikolaidis MG, Parotsidis C, Theodorou AA, Katrabasas I, Margonis K, Papassotiriou I, Taxildaris K. Physiological and performance adaptations of elite Greco-Roman wrestlers during a one-day tournament. *Eur J Appl Physiol*. 2010 Dec 16.  
Department of Physical Education and Sport Science, Democritus University of Thrace, 69100, Komotini, Greece.

**Abstract:** The aim of this study was to determine the effects of a simulated one-day Greco-Roman wrestling tournament on selected performance and inflammatory status indices. Twelve competitive wrestlers ( $22.1 \pm 1.3$  years) completed five matches according to the official Olympic wrestling tournament regulations following a  $\sim 6\%$  weight loss. Performance measurements, muscle damage assessment, and blood sampling were performed before and following each match. Performance and inflammatory markers were not affected by weight loss. Mean wrestling heart rate reached  $\sim 85\%$  of maximal and lactate concentration exceeded 17 mM. Fatigue rating demonstrated a progressive rise ( $P < 0.05$ ) throughout the tournament, peaking in match 4. Performance demonstrated a progressive deterioration ( $P < 0.05$ ) throughout the tournament, especially in the last two matches ( $P < 0.05$ ), with upper-body measures exhibiting a greater decline ( $P < 0.05$ ) and remaining below baseline ( $P < 0.05$ ) until the end of the tournament. Muscle damage markers increased during the course of the tournament with upper limbs affected more. Creatine kinase activity, CRP levels, IL-6 concentration, and leukocyte counts increased ( $P < 0.05$ ) progressively throughout the tournament, peaking in the last two matches. Cortisol, epinephrine and norepinephrine increased ( $P < 0.05$ ) after each match, but testosterone declined ( $P < 0.05$ ) progressively, reaching a nadir before the last match. This inflammatory response was accompanied by a marked increase ( $p < 0.05$ ) in lipid peroxidation, protein oxidation, and antioxidant status markers indicating the development of oxidative stress. These results suggest that a one-day wrestling tournament may induce significant physiological demands on wrestlers that may adversely affect their performance and inflammatory status especially during the later stages of the tournament.

**Editor's Note:** *This is a tremendously relevant study using elite wrestlers (and weight loss) that investigates how athletes respond to the FILA mandate that competition in each weight class in one day to be completed in one day. Recovery methods to mitigate or reduce these negative responses during the competition should be proposed and investigated.*

Bassiri-Jahromi S, Sadeghi G, Asghari Paskiaee F. Evaluation of the association of superficial dermatophytosis and athletic activities with special reference to its prevention and control. *Int J Dermatol*. Volume 49, Issue 10, October 2010, Pages: 1159–1164  
Medical Mycology, Pasteur Institute of Iran, Tehran, Iran.

**Abstract:** Objective This study was conducted to evaluate the association of superficial mycosis and athletic activities with special references to its prevention and control in Tehran. Participating in various kinds of sports can lead to direct and indirect exposures to and transmission of micro-organisms between athletes and also passive observers. Methods A retrospective study of superficial fungal infections in athletes was carried out during the period of March 2002 to December 2006 on 656 mycological proven cases of dermatophytosis found in athletes in Tehran. Mycologic examination consisted of culturing of pathologic material followed by direct microscopic observation. Mycologic cultures were carried out on Sabouraud Chloramphenicol Agar, Sabouraud Chloramphenicol and Cyclohexamide Agar, and Dermatophyte Agar incubated at 25 degrees C for at least 28 d. Diagnosis was based on macroscopic and microscopic characteristics of the colonies. Results A total of 1075 athletes, from 201 institutions, suspected of cutaneous fungal infections were examined and 656 (61%) were found to be positive for fungal infections. The fungal isolates comprised *Trichophyton tonsurans* (56%), *Epidermophyton floccosum* (11.8%), *Trichophyton mentagrophytes* (8.9%), *Trichophyton rubrum* (8.3%), *Trichophyton verrucosum* (3.9%), *Trichophyton violaceum* (3.3%), *Microsporum canis* (2.5%), and *Malassezia* spp. (5.3%). The distribution of lesions on the body in decreasing order was as follows: trunk, groin, hair and scalp, sole, toe webs, finger nails, and toe nails. Fungal infections were more commonly seen in wrestlers and individuals that participate in aerobics. Conclusion: The results suggest that athletic activity seems to be a predisposing factor, especially for fungal infections. Guidelines are provided regarding measures to prevent transmission of infectious diseases in athletic settings, including hygiene, infection control practices, and education of officials, coaches, trainers, and sports participants.

Beckwith, K., & Todd, J. (2010). George Hackenschmidt vs. Frank Gotch Media Representations and the World Wrestling Title of 1908. *Iron Game History*, 11(2), 14-25.

The article provides information on the wrestling match titled "The Athletic Contest of the Century" between international wrestling star George Hackenschmidt and American champion Frank Gotch, who were vying for the world's heavy-weight wrestling championship in Chicago, Illinois on April 3, 1908. The match had earned several critics from the British press and media attention in which it was considered as one of the most significant fights ever. It also presents the brief profiles of both wrestlers.



**Editor's Note:** An interesting historical analysis that shows a time when professional wrestling could be legitimate with world-wide interest.

Camic, CL, Housh, TJ, Weir, JP, Zuniga, JM, Hendrix, CR, Mielke, M, Johnson, GO, Housh, DJ, and Schmidt, RJ. Influences of body-size variables on age-related increases in isokinetic peak torque in young wrestlers. *J Strength Cond Res* 24(9): 2358-2365, 2010.

**Abstract:** The purposes of the present study were to determine the patterns of age-related changes in 1) height (HT), body weight (BW), fat-free weight (FFW), and absolute isokinetic peak torque (PT); and 2) isokinetic PT covaried separately for HT, BW, FFW, and HT and BW combined in young wrestlers. One hundred twenty-five male



wrestlers (mean age  $\pm$  SD = 14.3  $\pm$  2.4 yr; range = 11.1-18.2 yr) volunteered to perform concentric, isokinetic leg extension and flexion at 180° s<sup>-1</sup> on a Cybex II dynamometer to measure PT as well as underwater weighing to determine FFW. The polynomial regression analyses indicated there were significant quadratic increases across age for HT (R<sup>2</sup> = 0.62), BW (R<sup>2</sup> = 0.56), and FFW (R<sup>2</sup> = 0.47). For leg extension, there were significant increases across age for absolute PT (quadratic, R<sup>2</sup> = 0.66), PT covaried for HT (linear, r<sup>2</sup> = 0.10), PT covaried for BW (linear, r<sup>2</sup> = 0.12), PT covaried for FFW (quadratic, R<sup>2</sup> = 0.32), and PT covaried for HT and BW combined (quadratic, R<sup>2</sup> = 0.11). For leg flexion, there were significant increases across age for absolute PT (linear, r<sup>2</sup> = 0.59), PT covaried for HT (linear, r<sup>2</sup> = 0.07), PT covaried for BW (linear, r<sup>2</sup> = 0.08), PT covaried for FFW (quadratic, R<sup>2</sup> = 0.23), and PT covaried for BW and HT combined (linear, r<sup>2</sup> = 0.03). The results of this study indicated that age-related increases in leg-extension and flexion PT for the current sample of young wrestlers could not be accounted for by changes in HT, BW, FFW, or HT and BW combined. These findings suggested that neural maturation may contribute to increases in leg strength across age in young wrestlers.

Keywords: strength, growth, youth

*Department of Nutrition and Health Sciences, Human Performance Laboratory, University of Nebraska-Lincoln, Lincoln, Nebraska*

**Editor's Note:** *This is such an important area of study for those who work in youth sports! The importance of maturation cannot be overstated, and coaches must see beyond age, size, etc.*

Clark, RR, McKinley, T. BILATERAL OLECRANON EPIPHYSEAL FRACTURE NON-UNION IN A COMPETITIVE ATHLETE *Iowa Orthop J.* 2010; 30: 179-181

Keywords: injuries, elbow

*Department of Orthopedics University of Iowa Hospital and Clinics, 200 Hawkins Drive Iowa City, IA 52242 Phone 319-356-2223 Fax 319-353-6754, e-mail: [randyclark66@hotmail.com](mailto:randyclark66@hotmail.com)*

**Abstract:** Olecranon epiphyseal stress fractures and epiph-yseal non-unions have been described in throwing athletes, weight lifters and gymnasts. We present a case in which bilateral olecranon epiphyseal fractures were diagnosed in a competitive NCAA Division One wrestler who presented with chronic elbow pain. Given the rigors and physical demands of collegiate wrestling, we present a novel technique for open reduction internal fixation, grafting and supplementation with BMP for accelerated healing and return to competition.

**Editor's Note:** *The elbow is exposed to a wide variety of acute and chronic stresses in wrestling. Bone morphogenetic proteins (BMPs) are a group of growth factors and are produced using recombinant DNA technology. They can be delivered to the site of the fracture by being incorporated into a bone implant, and released gradually to allow bone formation, as the growth stimulation by BMPs must be localized and sustained for some weeks.*



Coelho RW, Keller B, da Silva AM. Effect of pre- and postcompetition emotional state on salivary cortisol in top-ranking wrestlers. *Percept Mot Skills.* 2010 Aug;111(1):81-6.

Keywords: stress/cortisol/anxiety

*Federal University of Paraná State, Curitiba, Brazil. [coelhohorcardo@ufpr.br](mailto:coelhohorcardo@ufpr.br)*

**Abstract:** The purpose was three-fold: (1) to investigate the effect of baseline, precompetition, and postcompetition stress on salivary cortisol levels in top-ranking Brazilian wrestlers (N = 17) participating in a national competition; (2) to estimate correlations among three stress measures (perceived stress, salivary cortisol, and physiological stress reaction); and (3) to compare cortisol concentrations between losers and winners. Salivary cortisol was collected at baseline, pre-, and postcompetition. Physiological stress reaction and perceived stress scores were measured just before warm-up for the competition. Analysis showed a significant main effect for testing time. Correlations among the stress measures were not significant. Analysis of covariance between the winners (n = 10) and the losers (n = 7) was also not significant. Salivary cortisol concentrations increased after the intense exercise of competition. The wrestlers did not perceive any physiological effects.

Cooper, Coyte G.<sup>1</sup>, Miloch, Kimberly<sup>2</sup> NCAA Wrestling: Creating an understanding of fan motives at the Big 10 Wrestling Championships *In J Sport Manag* Jan2010, Vol. 11 Issue 1, p71 13p.

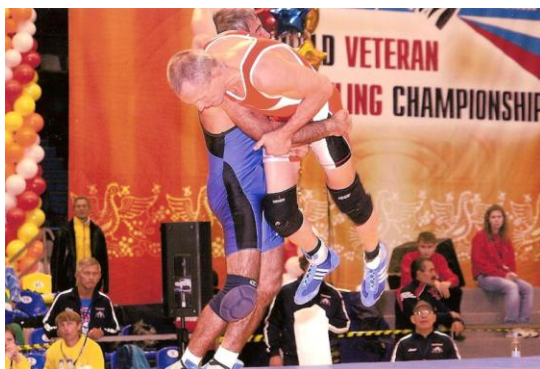
**Abstract:** The article offers information on a study which determined the motives of individuals for attending the Big Ten Wrestling Championships situated in the Bloomington, Indiana. A review of the related literature is offered. Data collection was reportedly done through a 33-item sport consumer motives questionnaire. Demographics included Caucasian, Hispanic, American Indian/Alaskan Native and African American. Identified motives included individual match-up, achievement and team race.

<sup>1</sup> Assistant Professor, University of North Carolina; <sup>2</sup> Associate Professor, Texas Women's University

**Editor's Note: Important information for the promotion of the sport!**

Farahani, A.V.; Asher, H. Alipour, S.; Amirbeigloo, A. Pre-participation Cardiovascular Screening of Elderly Wrestlers *Asian Journal of Sports Medicine*, Vol 1 (No 1), March 2010, 29-34.  
Sports Medicine Research Center, Tehran University of Medical Sciences, Tehran, IR E-mail: avasheghani@tums.ac.ir

**Abstract:** Purpose: Sudden death of a competitive athlete is a tragedy that is usually caused by a previously unsuspected cardiovascular disease. The aim of this study was to clarify the role of noninvasive testing in pre-participation cardiovascular evaluation of elderly wrestlers. Methods: We included 63 Iranian elderly wrestlers who participated in Tehran international elderly wrestlers' preparation camping by census method. A questionnaire including past medical and family history as well as coronary risk factors was filled out and then a complete physical examination of the cardiovascular system was done by an internist for all wrestlers. Electrocardiogram (ECG), complete echocardiographic examination and then symptom limited exercise test were performed and reported by the cardiologists who did not know the other examinations results. Results: Exertional dyspnea and typical chest pain (FC=I or II) were present in 5% and 1.7% of the examinees, respectively. There were one or more risk factors in 64.5% of the cases. Cardiovascular examination revealed abnormal heart sounds in 27.1%. ECG showed ischemic changes in 13.6% and premature atrial contractions and premature ventricular contractions in 11.4%. Echocardiography showed mild left ventricular systolic dysfunction in 3.4%, regional wall motion abnormality in 8.5%, valvular disease in 32.3%, diastolic dysfunction in 45.7%, and left ventricular hypertrophy in 16.9% of the cases. Exercise test results were negative, equivocal, positive and highly positive in 70.4%, 15.8%, 5.2%, and 8.6% of cases, respectively. Conclusion: Beside physical examination, pre-participation screening of elderly wrestling athletes with ECG and exercise testing is feasible and recommended in the presence of coronary



risk factors or cardiac symptoms. Echocardiography can also be recommended to detect other relevant abnormalities when there is a clue in the standard history, physical examination or ECG.  
Key Words: Wrestling; Cardiovascular disease; Elderly wrestler; Screening; Pre-participation examination

**Editor's Note:** Michael Cain of Summerfield, Fla., 52, collapsed during his opening round match of the 2009 Veterans World Championships in Kouvola, Finland. Cain received immediate medical assistance, but those providing care could not revive him. Cain was competing at 130 kg/286 lbs. in Div. D (51-55 years old).

Friedline, A. **Effects of weight-cutting tactics on clinical concussion measures in Division One collegiate wrestlers** M.A., The University of North Carolina at Chapel Hill, 2010, 103 pages; AAT 1477530

**Abstract:** Our purpose was to look at the effects of weight-cutting tactics on clinical concussion measures in Division I collegiate wrestlers. Scores on clinical concussion assessment tools were analyzed at baseline and pre and post practice. Concussion tools included The SCAT2, the SAC, the BESS, the GSC, and SRT computerized test. All subjects completed the same test battery at baseline and before and after a practice. Significant differences were observed for SCAT2 when pre and post-practice measures were compared to baseline ( $P < 0.05$ ) and BESS scores between baseline and post-practice ( $P < 0.05$ ). Significance was also observed for GSC when pre and post-practice were compared to baseline ( $P < 0.05$ ). A difference was further observed between pre and post-practice. Our results suggest that it is important for wrestlers to be tested in a euhydrated state in order to ensure weight-cutting tactics are not influencing the outcome of the clinical measures.

**Editor's Note:** *This master's thesis is a very timely investigation. Many schools are implementing the use of programs to establish a cognitive baseline which can be used as a post –concussion return to play guideline. Wrestlers, as well as other athletes, must be tested in a euhydrated state. See Yard EE, Comstock RD. Compliance with return to play guidelines following concussion in US high school athletes, 2005-2008 in this section.*

Kenyon LK, Sleeper MD, Tovin MM. Sport-specific fitness testing and intervention for an adolescent with cerebral palsy: a case report. *Pediatr Phys Ther*. 2010 22(2):234-40.

**Abstract:** BACKGROUND AND PURPOSE: This case report describes the development, implementation, and outcomes of a fitness-related intervention program that addressed the sport-specific goals of an adolescent with cerebral palsy. CASE DESCRIPTION: The participant in this case was a 16-year-old African American male with spastic diplegia. The participant joined his high school wrestling team and asked to focus his physical therapy on interventions that would improve his wrestling performance. An examination was performed using the muscle power sprint test, the 10 x 5-m sprint test, strength tests, the 10-m shuttle run test, and the Gross Motor Function Measure. The intervention consisted of interval training, which focused on the demands of wrestling. OUTCOMES: Scores on all tests and measures were higher after the intervention. DISCUSSION: The outcomes of this case report seem to support the use of a fitness-related intervention program for addressing the sport-specific goals of an adolescent with cerebral palsy.

**Editor's Note:** *Wrestling is a universal sport and can be a life-changing intervention in the hands of that special coach!*

Kürkçü, R, Ali Tekin, Selçuk Özda, Fahri Akçakoyun The effects of regular exercise on oxidative and antioxidative parameters in young wrestlers *African Journal of Pharmacy and Pharmacology* Vol. 4(5), pp. 244-251, May 2010

*School of Physical Education and Sports, Harran University, Ianiurfa, Turkey.*

*School of Physical Education and Sports, Mugla University, Mugla, Turkey.*

**Abstract:** The aim of this study was to investigate and compare the lipoprotein profile and the oxidant, antioxidant status in wrestlers with those in healthy control group of similar age and sex. The study covered 22 male wrestlers ( $18.50 \pm 1.35$  years) and 12 male sedentary controls ( $18.41 \pm 1.08$  years). A typical practice session consisted of live-wrestling, wrestling drills, calisthenics, instruction, running and weight training. On the other hand the control subjects who were high school sedentary students did not practice any exercise throughout the study. The study protocol was approved by the Local Ethical Committee. The measurements were blood sample, total antioxidative capacity of plasma, total peroxide concentration of plasma, total oxidant status, oxidative stress index and lipid profile. Data are presented as means  $\pm$  sd. When data did not follow the Gaussian distribution, the Mann-Whitney nonparametric test ( $U$ -test) was used to compare the different groups at  $p < 0.05$  level in the bilateral situation. High-density lipoprotein-cholesterol level ( $p < 0.05$ ), total antioxidant capacity, lipid hydroperoxide level, total oxidative stress and plasma oxidative stress index ( $p < 0.01$ ) increased significantly in the wrestlers. In conclusion,

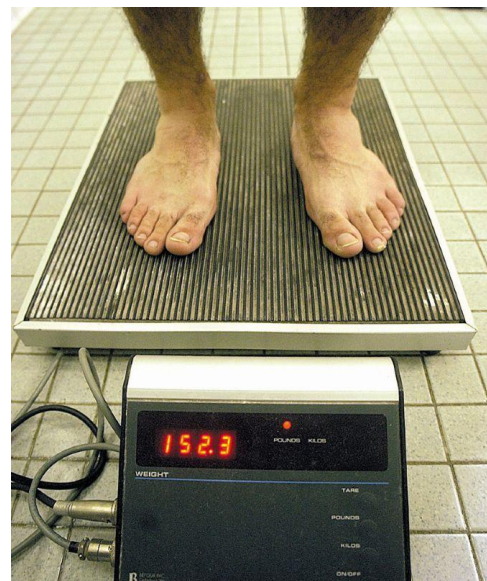
participating in wrestling training increased oxidative stress and antioxidant capacity when compared with untrained controls.

Key words: High-density lipoprotein, total peroxide concentration

**Editor's Note: Wrestling has a positive impact on health and fitness parameters. This is more support for its inclusion in physical education curricula. See Hamurcu et al.**

Lambert C, Jones B. Alternatives to Rapid Weight Loss in US Wrestling. *Int J Sports Med.* 2010 31(8):523-8 University of Louisville, Health and Sport Sciences, Louisville, United States.

**Abstract:** Amateur wrestling at the high school and collegiate level in the United States often involves exercise and thermal dehydration as well as food and fluid restriction to "make weight". Available evidence suggests this is the opposite of what is optimal for high-intensity exercise performance. A high-intensity taper will substantially improve performance when conducted after a period of high-volume high intensity training. Additionally, dehydration of approximately 3-4% of body weight will most definitely impair muscular endurance during high-intensity exercise although it likely will not impair maximal muscular strength or power. Even more gradual weight loss practices over a few days, which result in a reduction of body weight by approximately 3.3 to 6% will result in impaired performance as assessed by wrestling specific tests. It would seem of paramount importance for wrestlers to maintain a high-carbohydrate diet of approximately 8-10 g carbohydrate/kg body weight/day to maintain training intensity and optimize performance during individual matches and tournaments. Thus, the evidence would suggest that, prior to competition, collegiate wrestlers should be: 1) tapered, 2) in the euhydrated state, and 3) have ingested a high carbohydrate diet, rather than undergo rapid weight loss prior to competition.



**Editor's Note: More evidence for enlightened training!**

Lingor, R J, Olson, A. Fluid and diet patterns associated with weight cycling and changes in body composition assessed by continuous monitoring throughout a college wrestling season *Journal of Strength & Conditioning Research:* July 2010 - Volume 24 - Issue 7 - pp 1763-1772

**Abstract:** This study examined the methods used to meet certification weight for wrestling and to measure the changes in body composition during 1 season for Division III college wrestlers. Nine college wrestlers completed this study. Body composition was analyzed by underwater weighing (UWW) and multifrequency bioelectrical impedance before and throughout the competitive season. Hydration status was measured by urine osmolality (Uosm) and urine specific gravity (Usg). Nutritional intake was measured for 2 1-week periods, once at the beginning and again near the end of the season. Subjects' fat-free mass (FFM) increased an average of 1.8 kg, whereas fat mass (FM) decreased 2.2 kg as indicated by UWW from the beginning to the end of the season. Wrestlers on average cycled their weight 3.4 kg (4.7% of body weight) per week. The majority of wrestlers cut weight by reducing calories and restricting fluids starting 2 days before the competition. Uosm and body weights on Friday suggested that for wrestlers to achieve the necessary weight loss by dehydration to "make weight" for a Saturday meet, wrestlers would approach a 5% level of dehydration. No loss of FFM because of weight cycling (WC) was evident to achieve competitive weight. Most wrestlers significantly restricted fluids and caloric intake in the 48 hours before weigh-in.



**Editor's Note:** The NCAA weight certification procedures relies on a prediction of minimal wrestling weight while in a supposedly hydrated state. Future weigh-ins do not depend on any established hydration status. While most people see an improved culture surrounding the making of weight since these certification procedures were put into place, unhealthy practices are still being employed.

Hamurcu Z, Saritas N, Baskol G, Akpınar N. Effect of wrestling exercise on oxidative DNA damage, nitric oxide level and paraoxonase activity in adolescent boys. *Pediatr Exerc Sci*. 2010 Feb;22(1):60-8.

College of Physical Education and Sports, Erciyes University, Kayseri, Turkey.

**Abstract:** The objective of the current study is to determine the effects of regular wrestling exercise on oxidative DNA damage and antioxidant parameters. The findings of the current study have shown that 8-hydroxy-2'-deoxyguanosine (8-OHdG) obtained from wrestlers in basal status were significantly lower than those of sedentary ( $p = .001$ ). In contrast, Nitric oxide (NO) and Paraoxonase-1 (PON1) were remarkably higher in wrestlers in basal status than those of sedentary (respectively,  $p = .001$ ,  $p = .024$ ). While the NO of wrestlers increased immediately after a 1.5-h exercise compared with those before exercise ( $p = .002$ ), no differences were found between before and immediately after a 1.5-h exercise in 8-OHdG and PON1 (respectively,  $p = .777$ ,  $p = .408$ ). Statistically significant correlations were found between the NO and PON1 in the wrestlers in basal status ( $r = .671$ ,  $p = .002$ ). In conclusion, our study suggests that wrestling exercise for a healthy life is important in that it reduces DNA damage as well as enhancing antioxidant parameters.

**Editor's Note:** See Kürkçü *et al.*

Iglesias E, Boullosa DA, Dopico X, Carballeira E. Analysis of factors that influence the maximum number of repetitions in two upper-body resistance exercises: curl biceps and bench press. *J Strength Cond Res*. 2010 Jun;24(6):1566-72.

Department of Physical Education and Sport, Faculty of Sport Sciences and Physical Education, University of A Coruña, Oleiros, Spain. [eliseo@udc.es](mailto:eliseo@udc.es)

**Abstract:** The purpose of this study was to analyze the influence of exercise type, set configuration, and relative intensity load on relationship between 1 repetition maximum (1RM) and maximum number of repetitions (MNR). Thirteen male subjects, experienced in resistance training, were tested in bench press and biceps curl for 1RM, MNR at 90% of 1RM with cluster set configuration (rest of 30s between repetitions) and MNR at 70% of 1RM with traditional set configuration (no rest between repetitions). A lineal encoder was used for measuring displacement of load. Analysis of variance analysis revealed a significant effect of load ( $p < 0.01$ ) and a tendency in exercise factor ( $p = 0.096$ ), whereas the interaction effect was not significant. MNR at 70% of 1RM was lower for biceps curl



( $16.31 \pm 2.59$  vs.  $8.77 \pm 3$  in bench press and biceps curl, respectively;  $p < 0.05$ ) and at 90% of 1RM ( $21.85 \pm 11.06$  vs.  $18.54 \pm 12.84$  in bench press and biceps curl, respectively;  $p > 0.05$ ). Correlation between 1RM and MNR was significant for medium-intensity in biceps curl ( $r = -0.574$ ;  $p < 0.05$ ) and between MNR and 1RM/body mass ( $r = -0.574$ ;  $p < 0.05$ ). Neither 1RM nor 1RM/body mass correlated with velocity along set, so velocity seems to be similar at a same relative intensity for subjects with differences in maximum strength levels. From our results, we suggest the employment of MNR rather than % of 1RM for training monitoring. Furthermore, we suggest the introduction of cluster set configuration for upper-body assessment of MNR and for upper-body muscular endurance training at high-intensity loads, as it seems an efficient approach in looking for sessions with greater training volumes. This could be an interesting approach for such sports as wrestling or weightlifting.

Mandroukas A, Heller J, Metaxas TI, Christoulas K, Vamvakoudis E, Stefanidis P, Papavasileiou A, Kotoglou K, Balasas D, Ekblom B, Mandroukas K. Deltoid muscle characteristics in wrestlers. *Int J Sports Med.* 2010 Mar;31(3):148-53.

Laboratory of Ergophysiology-Ergometry, Department of Physical Education and Sports Science, Aristotle University of Thessaloniki, Greece.

**Abstract:** The purpose of the present study was to investigate the deltoid muscle characteristics of wrestlers. Nine Greco-Roman competitive male wrestlers (mean age 20.1 $\pm$ 2.7 yrs, height 175 $\pm$ 0.6 cm, weight 83.2 $\pm$ 12.5 kg, years of training 7.6 $\pm$ 2.7 yrs) participated in this study. Six male healthy sedentary students (mean age 21.2 $\pm$ 0.9 yrs, height 180 $\pm$ 0.3 cm, weight 80.1 $\pm$ 9.4 kg) served as controls. Muscle fibre distribution, cross-sectional area (CSA), as well as satellite cells, myonuclei and capillary density per muscle fibre area were determined by immunohistochemistry. Myosin heavy chain MHC isoform composition of single fibres was determined with protein electrophoresis. Immunohistochemical analysis showed that muscle fibre distribution of the MHC I and IIA were significantly higher in wrestlers than in controls ( $p<0.05$ ). Electrophoretic analysis of single fibres revealed a significantly higher proportion of fibres containing MHC I and IIC in wrestlers ( $p<0.05$ ). The mean CSA of type IIA fibres and the number of myonuclei per type II was significantly higher in wrestlers ( $p<0.05$ ). We also found that the number of satellite cells was 2.5 fold higher in wrestlers than in the control group. This study suggests that the observed muscle fibre profile in the deltoid of wrestlers may represent an adaptation based on the specific mechanical and biochemical demands of the long-term training in Greco-Roman wrestling.

**Editor's Note:** We are seeing more work that supports the idea that muscle fibers possess a greater amount of plasticity in response to the type of training being employed than formerly thought.

Martínez-Abellán, A., García-Pallarés, J., López-Gullón, J., Otegui, X., Baños, V., & Martínez-Moreno, A. (2010). FACTORES ANAERÓBICOS PREDICTORES DEL ÉXITO EN LUCHA OLÍMPICA. / ANAEROBIC FACTORS TO PREDICT WRESTLING PERFORMANCE. *Cuadernos de Psicología del Deporte*, 1017-23. García-Pallarés, Jesús<sup>1</sup> [jesus.garcia.pallares@gmail.com](mailto:jesus.garcia.pallares@gmail.com)

**Abstract:** This study was undertaken to establish the relationship between anaerobic metabolism (anaerobic power and anaerobic capacity) and success in wrestling. Thirty seven male Free- Style and Greco-Roman wrestlers took part in this study, body mass ranged between 68-84 kg. According to the performance level, all the wrestlers were divided into two groups: Elite ( $n = 18$ ) and Amateur ( $n = 19$ ). All the subjects performed a 30 s Wingate test on a SRM Indoor Trainer cycle ergometer (Schoberer Rad Meßtechnik, Germany) that was specifically modified for the standing crank-arm. The height of the arm ergometer's central axis and crank arm length were adjusted to optimize the test mean power. The mean and peak power, the fatigue index as well as the peak blood lactate were established at the end of the test. The elite group showed significant higher ( $P > 0.05$ ) values in all the Wingate studied variables compared to the amateur group (Peak power: Elite 781 $\pm$ 154 W, Amateur 643 $\pm$ 140 W; Mean power: Elite 523 $\pm$ 83, Amateur 433 $\pm$ 78 W; La Elite 10.7 $\pm$ 2.0 mmol $\cdot$ l, Amateur 9.2 $\pm$ 1.9 mmol $\cdot$ l, except the fatigue index results where no significant differences were detected (Elite 2.22 $\pm$ 0.33, Amateur 2.29 $\pm$ 0.57). These findings suggest that the upper body anaerobic performance is a critical success factor in wrestling. On the other hand, the power declines detected during the maximum 30 seconds test does not seem to be related to the wrestling performance.



**Editor's Note:** This study utilizes some excellent German equipment specific for arm cranking.

Matz, Neil G.. Mood states of Division III collegiate wrestlers Proquest Dissertations and Theses 2010. Section 6020, Part 0575 114 pages; [M.S. dissertation].United States -- Pennsylvania: California University of Pennsylvania; 2010. Publication Number: AAT 1475379.

**Abstract:** Purpose. The purpose of this study is to examine relationships between the number of days cutting weight and mood states and to see if there is a difference between weight classes for mood state scores. Problem . There is little research on the psychological effects of cutting weight. Methods: A descriptive type of research was conducted. Fifty-six male collegiate wrestlers from four NCAA Division III schools volunteered for the study. The Profile of Moods States survey was used. Findings: The number of days spent cutting weight had a significant relationship with the mood states of wrestlers. Additionally, the more effort a wrestler puts forward to cut weight the more negative the mood state. Conclusions: Wrestlers who cut weight more frequently or who expend more effort losing weight have an increased negative mood state. This suggests that athletic trainers and health care professionals may need to develop further collaboration with mental health care professionals to assist with athletes showing mood disturbances from the weight loss that occurs during a wrestling season.

**Editor's Note:** *The need to make weight produces stress for the athletes in weight class sports that are pervasive in their daily life. Psychological support for these athletes is important.*

Messiah, Clyde, III Muscle dysmorphia in collegiate athletes. Proquest Dissertations And Theses 2010. Section 0503, Part 0575 80 pages; [M.S. dissertation].United States -- Oklahoma: University of Central Oklahoma; 2010. Publication Number: AAT 1475957.

**Abstract:** Significance. This study has the potential to provide statistics and information on a subject that desperately needs it. The questions answered by these college athletes will reveal not only whether or not they have characteristics of muscle dysmorphia, but also shed light on some of the possible causes. This information will be valuable in planning strategies to help steer these athletes away from muscle dysmorphia and the harmful mental and physical effects that can result. Purpose. The primary purpose of this study is to examine muscle dysmorphia (MD) characteristics in NCAA Division II athletes. A secondary purpose of this study is to determine whether or not other factors such as coaches, positions within certain sports, pressure to keep scholarships or desire to make it to the professional level of athletics are causes of muscle dysmorphia or muscle dysmorphia characteristics. Additional purposes include comparing sports and genders for differences in MD characteristics. Identifying which sports are at risk and why is a crucial step in the process of being proactive and preventing muscle dysmorphia from occurring. Methodology. 72 varsity athletes (47 male and 25 female; avg. age =20.18 ± 1.36) were recruited from the University of Central Oklahoma athletic department. Varsity sports that were represented include football, men's basketball, men's wrestling, women's rowing, women's tennis and women's volleyball. Data was collected via the Muscle Dysmorphia Inventory (MDI) . The MDI is a 27-item self-report measure designed for the assessment of behavioral and psychological characteristics associated with MD. Additional questions were also asked about possible causative factors of muscle dysmorphia. Results. Tests of between-subjects effects revealed a significant effect for sport on MDI Diet ( p = .01) , MDI Supplement ( p = .01), MDI Exercise Dependency ( p = .01), MDI Physique Symmetry ( p = .01), effect of coaches on mass ( p = .01), effect of sport on mass ( p = .01), effect of position on mass ( p = .01) and effect of professional aspirations on mass ( p = .01). There were no significant differences between sports on MDI Pharmacology, MDI Physique Protection, and effect of keeping scholarship on the desire to gain mass. The most noticeable and reoccurring difference on the rest of the subscales was football scoring higher than most of the other sports on most of the subscales. Conclusions. The results of the present study suggests that muscle dysmorphia characteristics is present in NCAA collegiate athletes. The subscale that scored the highest with all sports was exercise dependency. This is of great concern because exercise dependency can result in injury both in the weight room and on the court/field. On a positive note, only three subjects (4%), answered to having used a pharmacological aid. The results of the present study support the need for more research to be done on the topic of muscle dysmorphia in all populations (NCAA male and female athletes, professional athletes, male and female high school athletes).

**Editor's Note:** *Muscle dysmorphia is marked by excessive concern with one's muscularity and/or fitness. Persons with muscle dysmorphia spend unusual amounts of time working out in gyms or exercising. This study was included because wrestlers were among the athletes studied.*

Oller AR, Province L, Curless B. Staphylococcus aureus Recovery From Environmental and Human Locations in 2 Collegiate Athletic Teams. *J Athl Train*. 2010 May-Jun;45(3):222-9.

**Abstract:** Context: Staphylococcus aureus is spread via direct contact with persons and indirect contact via environmental surfaces such as weight benches. Athletes participating in direct-contact sports have an increased risk of acquiring S aureus infections. Objective: To determine (1) potential environmental reservoirs of S aureus in football and wrestling locker rooms and weight rooms, (2) environmental bacterial status after employing more stringent cleaning methods, (3) differences in colonization rates between athletes and nonathletes, (4) exposed body locations where Staphylococcus was recovered more frequently, and (5) personal hygiene practices of athletes and nonathletes. Design: Cross-sectional study. Setting: Locker room and strengthening and conditioning facilities at a National Collegiate Athletic Association Division II university. Patients or Other Participants: Collegiate football players and wrestlers, with nonathlete campus residents serving as the control group. Intervention(s): Infection control methods, education of the custodial staff, and education of the athletes regarding the Centers for Disease Control and Prevention guidelines for infection prevention. Main Outcome Measure(s): Cultures were taken from the participants' noses, fingertips, knuckles, forearms, and shoes and from the environment. Results: Before the intervention, from the 108 environmental samples taken from the football locker room and weight room, 26 (24%) contained methicillin-susceptible S aureus (MSSA) and 33 (31%) contained methicillin-resistant S aureus (MRSA). From the 39 environmental samples taken from the wrestling locker room and pit areas, 1 (3%) contained MSSA and 4 (10%) contained MRSA. The MRSA rates were different between the 2 locations according to a chi<sup>2</sup> test (P = .01). Seven MRSA isolates were recovered from football players and 1 from a wrestler; no MRSA isolates were recovered from the control group. The fingertip location of S aureus recovery from football players was significant when compared with both other locations in football players and fingertips in wrestlers and the control group (P < .05). Football players and wrestlers shared more personal items than the control group (P < .05). After the intervention, the football locker room and weight room samples were negative for S aureus. Conclusions: Intact strengthening and conditioning equipment, proper hygiene, and proper disinfection methods lowered both environmental and human S aureus recovery at 1 university.

**Editor's Note:** Our best weapon appears to be increased education and awareness of athletes and custodial staffs in the utilization of the Centers for Disease Control and Prevention guidelines for infection prevention.

Panov, S. F., Pleshakov, A. A., Batrakov, A. A., Neplyuev, D. A. Involvement of the growth hormone and insulin in gastric secretion regulation in wrestlers during sport and post-sport ontogeny. *Human Physiology* 2010, Vol. 36 Issue 4, p466 7p.

**Abstract:** The roles of gastrin, somatotrophic hormone, insulin, and glucose in the formation of long-term and acute adaptation of gastric secretion in wrestlers during sport and post-sport ontogeny are discussed. The basal secretion of hormones and the blood glucose level have been found to change with age in a wavelike manner. Ascents and declines of different waves of their time course correspond to sensitive stages of ontogeny. Changes in hormone secretion and the glucose level under bicycle ergometry are statistically nonsignificant in 90% of cases, but these changes are enough to obtain a final result, namely, an adequate level of protein hydrolysis as a result of physical activity.

*Lipetsk Pedagogical State University, Lipetsk, 398020 Russia*

Jonas Poderys, Eurelija Venskaitytė, Kristina Poderienė, Alfonsas Buliuolis, Alfonsas Vainoras  
Functional state assessment on the dynamics of interparametric concatenations during exercise tests *Medicina* (Kaunas) 2010; 46 (6): 429-434

**Key words:** exercise tests; cardiovascular system; muscular system;

**Summary.** The aim of this study was to complement an analytical approach by a new methodology of data sequences analysis of muscular and cardiovascular indices during the assessments of functional state. The participants of the study were 14 elite Greco-roman wrestlers and they underwent two exercise tests 30 squats per 45 s while 12-lead ECG was recorded continuously and 30-s vertical jumps test while the height, contact and flight times of each jump recorded. The parametric interactions parameters and their sequences analysis based on a



mathematical method founded upon a matrix theory were applied. The obtained results enabled us to identify dynamical changes of the independence of parameters or an opposite phenomenon – interaction. The dynamics of ECG or performance parameters did not allowed us to locate the moments of critical changes during the exercising. The dynamics of concatenation between the time of push-off and the height of jumps while performing repeated jumps has a tendency to increase in the values of discriminant and the fluctuations at some point of jumping task comes on. Analysis of concatenation between ECG or muscle performance parameters allows distinguishing the individual peculiarities which could be io value of discriminant, in time of exercising before the fluctuations occurs, in character how the body behave as to compensate fatigue. It was concluded that assessment of the dynamics of inter-parametric concatenation of physiological parameters based on the data sequences analysis provide a new approach in the field of functional state assessment allowing to reveal features of functional preparedness and fatigability during workloads.

Correspondence to J. Poderys, Laboratory of Kinesiology, Lithuanian Academy of Physical Education, Sporto 6, 44221 Kaunas, Lithuania. E-mail: [L.poderys@lkka.lt](mailto:L.poderys@lkka.lt)

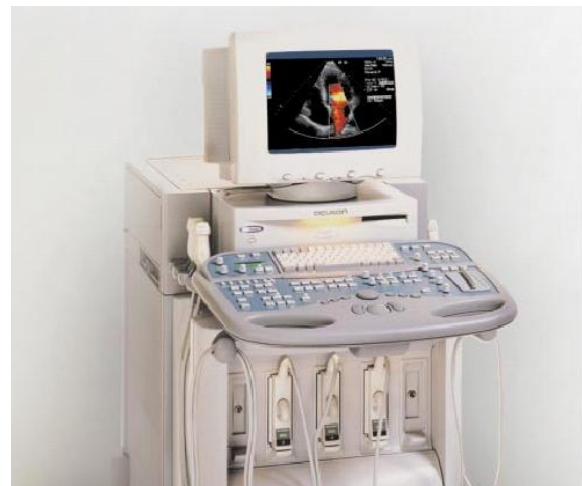


*Editor's Note: Dr. Poderys has used wrestlers to research methods to establish adaptation to training. This can allow one to establish the effectiveness of the training as well. He has used some rather simple field tests utilizing body weight squats and jumps (such as the Ruffier Test) while connected to an ECG. These can be done during training without imposing an extra stress or fatigue.*

Popovic D, Ostojic MC, Petrovic M, Vujisic-Tesic B, Popovic B, Nedeljkovic I, Arandjelovic A, Jakovljevic B, Stojanov V, Damjanovic S. Assessment of the Left Ventricular Chamber Stiffness in Athletes. *Echocardiography*. 2010 Sep 26. doi: 10.1111/j.1540-8175.2010.01311.x. [Epub ahead of print]  
Division of Cardiology Division of Endocrinology Department of Medical Ecology, School of Medicine, University of Belgrade, Serbia. E-mail: [dejana01@eunet.rs](mailto:dejana01@eunet.rs)

### Abstract

Since diastolic dysfunction is an early sign of the heart disease, detecting diastolic disturbances is predicted to be the way for early recognizing underlying heart disease in athletes. So-called chamber stiffness index  $(E/e')/LVDd$  was predicted to be useful in distinguishing physiological from pathological left ventricular hypertrophy, because it was shown to be reduced in athletes. It remains unknown whether it is reduced in all athletic population. Standard and tissue Doppler were used to assess cardiac parameters at rest in 16 elite male wrestlers, 21 water polo player, and 20 sedentary subjects of similar age. In addition to  $(E/e')/LVDd$  index, a novel  $(E/e')/LVV$ ,  $(E/e')/Rve'lat$  indices were determined. Progressive continuous maximal test on treadmill was used to assess the functional capacity.  $VO(2)$  max was the highest in



water polo players, and higher in wrestlers than in controls. LVDd, LVV, LVM/BH(2.7) were higher in athletes. Left ventricular early diastolic filling velocity, deceleration and isovolumetric relaxation time did not differ. End-systolic wall stress was significantly higher in water polo players. RV e' was lower in water polo athletes. Right atrial pressure (RVE/e') was the highest in water polo athletes. (E/e'lat)/LVDd was not reduced in athletes comparing to controls (water polo players  $0.83 \pm 0.39$ , wrestlers  $0.73 \pm 0.29$ , controls  $0.70 \pm 0.28$ ;  $P = 0.52$ ), but (E/e's)/RVe'lat better distinguished examined groups (water polo players  $0.48 \pm 0.37$ , wrestlers  $0.28 \pm 0.15$ , controls  $0.25 \pm 0.16$ ,  $P = 0.015$ ) and it was the only index which predicted VO(2) max. In conclusion, intensive training does not necessarily reduce (E/e'lat)/LVDd index. A novel index (E/e's)/RVe'lat should be investigated furthermore in detecting diastolic adaptive changes.

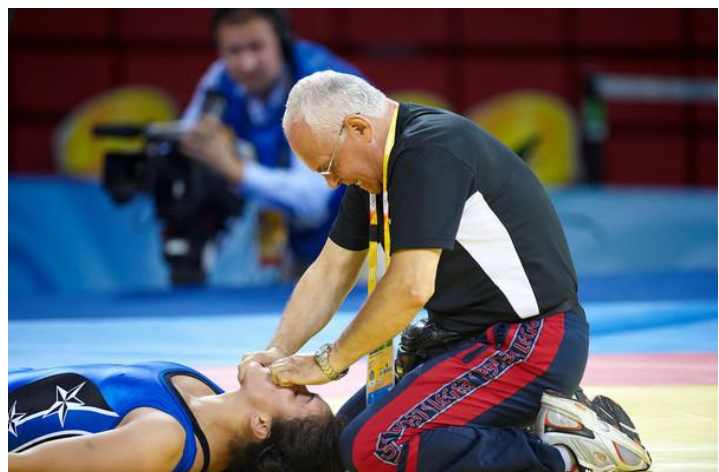
**Editor's Note:** To be able to differentiate between the physiological adaptation found in athletes and the pathological condition found in heart disease is the goal.

Shadgan B, Feldman BJ, Jafari S. Wrestling Injuries During the 2008 Beijing Olympic Games. *Am J Sports Med.* 2010 Sep;38(9):1870-6  
The International Federation of Associated Wrestling Styles and University of British Columbia.



**Abstract:** Better understanding of the incidence, mechanisms, and characteristics of potential injuries in wrestling helps to implement preventive measures to better care for these athletes. Several studies have investigated the incidence and type of injuries in amateur and intercollegiate wrestling; however, there is a lack of studies that review the incidence and nature of injuries in elite wrestlers during Olympic Games or World Championships. **PURPOSE:** The purpose of this study was to assess the injury profile of elite senior wrestlers in Greco-Roman, freestyle, and female wrestling during the 2008 Beijing Olympic Games. **STUDY DESIGN:** Descriptive epidemiologic study. **METHODS:** Study participants consisted of

343 wrestlers participating in the 2008 Beijing Olympic Games. Standard checkoff forms were used to collect the injury data, including injury type, severity, location, timing, and mechanism. **RESULTS:** A total of 343 athletes sustained 32 injuries during 406 matches, which is equivalent to an overall incidence of 9.30 injuries per 100 athletes and 7.88 injuries per 100 matches. Among the 3 styles, freestyle had the highest injury rate (10.1%) and female wrestling the lowest (7.5%). In sum, 84.4% of all injuries were categorized as mild. Although the overall injury rate in male athletes was slightly higher than that among female athletes (9.7% versus 7.5%), this difference was not statistically significant (odds ratio = 1.21, 95% confidence interval = 0.46-3.68;  $P = .40$ ). **CONCLUSION:** The rate and severity of wrestling injuries during the 2008 Beijing Olympic Games were lower than previous reports. No serious and catastrophic injury was recorded, and most injuries were minor.



Stanforth B, Krause A, Starkey C, Ryan TJ. Prevalence of community-associated methicillin-resistant *Staphylococcus aureus* in high school wrestling environments. *J Environ Health*. 2010 Jan-Feb;72(6):12-6.

*Ohio University, Athens*

**Abstract:** Methicillin-resistant *Staphylococcus Aureus* (MRSA) was predominantly a hospital-acquired organism; recently, however, community-associated MRSA (CA-MRSA) has been causing outbreaks in otherwise healthy individuals involved in athletics. As such, CA-MRSA is of emerging concern to sanitarians and public health officials. Secondary school athletic trainers and student athletes may be at elevated risk of spreading or contracting MRSA. The absence of proper hygiene protocols or equipment may further increase this risk. In the study discussed in this article, environmental samples were obtained to identify the prevalence of MRSA on surfaces in high school athletic training and wrestling facilities mats in nine rural Ohio high schools. Frequencies and descriptive statistics were prepared. All nine (100%) of the sites tested had at least one positive sample for the presence of MRSA. The need for heightened sanitation, hygiene education of affected persons about skin and soft tissue infections like MRSA, and intervention opportunities for public health professionals are discussed.

Sysoeva OV, Kulikova MA, Maliuchenko NV, Tonevitskiĭ AG, Ivanitskiĭ AM. [Genetic and social factors in developing of aggression] *Fiziol Cheloveka*. 2010 Jan-Feb;36(1):48-55. [Article in Russian]

**Abstract:** The association of 5-HTTLPR gene polymorphism and aggression was studied in control group of males and females and in the athletes. The sport activities were found to decrease the aggression: the effect persist for the synchronized swimmers and for the **wrestlers**. Control group of males were characterized by higher aggression scores (Assault, Negativism, Suspicion and Verbal aggression scales of Buss-Durkee Hostility Inventory) compared to females. For all female-subjects irrespective of sport activities and age, the association between the variants of 5-HTTLPR gene and the Indirect Aggression and Negativism scores were found: carriers of SS genotype has higher scores on Indirect Aggression and lower scores on Negativism. For the males the association was different: The averaged Hostility scores were higher for the carriers of LL-genotype. The brain processes, presumably underlying the association between aggression and 5-HTLPR gene, were studied in male control group. The increased MMN component of ERP, which responsible for the automatic change detection, and decreased P3a component, related to involuntary attention and cognitive control were found in LL-carriers. It might be considered as a sign that SS-carriers process the information with more cognitive resources. Probably they perceive the stimulus as more complicated, which lead to activation the additional resources of frontal cortex. It might be also suggested that the carriers of SS-genotype tend to deeper processing of the incoming information. Probably, it is this more "serious" analysis of external information, which underlies the rejection of impulsive aggressive actions.

**Editor's Note:** *Very complex subject, yet, "The sport activities were found to decrease the aggression."*

Tartibian , B., Maleki, BH, Abbasi, A The effects of omega-3 supplementation on pulmonary function of young wrestlers during intensive training. *Journal of Science and Medicine in Sport* 13 (2010) 281–286  
*Department of Physical Education and Sport Science, Urmia University, Iran*

**Abstract:** The purpose of this study was to examine the effects of omega-3 supplementation on young wrestler's pulmonary function during intensive wrestling training. Forty healthy young male wrestlers participated in this study. The subjects were randomly divided into experimental ( $n = 10$ ), placebo ( $n = 10$ ), active control ( $n = 10$ ) and inactive control ( $n = 10$ ) groups. Participants in experimental, placebo and active control groups performed wrestling incremental training up to 95% of exercise MHR, three times a week, for 12 weeks. The inactive control group did not participate in any exercise training. Subjects in the experimental group were asked to consume omega-3 (1000 mg/day for 12 weeks), while those in placebo were refused any doses of omega-3. The pulmonary variables were measured at baseline and at the end of 12 weeks of training program. Results indicated that consuming omega-3 during 12 weeks training had a significantly positive effect on pulmonary variables such as FEV1, FVC, VC, MVV, FEF25–75, FIV1 ( $p = 0.001$ ), but no significant changes were observed in FEV1% ( $p = 0.141$ ) and FIV1% ( $p = 0.117$ ). The results of the present study suggest that consuming omega-3 during intensive wrestling training can improve pulmonary function of athletes during and in post-exercise.

**Keywords:** Eicosapentaenoic acid; Docosahexaenoic acid; Inflammatory mediators

Utter AC, Quindry JC, Emerenziani GP, Valiente JS. Effects of rooibos tea, bottled water, and a carbohydrate beverage on blood and urinary measures of hydration after acute dehydration. *Res Sports Med.* 2010 Apr;18(2):85-96.

**Abstract:** Rooibos tea contains polyphenol antioxidants, including flavonoids and phenolic acids that are potent free radical scavengers and has purported benefits for accelerated rehydration. The objective was to evaluate the effects of three different drinks (rooibos tea, bottled water, and a carbohydrate beverage) on blood and urinary markers of hydration after acute dehydration in collegiate wrestlers. Twenty-three athletes were recruited and followed a randomized, cross-over design with three different study arms comparing the effectiveness of rooibos tea, carbohydrate beverage (6% or 60 grams l(-1)), or bottled water (placebo) in promoting rehydration after a 3% reduction in body mass. Urine specific gravity (U(sg)) urine (U(osm)) and plasma osmolality (P(osm)), and plasma volume were measured pre- and post dehydration and at 1-h after rehydration. Statistical analyses utilized a 3 (conditions) x 3 (times) repeated measures analysis of variance to test main effects. Significant interaction effects were found for P(osm) and U(osm), both of which remained below baseline after 1-h rehydration in the rooibos tea and water trials. No significant interaction effects were found for either urine U(sg) or plasma volume shift. The findings of this study demonstrate that rooibos tea was no more effective in promoting rehydration than plain water, with significant changes being found for P(osm) and U(osm) in the carbohydrate/electrolyte solution, in collegiate wrestlers after a 3% reduction in body mass and a rehydration period of 1-h when consuming 100% of their body weight loss.

Department of Health, Leisure, and Exercise Science, Appalachian State University, Boone, North Carolina 28608, USA. [utterac@appstate.edu](mailto:utterac@appstate.edu)

Utter AC, McAnulty SR, Sarvazyan A, Query MC, Landram MJ. Evaluation of ultrasound velocity to assess the hydration status of wrestlers. *J Strength Cond Res.* 2010 Jun;24(6):1451-7.

Department of Health, Leisure, and Exercise Science, Appalachian State University, Boone, North Carolina, USA. [utterac@appstate.edu](mailto:utterac@appstate.edu)

**Abstract:** The objective of this study was to evaluate the utility of ultrasound velocity (UV) to detect changes in the hydration status of wrestlers after undergoing acute dehydration and a 2-hour rehydration period. Forty-seven NCAA wrestlers (mean $\pm$ SEM); age 19.1 $\pm$ 0.2 years, height 1.73 $\pm$ 0.1 m, body mass (BM) 79.4 $\pm$ 2.4 kg were tested in euhydrated, dehydrated, and a 2-hours rehydrated conditions. Hydration status was quantified by measuring changes in plasma osmolality (Posm), urine osmolality (Uosm), urine specific gravity (Usg), and BM. Ultrasound velocity was measured at 1 MHz using 1.5-microsecond duration tone burst in the soleus muscle. Significant changes ( $p<0.001$ ) in UV during periods of dehydration (BM change=-3.6 $\pm$ 0.14%) (UV=+2.18 m.s) and rehydration (BM change=+2.8 $\pm$ 0.12%) (UV=-2.89 m.s) were found. Significant main effects ( $p<0.001$ ) were also found for Usg, Uosm, and Posm during dehydration. The change in Posm from the 1 to 2-hour rehydration time period significantly correlated to the change in UV during the same time period ( $r=0.27$ ,  $p<0.001$ ). This study demonstrates that changes in UV correspond to the changes of Posm, Usg, Uosm, and BM during acute dehydration and rehydration in collegiate wrestlers. The use of ultrasound measures may have potential application as an alternative field-based method to assess the hydration status of collegiate wrestlers although future research is warranted.



**Ultrasonic measurement in a subject's leg for testing the soleus muscle**

*Editor's Note: The measure of hydration status is a fundamental part of any weight control plan in wrestling. Finding a simple, valid, inexpensive and non-invasive method (use of body fluids) is a very desirable.*



Weight, Erianne A. The role of the entrepreneurial coach--non-revenue sport survival within big-time collegiate athletics. *Int J Sport Manag* Jan2010, Vol. 11 Issue 1, p16 15p.

**Abstract:** The article offers information on a study which investigated the perceptions of athletic directors on the influence of coaches in realizing sustained vitality in Division I-A wrestling programs. A review of the related literature is offered. It details the research methodology. An analysis of the influence of a wrestling coach on sport cuts and ways that athletic directors employ to strengthen their program's longevity is detailed. The results of the study are examined.

*Bowling Green State University (Ohio)*

**Editor's Note: Promotion is a necessity at all levels of wrestling!**

YAMANER, F., BAYRAKTAROĞLU, T. ATMACA, H., ZİYAGİL, MA, TAMER, K  
Serum leptin, lipoprotein levels, and glucose homeostasis between national wrestlers and sedentary males. *Turk J Med Sci* 2010; 40 (3): 471-477  
E-mail: medsci@tubitak.gov.tr

**Abstract:** Leptin is an important controller of the size of fat stores by inhibiting appetite. In wrestling, fat metabolism is important not only for aerobic energy system, but also for weight control and weight loss before competition. The aim of this study was to measure and compare the serum leptin levels, glucose homeostasis, and serum lipoproteins between Turkish national wrestlers and sedentary males. **Materials and methods:** Forty-five Turkish national wrestlers at the end of Olympic training camp before Beijing 2008 Olympic Games and 43 sedentary students were selected as subjects. Post-exercise levels of serum leptin, HOMA (Homeostasis model assessment) values, triglycerides, total cholesterol, LDL-cholesterol, HDL-cholesterol, and VLDLcholesterol were measured after overnight fasting. A Mann-Whitney U test was used to test the differences between 2 groups. Pearson Correlation was conducted between leptin and the other parameters. **Results:** No significant difference was observed among the means of leptin and total cholesterol levels of the 2 groups. Wrestlers had significantly higher fasting insulin, HDL-cholesterol, triglyceride, and HOMA levels, but a lower LDLcholesterol level compared to the sedentary males. The positive correlation was only found between leptin and fasting insulin levels ( $r = 0.310$ ,  $P = 0.043$ ). **Conclusion:** This study indicated that wrestling training had no effect on resting leptin level after overnight fasting and wrestlers had also decreased insulin sensitivity with higher fasting insulin, HDL-cholesterol, triglyceride, and HOMA levels compared to sedentary males.

**Key words:** leptin, lipoproteins, insulin resistance, weight loss

**Editor's Note: The role of leptin may be a bit different in female wrestlers. See Psatha, et al. EFFECTS OF STRENUOUS TRAINING AND REPEATED CYCLES OF WEIGHT LOSS ON LEPTIN AND SEX HORMONES IN ELITE FEMALE WRESTLERS *Medicina Sportiva*, Vol. 8 (1):2004.**

Yanagawa Y, Morimura T, Tsunekawa K, Seki K, Ogiwara T, Kotajima N, Machida T, Matsumoto S, Adachi T, Murakami M. Oxidative Stress Associated with Rapid Weight Reduction Decreases Circulating Adiponectin Concentrations. *Endocr J*. 2010 57(4):339-45

**Abstract:** The effect of stress associated with acute weight reduction on adipocytokine production is incompletely understood. In the present study, we have investigated the changes in circulating adipocytokine concentrations and urinary concentrations of stress markers in male collegiate wrestlers during acute weight reduction for a competition. Twenty healthy Japanese male wrestlers (18-22 years of age) who participated in the national collegiate wrestling tournament were studied. Body weight, body fat amount, serum testosterone, serum leptin, serum adiponectin, urinary 8-hydroxy-2'- deoxyguanosine (8-OHdG) and urinary biopyrrins were analyzed during acute weight reduction for the competition. Body weight, body fat amount and the serum concentrations of testosterone, leptin and adiponectin significantly decreased on the day of weigh-in compared with the levels 12 days before weigh-in. In contrast, urinary concentrations of 8-OHdG and biopyrrins significantly increased on the day of weigh-in compared with the concentrations 12 days before weigh-in. A positive correlation was observed between the serum concentrations of adiponectin and testosterone, and a negative correlation was observed between the concentrations of serum adiponectin and urinary biopyrrins. The present results suggest that rapid weight reduction

increases the urinary concentrations of stress markers, which is associated with a decrease in serum concentrations of adiponectin.

*Department of Clinical Laboratory Medicine, Gunma University Graduate School of Medicine, Maebashi, Japan.*

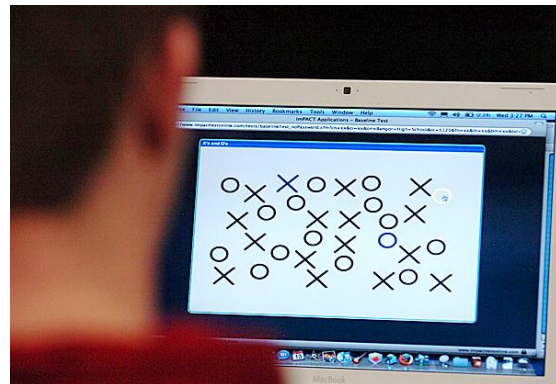
**Editor's Note:** *The identification of these stress markers gives us more tools to monitor and manage the stress incurred through making weight.*

Yard EE, Comstock RD. Compliance with return to play guidelines following concussion in US high school athletes, 2005-2008. **Brain Inj.** 2009 Oct;23(11):888-98.

*Center for Injury Research and Policy, The Research Institute at Nationwide Children's Hospital, Columbus, Ohio 43205, USA.*

**Abstract:** PRIMARY OBJECTIVE: To determine whether US concussed high school athletes complied with recommended return-to-play guidelines during the 2005-2008 school years. RESEARCH DESIGN: Prospective cohort study in 100 nationally-representative US high schools. METHODS AND PROCEDURES: Certified athletic trainers submitted injury reports for concussed athletes in five boys' (football, soccer, basketball, wrestling, baseball) and four girls' (soccer, basketball, volleyball, softball) sports via High School RIO (Reporting Information Online). Concussions were retrospectively graded and it was determined whether athletes followed American Academy of Neurology (AAN) or Prague return-to-play guidelines. MAIN OUTCOMES AND RESULTS: There were 1308 concussions reported during 5 627 921 athlete-exposures (23.2 concussions per 100 000 athlete-exposures), reflecting an estimated 395 274 concussions sustained nationally. At least 40.5% and 15.0% of concussed athletes returned to play prematurely under AAN and Prague return-to-play guidelines, respectively. In football, 15.8% of athletes sustaining a concussion that resulted in loss-of-consciousness returned to play in <1 day. Males (12.6%) were more likely than females (5.9%) to return 1-2 days after sustaining an initial grade II concussion. CONCLUSIONS: Too many adolescent athletes are failing to comply with recommended return-to-play guidelines. Sports medicine professionals, parents, coaches and sports administrators must work together to ensure athletes follow recommended guidelines.

**Editor's Note:** *All contact sports are experiencing a needed wave of attention and interest in the prevention and management of concussions. Many schools have begun to use a system that establishes a "normal" baseline of cognitive function for the athlete. This test can be administered after a head injury and be compared to the baseline scores to identify when the athlete can return to participation.*



Ziyagil MA, Gursoy R, Dane S, Yuksel R. Left-handed wrestlers are more successful. **Percept Mot Skills.** 2010 Aug;111(1):65-70.

*Amasya University, Turkey*

**Abstract:** It has been reported that there is a high proportion of left-handers among top athletes in different sports. In this study, the goal was to examine the rate of left-handedness in the top wrestlers at the world championships for achievement by left-handed wrestlers. The rate of left-handedness was higher in wrestlers with medal honors compared to wrestlers without medals for both men and women. The winning numbers and match degrees were higher in the left-handed wrestlers than in both right- and mixed-handed wrestlers among top international wrestlers.



# The International Network of Wrestling Researchers (INWR)

A vision what we can do to advance the status of wrestling

Dr. David Curby  
Overtime School of Wrestling  
Naperville, Illinois, USA



FILA Scientific Congress-Moscow  
September 8, 2010



My talk will be to introduce to many of you, the International Network of Wrestling Researchers (INWR), and to describe my vision of what it can do to advance the status of wrestling throughout the world. Before I begin I want to acknowledge the sponsorship and support of this meeting by both FILA and President Martinetti, and the Russian Wrestling Federation and its President, Mr. Mamiašvili. Additional thanks must be extended to the men that I worked with in the organization of this event-First Vice-President Wrestling Federation of Russia and Director of the World Championship Organizing Committee, Mr. Georgy Byrusov, and Professor Boris Podlivaev. The objectives will be to: 1) Explain the goals of the International Network of Wrestling Researchers and extend an invitation to join; 2) Define the needs and parameters of wrestling sport science research and its role in the promotion of our sport; and 3) Present possible areas for future activities and research.

## What is the INWR?

From initial discussions with Drs. Mirzei (Iran) and Barbas (Greece), while at the FILA Advanced GR Coaches Course in Almaty in 2007, an idea was conceived for an organization for those who work in wrestling sport science. Others began joining us and further talks took place while in Komotini for the Annual Physical Education and Sport Science Conference in 2009, where we added Drs. Kazarian and Safranbasi. Today, here we are in Moscow, having our inaugural meeting in conjunction with the FILA Scientific Congress for the 2010 World Wrestling Championships.

The genesis of this organization stems from conversations with these colleagues regarding the support such an organization can provide our sport, as well as providing collegial support and

some important camaraderie in our work that relates to wrestling. My correspondence with a researcher in judo, Dr. Michel Calmet of France (<http://www.apc-scolaire.fr>) began in 2007, and it was a critical event, as he described to me the, then recent, formation of the International Association of Judo Researchers.

### **Aims and Objectives:**

The aims of the International Network of Wrestling Researchers (INWR) are to "Facilitate the development of wrestling through international and intercultural understanding and cooperation; and to support wrestling-related research and education."

### **Proposed Objectives are:**

- Identify wrestling researchers and scientists from around the world.
- Create opportunities for researchers to connect and share ideas through a communication network.
- To provide expert advice for decision-makers in our sport.
- To provide researchers with opportunities for publications and presentations.
- To improve the availability of research-related sources.
- To encourage and support wrestling-related educational activities.
- To support and facilitate the best wrestling teaching and coaching methods.
- To work collaboratively and explore partnerships with other organizations and programs who can benefit from the intellectual resources of this organization.
- Providing a discussion forum to enable communication between all those who use an official website.
- Encourage and support wrestling related activities between students and researchers.
- Another purpose will be to create a database of wrestling-related research articles for open access. There is currently limited access to places where students can search for scientific or scholarly articles of wrestling. The continuation of this resource would be a plus for the development and expansion of wrestling around the world. It would also be a valuable resource providing important, practical information to teachers, coaches, referees, officials, athletes, and administrators.

### **What is the Nature of Wrestling Research?**

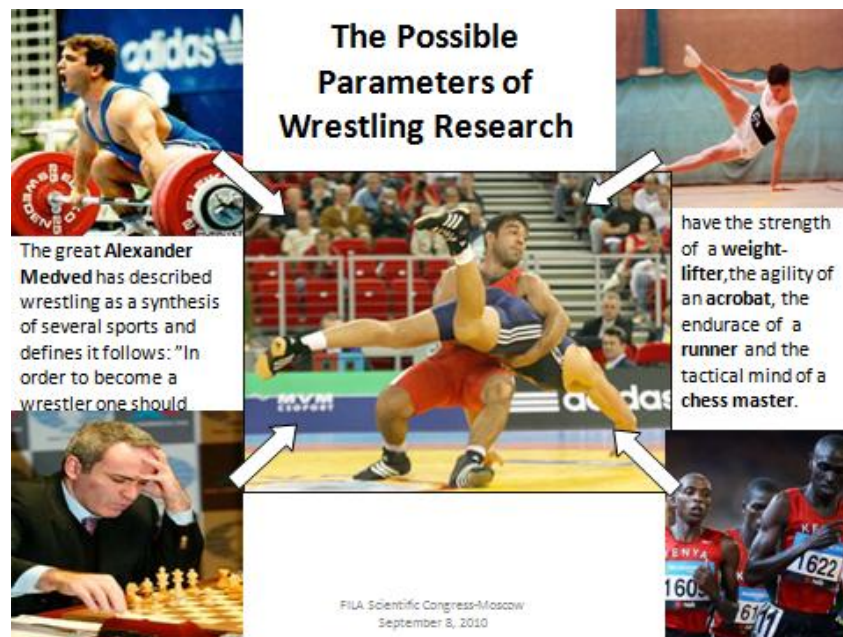
In the introduction of the book from the first FILA Coaches Clinic in 1976, President Milan Ercegan stated,

*"It is no longer possible for a wrestling coach to limit his work to on the mat training only. Modern training implies the increasing impact of several scientific disciplines. The coach should know the theory of his sport, the methodology of sports training, and the principles of anatomy, physiology, psychology, and biomechanics. Finally, his work must not be limited to only working with the outstanding sportsman, he should equally devote himself to the work with children and young sportsmen. It is on you, the wrestling coaches that the future of the sport depends."*

I have often used a slide from a lecture given by my friend Dr. Ramazan Savranbasi. In it he tells of how the great Alexander Medved has described wrestling as a synthesis of several sports



and defines it follows:”In order to become a wrestler one should have the strength of a **weight-lifter**, the agility of an **acrobat**, the endurance of a **runner** and the tactical mind of a **chess master**.” Wrestling is a simple and natural activity, but a very complex sport!



When we examine the academic publications regarding wrestling, we see even more categories. The parameters that describe wrestling have indeed grown complex. A search for the first references to true scientific research in wrestling, in the modern sense, one sees them beginning in the early 20<sup>th</sup> century (Tunnemann, H. *Ringkampf 1891-1991: Internationale Auswahlbibliographie*. FILA und Deutscher Ringer-Bund, 1991):

- R. Gullichsen and J. L. Soisalon-Soininen. Über die kohlenstoffabgabe des menschen beim fechten und ringen. *Skandinavisches Archiv fuer Physiologie* 48:188-194, 1921.
- C. F. Simon. Quantitative tests for albumin in wrestlers. Springfield College. 1922.  
M.S.Dissertation
- W. E. Burge. Effect of gymnasium exercise and athletic contests on blood catalase. *Americam Journal of Physiology* 63:431-432, 1923.
- F. Bach. (Body composition of professional wrestlers.). *Anthropologischer Anzeiger (German)* 1924 (1):200-217, 1924.

Let us discuss some of these academic disciplines that can be used to study wrestling. Physiology, psychology, biomechanics, training science, and sportsmedicine are the areas that are the most obvious for study since they can contribute directly to improved performance. Sociology, history, philosophy (includes ethics and values), sports management/administration, and pedagogy concern themselves more with the impact of the sport on society. These areas, while not as important to practicing athletes, have a great deal to contribute to an understanding of the role of wrestling in society. Thus, all of these areas are fertile for research and can add to our sport.

## The Use of Research in the Advancement of Wrestling

What are the major problems confronting today's wrestling? What is the biggest threat for wrestling? How can wrestling become more attractive? What should be the role of wrestling sport scientists?

We must apply our work to the solution of problems that confront us. I will give examples from five of the areas of wrestling research. The first is in the area of **Psychology**. Psychology is a very complex and rich area for research. I refer to a study of one of the important participants- the referee.

Kendristaki,A.; I. Barbas, E. Bebetos, D. Gurby, B. Mirzaei, R. Savranbasi, V. Kalivas  
*The profile of referees in the sport of wrestling and how they affect the results of the match. 18th International Congress of physical education and sport, Department of physical education and sport of Democritus University of Thrace, Komotini, GR May 2010.*

The purpose of this study efforts aim at is to investigate orientation of the motivation of the referees. The sample consists of 213 international referees from 30 countries. Their ages ranged from 26 to 60 years. The researchers showed that referees with an egocentric orientation are more likely to adopt inappropriate behavior and aggressive behavior towards athletes. Are the referees engaged to their work because they like and enjoy it or because they will get something out of it? This is an important distinction to be made in our selection of people who can such an impact on the attraction by the public to our sport.

**Sports Medicine** is a key element in making our sport more attractive. How do we bring more young wrestlers into the sport? In order to attract more athletes, there must be a positive image in the public for our sport. This public perception includes parents, and of course mothers, who are first and foremost concerned with the safety and well-being of their children. The aspect of danger must be minimized. This involves **risk reduction** and injury **prevention**. Some of this can be achieved through well-educated and professional coaches. These coaches will use progression of teaching, age appropriate activities, appropriate space and mats, proper matching of athletes, appropriate conditioning and physical preparation and progression, employing teaching techniques that develop a healthy psyche, and the teaching of safety and hygiene to the athletes are all important.

Certainly dermatological studies can be very important for our sport. Some recent examples include:

- lkit, M.; M. Saracli, H. Kurdak, A. Turac-Bicer, T. Yuksel, M. Karakas, E. Schuenemann, and S. M. Abdel-Rahman. Clonal outbreak of Trichophyton tonsurans tinea capitis gladiatorum among wrestlers in Adana, Turkey. *Med Mycol* Oct 14, 2009.
- Aghamirian M.R.; and S. A. Ghiasian. A clinico-epidemiological study on tinea gladiatorum in Iranian wrestlers and mat contamination by dermatophytes. *Mycoses* Nov 16, 2009.

Anderson. BJ; Managing herpes gladiatorum outbreaks in competitive wrestling: the 2007 Minnesota experience. *Curr Sports Med Rep* 7 (6):323-327, 2008.

While some dermatological concerns, such as tinea corporis, can be dismissed as more or less a nuisance, some can have more serious complications. Medical precautions, management protocols, and treatments must be established for herpes gladiatorum, which can have severe complications, as well as for MRSA infections in the athletic population. In our educational programs we must make hygiene and sanitation a primary concern for the coach.

Let us now look at an example from **Training Science**. The need to assess optimum training adaptation, and indeed the need to avoid overtraining, may call for assessment of a wrestler's current physical state on a particular variable. This can require a standardized test. While scientists can employ similar tests, the exact protocols are not always exactly defined in the literature and therefore the results may not be comparable. As an example, many researchers have used arm crank tests, but often various loadings, intervals, and other methodological differences are present. Collaboration and communication can eliminate this problem.

Akopyan, AO; V. A Pankov, and A. Yu Kim. Formation of technique of Grecian-Roman wrestlers training in new conditions of competitive activity. *Teoria i praktika fiziceskoj kul'tury* 2006 (2):21-23, 2006.

Popadic, O.; Gacesa JZ, Barak OF, and Grujic NG. Maximal anaerobic power test in athletes of different sport disciplines. *J Strength Cond Res* 23 (3):751-755, 2009.

The academic discipline of **History** may not have any immediate performance significance for a wrestler, but we need to encourage the writing of biographies, and production of movies of our great heroes. The inspiration drawn from these greats is far-reaching and must be used to attract the next generation. Their legends also help to keep our sport in the public mind. Historical research includes the study and teaching of the many folk styles from around the world.

Tomikowa, R. Mongolian Wrestling (Bukh) and Ethnicity. *Int J Sport Health Science* 4:103-109, 2006.

**Pedagogy** offers much to us in the world of wrestling. Understanding how wrestlers learn, as well as the best approaches to be used at different ages, by different types of learners can all be gained from the "science of teaching." We must use current best practices in the development of instructional programs for physical education classes. My practical example for this area, while not research, is quite current, as a news release from describes how Turkey will be providing coaching in African countries. Whether it is providing help to countries attempting to develop their wrestling, or the exchange of specialists between countries with established programs, this type of collaboration is a must for our sport to grow.

Wrestling must be maintained in the physical education programs for all youth. This means that the preparation programs for physical educators must also include how to teach this sport. While it is easy for even the worst physical education teacher to organize a game of basketball or soccer, wrestling demands a higher level of technical expertise for safe and satisfying instruction. The emphasis must be on the physical development, games and folk wrestling, and acquisition of

technique. We must prepare sound and interesting instructions and examples for lessons, based on modern pedagogy, so wrestling is included in the physical education curriculum. Well-educated and ethical coaches often hold the key as to how the public perceives these issues. They are important role models, along with the older, successful wrestlers, who ultimately attract athletes to our sport. Some current research that is relevant includes:

*Mparmpas i. Aggeloyisis n., Taxildaris Almpanidis* ***The pedagogical value wrestling for the development of children*** 18th International Congress of physical education and sport, Department of physical education and sport of the Democritus University of Thrace, Komotini, GR May 2010.

T. Karipidis, F. Kerimov, I. Barbas *Sports for all as a means of developing the sport of wrestling.* 18th International Congress of physical education and sport, Department of physical education and sport of Democritus University of Thrace, Komotini, GR May 2010.

### **Wrestling Research and Some Cautions**

The expansion and integration of sport into the daily life of modern society, has been facilitated in part by the advances in sports medicine and sport science. Our understanding of the human body, and its need for activity, has increased exponentially. The people involved with the sport science of wrestling must make sure that our scientific base of knowledge is fully employed and utilized. We must be assertive in guiding our athletes and coaches to base their methods on the most scientifically sound practices. We must also be assertive in seeking that decisions made within the sport are based on the best information.

We in sport science all must work to keep wrestling in the spotlight. Conferences such as this beautiful symposium must be repeated in other countries. We must take advantage of major competitions to hold similar scientific congresses and publicize the activities.

Sport science research is not a panacea. We must maintain our humanity in all that we do.

*Everything that can be counted, does not necessarily count; everything that counts cannot necessarily be counted.* Einstein

*The wrestlers we work with are NOT commodities—something to exploit for glory and profit.* INWR

### **INWR Membership and Registration**

Membership is open to persons who have a major academic qualification in a wrestling related discipline or other related academic disciplines, and who show evidence of interest in wrestling related sport science research. We will encourage the registration of student members.

Undergraduate and graduate students who are studying or carrying out research in the area of wrestling research or related disciplines are also encouraged to register.

Qualified and interested people are invited to register via email: [davcurb@gmail.com](mailto:davcurb@gmail.com)

Individuals will be asked to complete an information form containing personal experiences and interests. We need to identify the pool of interested people from around the world. An initial task is to establish at least one contact person in each country that has national wrestling governing body. Please share with your colleagues and other appropriate scholars.

### **Future Activities**

Meetings will be established at major competitions. For 2011, there will be a May meeting in Greece in conjunction the the Komotini International Sport Congress, and a meeting at the World Championships in Turkey. We have been invited to participate in and help plan the Combative Sports portion of the Pre-Olympic Congress in London in 2012.

I hope for an increase in translations of some important works that have not been readily available in English language journals, more support for developing nations, increased exchanges and collaborative research, expanded database use and sharing of reviews of research.

We are initiating the publication *The International Journal of Wrestling Science* in 2011. A scholarly journal that covers all of the areas of wrestling research presented in this paper.

**Please complete the following information request and return to Dr. David Curby at:**  
[davcurb@gmail.com](mailto:davcurb@gmail.com)

Name:

Email:

Institution/Organization:

Mailing Address

Country:

Current Areas of Interest:

Completed Wrestling Research:

**(If possible attach your picture)**



## TRAINING AND SCIENCE IN WRESTLING

prof. dr. Harold Tünnemann

### **Olympic high performance sports and science in the society**

The image of professional sports in the leading countries in the Olympic cycle 2004-2008 shows that the development of national competitive sport has been run for many years and in many countries, very intense. Nations like the United States, Russia (and previously the Soviet Union), United Kingdom, France, Japan or Australia, have for decades been at the forefront of international competitive sport.

The Olympic Games became a major sports media event not only to the 10,000 athletes from more than 200 countries involved, but also nearly 20,000 media representatives to report every day of the competitions, the lucky winners, or the tragic failures. The identification of a country with competitive sports and his representatives is meanwhile global. Through this sustained interest in a successful competitive sports between the sports and other social sectors in many developing countries have grown very close and complex relationships. This is also necessary, since not a few of the national competitive development activities regarded as significant only in the **direct interaction of the sports organizations with politics, education, business and / or media can be.**

But before a successful national representation ever comprehensive and sustainable national investments have been.

It turns out that, overall, the willingness of governments, national Olympic committees to invest of the leading bodies and the industry in the national competitive development, remains high. Lord Sebastian Coe expressed it in connection with the preparation of the Olympic Games in London like this:

*"Excellence is not a cheap product. In order to climb the podium to have three things together: the responsible national organizations have their duties to meet, the coaching must have world-class workforce and it must be hungry, motivated athletes. "*

The coaches are considered in these processes as a key "player". Increasingly complex, interdisciplinary teams will be set up to secure the provision of top performances at just the right time.

These include a very wide extent, the massive development and expansion of training of scientific research institutes such as the AIS in Canberra, the JISS in Tokyo, the HIS in Seoul, or the EIS, with its nine institutes in the UK, where complex, sport-specific projects can realized in an interdisciplinary way. **Investment in science** have continued in the past Olympic cycle, and often extended.

The availability of modern training centers, which are often closely associated with these research capabilities, are now belonging to a standard of basic eligibility requirements. Examples include the comprehensive construction program that was carried out in Russia, the most modern training centers affiliated with academic training support, the INSEP in Paris, which in recent

years, extensively has been modernized, the EIS in Manchester with its excellent training and research conditions in cycling, the CAR in Barcelona or the JISS in Tokyo. The JISS was opened in a year ago in Tokyo, the National Training Center (as well as a sports boarding school) on the campus of the JISS provides the most advanced training conditions in a variety of sports.

### **Training control on the basis of a scientific coaching counseling system for an optimal organization of competition performance**

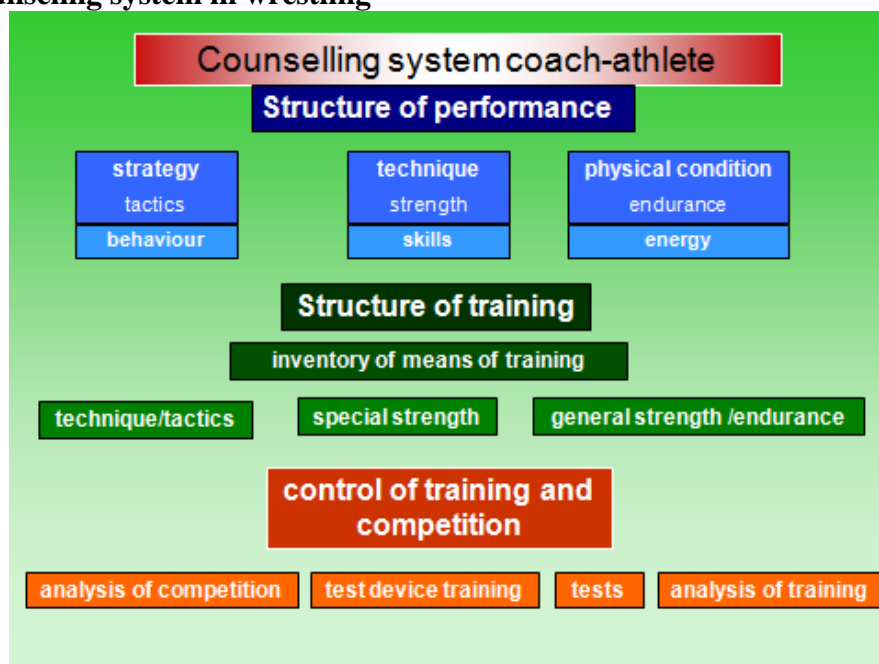
There is no doubt about the leading role of the coach in the development of performance. He is mother and father for the athletes, he has to develop general and individual training concepts and has to put them into training actions, he has to cooperate with the authorities of the federations, with the parents, media etc. and **he has to put the questions to the scientist and has to work together with the scientists.**

In general there are the following reasons for the development of the performance in wrestling:

- Structures of Federations oriented toward elite sport
- Experienced coaches
- Training concept oriented toward world's elite
- Infrastructure which promotes performance
- Performance-motivated athletes / team spirit
- Concentration of the athletes / acceptance of training camps
- Team work with partners among other things advanced training science
- Training control on the basis of a coaching counseling system

One of the most complicated tasks of the coaches is the training control on the basis of a counseling system based on for an optimal organization of competition performance. In the following figure the teamwork of coaches and scientist on the main topics of wrestling is listed.

### **Scientific counseling system in wrestling**



The new rules in wrestling decisively influence the performance structure of the competition and thus the individual training concepts. A one-sided focus on individual technical and tactical skills does not guarantee more success in the competition. Conditional capabilities such as special strength endurance and specific power belong to the current requirements for competitive performance, and they therefore need to be further opened in the center of the training concepts. The scientific coaching counseling system offers many possibilities of cooperation between trainers and researchers for an optimal training control.

I appeal not only to my established and previously successful coaches and scientists, but also to the younger generation of the wrestling family to work in close co-operative collaboration. In this respect I am optimistic about the future. The following pictures from the 2010 Youth Olympic Games in Singapore of Aldar Balshininmaev from Russia provide impressive evidence for a future that includes a high level of technical development.



## DÉVELOPPEMENT D'UN PROGRAMME D'ESSAIS POUR LES PERFORMANCES DE LUTTE MAXIMUM

**Dr. David Curby**  
**USA**



**FILA ADVANCED SCHOOL  
FOR COACHES IN GRECO-  
ROMAN WRESTLING**  
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## DEVELOPMENT OF A TESTING PROGRAM FOR MAXIMUM WRESTLING PERFORMANCE

### **Physiological Testing of Wrestlers**

Application of information from sport science research is seen in most sports. In some respects wrestling seems to lag behind in this area. In this presentation I will present some reasons for this deficiency, outline some applications for physiological testing, and present some tests which have been used in the sport. How do we know if our wrestlers are ready for the demands of our sport? The physiological testing of wrestlers can help.

### **Problems Encountered in Testing Wrestling**

Wrestling is an “open” skill sport as opposed to single closed skill, such as running or rowing (these are easier to test). It is difficult to test our athletes for oxygen consumption while wrestling! Combative sports such as wrestling must consider the response by opponents, tactics, and strategy. The skill level of the opponent is an important variable that is not controllable. Rules changes have changed the length of matches and placed a premium on explosive actions.

### **Why Test Wrestlers?**

Sometimes there is a lack of acceptance by athletes and coaches. 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. We should test what we can

modify through training and provide usable information to the coach and wrestler. Examples are:

- Identify important strengths and weaknesses
- Develop athlete Profiles
- Can isolate specific needs
- Monitor Development of the Athlete
- Compare to norms-Elite wrestlers/champions/age group
- Check effectiveness of training regimen
- Check Status of Rehabilitation
- Readiness for competition
- Detect overtraining
- Selection of athletes
- Provide Motivation

### **Criteria for Selection of Tests**

- Relevance
- Specificity
- Practicality
- Validity
- Accuracy

### **Quality Control in Administering Tests**

- Standardizing Test Conditions
- Precision
- Reliability
- Interpretable Results

### **Ethical Considerations**

- Safety
- Privacy

### **A successful testing program must:**

- Have acceptance by athletes:
- Provide usable information
- Provide understandable feedback to athlete and coach
- Be repeated at regular intervals
- Be integrated into training program so it is not disruptive to training
- Consider equipment-cost and ease of use
- Respect of Athlete's rights
- Comparisons are only valid if each athlete can work under similar conditions of mechanical efficiency.

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

- Aerobic Capacity
- Anaerobic Capacity
- Strength-both static and dynamic
- Strength Endurance
- Explosive Power
- Power endurance
- Kinesthetic Sense
- Flexibility
- Speed & Quickness
- Ability to Recover Quickly
- Appropriate Body Composition
- Balance



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-sport specificity.

There are three energy systems used in sports. Testing should take these into account. One must identify the needs of the sport and the energy systems utilized during competition.

**ATP-CP System** (also called Alactic 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** (also called Anaerobic or Glycolytic 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 tests vs. Field tests**

Test what we can modify through training and/or provide usable information to the coach and athlete, e.g. How usable is the information gained from muscle fiber typing?

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. Many of these tests require little equipment other than a stopwatch. For example, testing running ability in each system can provide important information:

Sprinting a 60 meter dash - ATP-PC System

400 meter run - Lactic Acid System

5 K Run - Aerobic System

Other tests, while seemingly technical, can be performed by most coaches. Some examples are body fat measures with calipers; heart rate monitoring; even some lactate measures. There are some examples of wrestling specific tests which are complex, but performed in a gymnasium setting.

The testing program to be used must take into account the resources of the local club, as well as the national federation. The professional scientific support provided to the local coaches is very important, but the initiative taken by these coaches in developing testing procedures on their own can yield great results. Let us look at some examples of wrestling testing.

## Body Composition

Body composition assessments are important for both performance and health, and are even a part of the rules, which govern participation in the USA. Body composition techniques involve the partitioning of the body into two components – the fat component and the lean component. It is often expressed as percent body fat. An understanding of this fitness variable is essential for the coach and wrestler. Most studies indicate that champion wrestlers possess body fat levels of 10% or less. Laboratory methods usually employ underwater or “hydrostatic” weighing that yields a total body density which is converted into a percent body fat.

$$\text{Percent Body Fat (Brozek Equation)} = \left( \frac{4.57}{\text{Body Density}} - 4.142 \right) \times 100$$

Other high tech methods include DEXA, Air Displacement Plethysmography (Bod Pod™), or the use of bioelectrical impedance, made popular in Tanita Scales™.

Caliper (rather inexpensive) techniques that measure selected skinfolds can be quite accurate if proper protocols are learned and applied. Skinfold values are entered into equations that have been developed by researchers that also compute a body density. Here is the Lohman equation using the three skinfold sites of tricep, subscapular and abdominal:

$$\text{Body Density} = 1.0982 - (0.000814 \times \text{Sum of Skinfolds}) + (0.00000084 \times (\text{Sum of Skinfolds})^2)$$

The use of an excel spreadsheet or other computer program makes the computations easy.

**Flexibility** is another performance factor that can be measured rather easily. Among the areas measured are the legs, back and shoulders. Mirzaei has described the tests employed in Iran-the sit and reach test, the arm raise from a prone position while holding a wooden rod (distance from floor to the rod), and a prone truck lift measuring the distance from the floor to the chin while arching the trunk from the mat.

**Special Mobility** for wrestling is a combination of flexibility and the required special movements. A primary example is the wrestler’s bridge. This has been described in several testing batteries with some variation. Among the most basic are: 1) tests of **flips** back and forth from the bridge, and 2) **spins** in each direction from the bridge (generally 5 times each way). These can be described as the number accomplished in a specific time, e.g. 30 seconds, or the time needed to complete a specified number of repetitions.

**Jumping tests** are also used to measure lower body anaerobic power. A standing long jump, or multiple jumps (standing triple jump) for maximal distance are easily added to any testing program. The **Ergo Jump Test** developed by Bosco requires some instrumentation and can be more sensitive to power development over a span of time.

**Speed** is another performance variable that can be approached from a variety of directions. Sprinting tests (30-60 meters) have been employed. The time of execution of techniques with a dummy/manikin or partner are found in the literature. Reaction timing requires precise

instrumentation. Aspects of speed as well as **speed endurance** can be measured in dummy throw tests.

**Balance** is listed in most lists of important characteristics for wrestlers, however the dynamic balance needed is difficult to test in a wrestling specific manner. Some laboratories are doing research with the Biodex Stability System™.

**Strength Testing** is very important and one finds a large number of possible approaches. This is because of the number of variables encountered. These include the type, duration, speed and location of the contraction. In wrestling one sees isometric as well as various isotonic contractions in a wide variety of body parts. There is a need for one-time maximal strength and muscular endurance. Muscles of the back, shoulders, hands, and neck are all important and should be monitored. Both body weight exercises and weights can be employed. A unique approach in how to address these multiple needs was seen in the East German standards developed for wrestlers. They tested for **maximal strength** through a 1-repetition max; **speed strength** by timing the lifting of a weight (75% of your weight class weight) for 8 reps; and tested **strength endurance** with maximum reps at the weight class standard. They also have performance standards for each weight class.

#### WEIGHTLIFTING STANDARDS FOR EAST GERMAN WRESTLERS MINIMUM STANDARDS FOR EACH WEIGHT CLASS

##### STRENGTH-1 REPETITION MAX

	WEIGHTCLASS (KG)									
LIFT	48	52	57	62	68	74	82	90	100	130
BENCH	85	90	95	100	105	110	115	120	125	130
PULLUPS	45	50	55	60	65	70	72.5	72.5	72.5	72.5
SQUAT	150	160	170	180	185	190	195	200	205	205
PRONE ROW	85	90	95	100	105	110	115	120	125	130
CLEAN	90	95	100	105	110	115	120	125	130	135

##### TIME FOR 5 REPS WITH WEIGHT CLASS STANDARD

	WEIGHTCLASS (KG)									
LIFT	48	52	57	62	68	74	82	90	100	130
BENCH	6.0	6.0	6.5	6.5	7.0	7.0	7.5	8.0	9.0	10.0
PULLUPS	6.0	6.0	6.0	6.5	6.5	6.5	7.0	7.0	7.5	8.5
SQUAT	5.0	5.0	5.0	5.5	5.5	5.5	6.0	6.0	6.5	7.5
CLEAN	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5
ROPE CLIMB	5.3	5.2	5.1	5.0	5.0	5.0	5.1	5.2	5.4	5.4

##### MAX REPS WITH WEIGHT CLASS STANDARD

	WEIGHTCLASS (KG)									
LIFT	48	52	57	62	68	74	82	90	100	130
BENCH	40	38	36	34	32	30	28	26	24	22
PULLUPS	35	34	33	32	31	30	28	26	22	18
HALF SQUAT	66	64	62	60	58	56	54	52	48	44
PRONE ROW	40	38	36	34	32	30	28	26	24	22

Performance standards for many of these field tests have been established by Russian coaches and scientists. A standard is not an average or norm, but rather a target for high performance. It is based on empirical evidence from research. Some of these standards were presented at an earlier FILA Coaches Conference in Rome, 2000. Prof. Dr. Yuri Shakhmuradov gave a lecture entitled: *Characteristics of Separate Aspects in Athletes' Training to Achieve Predicted Results at XXVIII Olympic Games of 2004*.

These standards were performance standards for each weight class for a variety of strength activities (some with weight and some with body weight) incorporating wrestling specific movements. Dr. Boris Podlivaev shared an updated version of these standards at the FILA Scientific Congress held at the Moscow World Championships.

Adapted from Podlivaev, B.

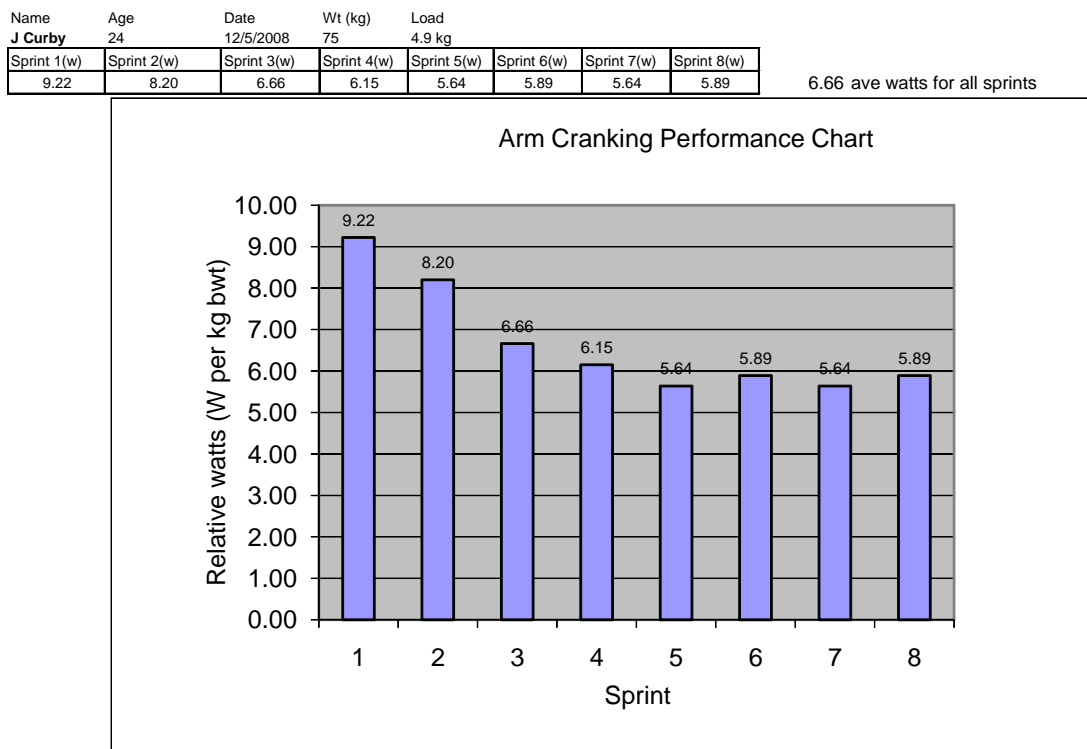
	Tests	55 – 60kg		66 – 84kg		96 – 120kg	
		X	±?	X	±?	X	±?
1	30m sprint (s)	4.53	0.14	4.59	0.10	4.63	0.23
2	60m sprint (s)	7.90	0.18	7.79	0.35	7.80	0.19
3	100m sprint (s)	12.98	0.30	12.87	0.36	13.27	0.80
4	Long jump (cm)	205.50	14.92	248.50	11.56	255.50	9.85
5	Triple jump (cm)	622.00	10.85	657.50	15.86	655.50	15.71
6	High jump (cm)	63.20	4.05	66.10	1.91	56.70	4.08
7	Squat with a partner (n)	21.20	2.66	26.30	4.64	16.50	5.99
8	Pull-up (n)	34.40	6.83	32.40	10.84	22.60	8.77
9	Pull-up (n/20c)	18.40	3.31	18.30	4.42	15.20	5.18
10	Push-up (n)	70.30	17.63	68.10	13.35	57.60	16.42
11	Push-up (n/20c)	26.00	3.27	24.00	4.08	22.20	5.87
12	Push-up on parallel bars(n)	30.50	7.92	26.60	8.40	25.00	10.02
13	Clean of the bar (kg)	74.00	8.10	82.00	3.50	113.50	13.55
14	Bench press (kg)	83.00	6.75	92.50	8.58	125.50	20.47
15	4M hands climbing (s)	7.13	1.20	6.59	0.90	8.80	2.23
16	Hanging leg raises (n)	18.20	4.24	15.30	2.36	14.40	4.50
17	Lifting of partner by rear body lock (n)	13.60	2.67	16.90	5.32	14.00	5.27
18	Sit-up (n/20c)	21.60	3.13	18.10	1.97	18.00	4.06
19	800m sprint (min)	2.47	0.18	2.51	0.16	3.20	0.26
20	8km cross (min)	28.34	2.01	29.18	1.47	36.31	7.04
21	A change of position from bridge face down to bridge face up by moving feet (5 times to the left, 5 times to the right) (s)	13.15	0.69	13.63	0.67	14.37	1.41
22	10 turnovers on the bridge (s)	13.57	0.68	14.29	0.50	17.03	3.48
23	10 throws of dummy with layback (s)	18.65	1.60	19.54	2.44	23.42	6.15
24	Complex test (min)	2.46	0.10	2.56	0.08	3.16	0.15



## MORE COMPLEX TESTING

**Aerobic Capacity** can be measured directly via laboratory analysis of expired gases and is usually expressed in terms of the volume (in milliliters-ml) of O<sub>2</sub> that the body can utilize for every Kg of body weight. While wrestling is primarily an anaerobic activity, a good aerobic base is needed for training as well as fast recharging of the immediate and lactic acid energy pathways. Distance runs, the pacing “beep” soccer test, PWC<sub>170</sub> performed on a cycle ergometer, or a graded exercise test done on a treadmill with gas analysis can be used to estimate this value. Top wrestlers are usually above 60 ml·kg·min<sup>-1</sup>.

**Testing Anaerobic Power** is frequently tested with arm cranking on bike ergometers. It is quite appropriate for testing the important upper body parameters in wrestlers. Anaerobic performance of the upper limb muscles and how the repetition test reflects the potential of muscles to derive the energy via the glycolytic pathway are measured. Scientists at the Wingate Institute in Israel developed a 30 second all-out cycling test to determine maximal anaerobic power (maximal rate of work production at the expense of ATP and creatine phosphate breakdown) and maximal anaerobic capacity (total work that can be done in 30 seconds, presumably at the expense of ATP, creatine phosphate and anaerobic glycolysis). The test can be performed with either legs or arms. The Horswill Arm Cranking Wrestling Test evolved from the basic 30 second Wingate test to include repeated bursts. This Wingate modification uses 8 – 15 second spurts of arm cranking, with 6.5 g per kg body weight loading which done over 6 minutes, to parallel a match. The power production and fatigue curve over the eight sprints is charted.



Your Power Decline is:

38.8 %

Your Pummel Test Index is:

92.51

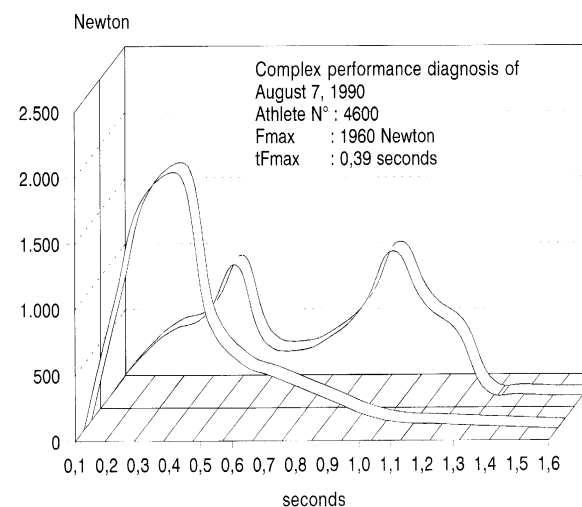
Wmin	Wmax	Wmean	Wmax norm	mean Wnorm
5.64	9.22	6.661	9.5	5.500

## Cybernetic Devices

**IAT in Leipzig** developed many interesting, “exotic,” research tools during the ‘70’s. The development of these cybernetic simulators was undertaken by Dr. Georg Blümel, Dr. Klaus Freyer, and Dr. Harold Tünnemann. While they were expensive and complex, they merit our attention.

### Gut Wrench Machine

The device utilized a brake drum from a truck with an electromagnet to provide the resistance. The resistance could be adjusted until a maximal force production could be registered. This maximal force, along with the time to maximal force are recorded. A sample printout is also shown. The analysis of force generation by such a device allows one to see that the successful execution of the technique is accomplished by attaining the highest peak force within 0.4 sec.



Some other very interesting devices have been used with Swedish wrestlers. **Dr. Sandor Csargo** built some very Greco-Roman wrestling specific measurement devices. One is termed the “Power Box.”



**Lactate measurement during exercise** is used by coaches to determine the efficiency of training programs and to monitor training intensities. During light to moderate exercise, blood lactate remains just slightly above resting levels (<2.0 mmol/L.)

Dr. Ramazan Savranbasi has presented extensive lactate data. He has profiled the lactate production as he wrestled to a World Championship WC from Hamza Yerlikaya. Turkish National Greco-Roman team's lactate levels during the Vehbi Emre International in 2006. Post match (5 min) values ranged between 7.4 – 17.7 and mean of 12.3 (mmol·L<sup>-1</sup>).

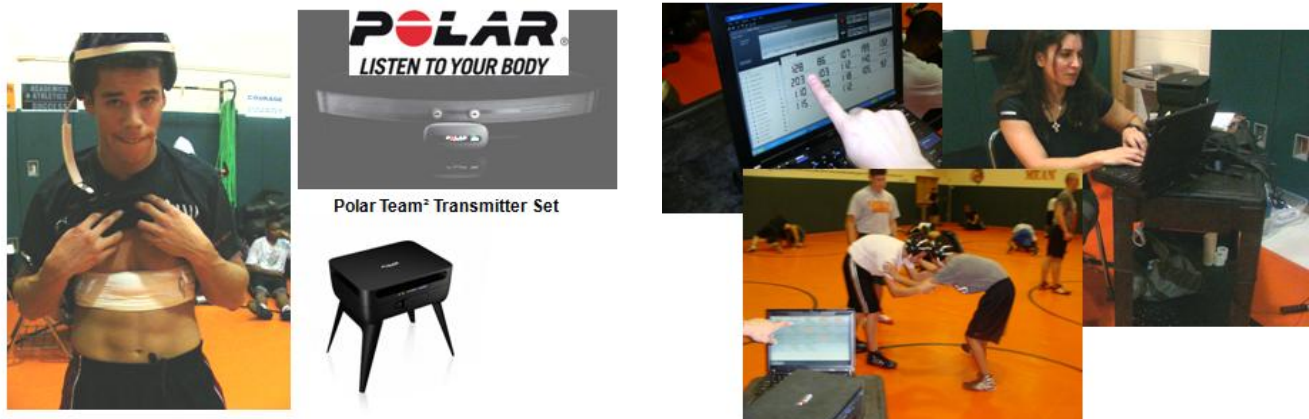
**Recovery Indices (or recovery %)** can be calculated with lactate or heart rate data following a

$$RCC\% = \frac{\text{lactate 5 min} - \text{lactate 20 min}}{\text{lactate 5 min}} \times 100$$

match or standardized exercise bout. Lactate recovery usually employs a lactate measure at 3-5 minutes post-exercise and is compared to the level at 20 minutes post exercise.

Recovery coefficient% should be 40% or better in well-trained wrestlers.

There have been some efforts to monitor heart rates wrestlers during competition. Most of the time heart rates are measured immediately after a bout, but the Polar® Team<sup>2</sup> equipment can be used to get results in real time. Modifications for a “combative sport” strap to reduce the occurrence of the transmitter becoming disconnected will be discussed with Polar. The potential for a minimal impact on the performance of the competitors seems possible.



### **Data Handling**

A system for the accurate recording and saving of test results is required. Excel spreadsheets are useful. In some simple systems the coach may organize this system. For more extensive testing additional personnel may be necessary.

### **Feedback to Wrestlers**

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. The essential purpose of integrating findings from sport science into current training structures and conditions was to make suggestions as to how coaches should verify developments of wrestling performance in their clubs and training centers. One major step is to provide the wrestler with an interpretable summary of his performance, along with recommendations.

## **PHYSIOLOGICAL PROFILE OF A WORLD WRESTLING CHAMPION**

**Mirzaei Bahman, Lotfi Navid** , University of Guilan, Rasht, Iran

**Curby David G.**, Overtime School of Wrestling, Naperville, Illinois, USA

**Barbas Ioanis**, Democritus University of Thrace, Komotini, Greece

### **Introduction**

One of the challenges confronting the coaches and sport scientists is to understand the physical and physiological factors contributing to successful wrestling. The use of physical fitness tests for the measurement of the current status of the wrestler can provide both the wrestler and coach with information relative to the wrestler's current physiologic capability and can allow them to compare that capacity with reference values from appropriate peer groups. Also, the assessment of current status reveals strengths and relative weaknesses and can become the basis for the development of an optimal training program. Due to the importance of this topic, a significant portion of the studies performed on wrestlers are descriptive in nature, presenting the physiological and anthropometric profiles for a wrestling team (HORSWILL et al., 1988; SHARRAT et al., 1986; MIRZAEI et al., 2009), or a group of successful or less successful wrestlers (ROEMMICH & FRAPPIER, 1997) and in some cases, only one wrestler (UTTER et al., 2002; WIDERMAN & HAGAN, 1982).

Sharratt et al. (1986) described the physiological profile of elite Canadian freestyle wrestlers and indicated that the Canadian wrestlers have a physiological profile similar to elite wrestlers from other countries. Horswill et al. (1988) studied the physiological profile of elite junior wrestlers. They reported values of body fat (%):  $7.2 \pm 2.4$ ; aerobic power  $51.2 \pm 9.3$  ( $\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ); arm power (W);  $390.7 \pm 92$  and leg power (W):  $390.7 \pm 92$ . They concluded that elite junior wrestlers appear to have a similar percentage of body fat, lower maximum aerobic power and higher relative anaerobic power compared to elite collegiate and senior wrestlers. Roemmich and Frappier (1993) compared successful and less successful varsity wrestlers matched for age, weight, height, and wrestling experience on physiological variables important for wrestling success using field tests available to high school wrestlers. They showed that successful wrestlers had significantly more muscular strength, muscular endurance, flexibility of the low back and hamstrings, aerobic fitness, and relative anaerobic power than less successful wrestlers. However, regarding body fat (BF) %, no significant difference was indicated between the two groups. Callan et al. (2000) studied the physiological profile of elite U. S. freestyle wrestlers and indicated that a profile of elite wrestlers can be used as training targets for developing athletes. Utter et al. (2002) studied the physiological changes of a nationally ranked older elite freestyle wrestler during a 7-month observation period as he prepared for the 2000 Olympic freestyle wrestling trials. The results showed that in the 7 months before a major event, the subject displayed a high level of wrestling-specific fitness for muscular strength, anaerobic power and capacity, and aerobic conditioning despite a small decrement (1 kg) in fat free mass. Yoon (2002) reported that the maximal oxygen uptake of national and international wrestlers taking part in international competition has been shown to be about 53 to 56 ( $\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ). He also indicated that the flexibility of top-level wrestlers was higher than that of lower level wrestlers. The result of anthropometric, bioenergetic, and biomechanical traits of Iranian wrestlers participating in the World Cup in Baku and the 2004 Asian championships in Tehran indicated that there are no significant relationships between bioenergetic traits and the results from these competitions (MIRZAEI & MANSOUR SADEGHI,

2007). It has been noted that the bioenergetic and biomechanical indices in this study could not be the only contributors to success in wrestling competition, but that a series of factors were effective in achieving desired outcomes. Schmidt et al. (2005) investigated 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, and reported percent body fat (%):  $11.6 \pm 3.9$ ; LBM (kg):  $68.5 \pm 8.7$ ; back squat (kg):  $150.8 \pm 25.2$  and bench press(kg):  $98.3 \pm 25.4$ . Cvetković et al. (2005) studied the technical efficiency of wrestlers in relation to some anthropometric and motor variables and reported that technical efficiency in young top-level wrestlers depends on a large number of motor ability variables as well as some morphological characteristics like body weight. Vardar et al. (2007) investigated the relationship between body composition and anaerobic performance of elite young wrestlers from the Turkish national team. The results are as follows: body mass (kg):  $65.4 \pm 12.3$ ; body fat (%):  $9.7 \pm 6.3$ ; peak power ( $W \cdot kg^{-1}$ ):  $8.5 \pm 1.0$  and indicated that there is a significant relationship between mean power and lean body mass ( $r=0.90$ ), however, no significant relationship was found between anaerobic parameters and percent body fat. Mirzaei and Ghafouri (2007) studied the physiological profile of Iranian senior Greco-Roman wrestlers. They concluded that with the increase of weight in weight classes, the pull-up records are reduced, while no significant differences were found in the results of the flexibility tests. Rahmani-Nia et al. (2007) determined the physiological profile of Iranian junior Greco-Roman wrestlers. They measured muscular endurance and strength, maximal oxygen uptake, agility and speed. Mirzaei et al. (2009) studied physiological profile of Iranian junior freestyle wrestlers. They reported mean and standard deviation of body weight (kg):  $77.5 \pm 19.8$ ; flexibility (cm):  $38.2 \pm 3.94$ ;  $VO_2$  max ( $ml \cdot kg^{-1} \cdot min^{-1}$ ):  $50.5 \pm 4.7$ ; maximal anaerobic power (W):  $455.5 \pm 87.6$ ; push-up (n):  $66.9 \pm 7.6$ ; pull-up (n):  $31.6 \pm 9.7$ ; bent-knee sit-up (n):  $66.5 \pm 8$ ; speed (s):  $5.07 \pm 0.17$ ; agility (s):  $8.7 \pm 0.25$  and body fat (%):  $10.6 \pm 3.8$ . In another study, Mirzaei et al. (2010) studied the relationship between body composition, aerobic power, anaerobic power and strength of Iranian freestyle and Greco-Roman wrestlers participating in the Beijing Olympic Games 2008 and reported a significant relationship between the values of upper and lower body Wingate tests and lean body mass. They also reported that the results of anthropometric and physiological measures of Iranian wrestling team are similar to the wrestlers in other countries. Since the information regarding top level wrestlers in Greco-Roman wrestling is limited, there is not a distinct criterion for coaches and athletes in this style of wrestling to establish a necessary foundation for competitive success. Therefore, the purpose of this study was to investigate the anthropometric and physical fitness traits of four-time World senior Greco-Roman wrestling champion in the 55-kg weight class and compare it to the Iranian national norm to provide new criteria for the wrestlers and coaches. The results may provide useful information for training and tactical emphasis.

## Material and Methods

### Subject

The four-time (2005, 2006, 2007 and 2009) World senior Greco-Roman wrestling champion in the 55-kg weight class was the subject of this study. The subject was tested in the physical fitness assessment center of Iran's NOA (national Olympic academy) six weeks prior to the World championships 2010. Before participating, the





subject read and signed an informed consent statement in adherence with the human subject's guidelines of Iran's NOC (National Olympic Committee) research center.

## Procedures

The physiological parameters included cardiovascular endurance, muscular endurance and strength, speed, agility, flexibility, reaction time, anaerobic power and body composition. Subcutaneous body fat was measured at 7 sites (subscapular, triceps, chest, pectoral, suprailiac, abdominal, and thigh) with a Lafayette caliper. Body fat percent was computed through the formula developed by Brozek et al. (1963). Height and weight were also recorded. The subject



performed a graded treadmill exercise test (Gas analyzing method) to estimate  $\text{VO}_2\text{max}$ . Flexibility tests included sit-and-reach, trunk-and-neck extension and shoulder-and-wrist elevation. In the sit-and-reach test, the subject sits in front of a sit-and-reach testing box, where the feet meet the testing box at the 23 cm mark of the measuring scale. The subject was instructed to reach forward, with palms down and one hand on top of the other along the measuring scale of the testing box. The reach was

repeated three times with a maximum reach on the third repetition held for 1 second. The distance of the fourth reach was used as the absolute measure for the sit-and-reach test. For the shoulder-and-wrist elevation test, the subject was instructed to lie prone with arms extended overhead while holding a yardstick with a shoulder-width grip the hands. The subject was instructed to raise the stick upward as high as possible while keeping the chin on the floor and elbows extended. The yardstick's highest point above the floor was recorded. In trunk-and-neck elevation test, the subject lies prone with both hands on the lower back. The subject was instructed to raise his trunk upward as high as possible from the floor. The height of the nose above the floor when trunk was raised to its maximum position was used as the absolute measure of trunk-and-neck extension (EVANS et al., 1993).

Reaction time was measured with the subject standing on an instrumented jumping pad in front of a reaction time apparatus (Satrap Company, Iran) and was instructed to react to the stimuli of from either a left or right visual stimuli by moving his foot from the pad. The test was repeated three times and the best of three was recorded in milliseconds (ms) as the subject's bilateral visual choice reaction time. A 40-yd sprint test was used to assess speed. A pull-up test (with palms facing the subject) was used to assess muscular endurance and a 1-minute bent-knee sit-up test was used to assess abdominal muscular endurance. The bent-knee sit-up test required the subject to lock his hands behind his head and touch his elbows to the thigh with a partner holding his ankles. A 4 × 9-m shuttle run test was used to assess agility. The subject touched a sensor with his hand at each 9-m line.

## Results

Subject data and body composition are shown in Table 1. The performance measures of the four-time World senior Greco-Roman wrestling champion are presented in Table 2 and 3. Table 2 contains testing results for maximal oxygen uptake, anaerobic power, and muscular endurance and strength. Bilateral visual reaction time, flexibility, agility, and speed are listed in Table 3.

**Table 1-** Subject descriptive data and body composition

Variable	Weight (kg)	Height (cm)	Sitting height (cm)	Arm-span (cm)	Body fat (%)
Result	61	167	89	174	8.4

**Table 2-** Muscular endurance and strength,  $\text{VO}_2\text{max}$

Test	Sit-ups (rep/min)	Pull-ups (rep)	$\text{VO}_2\text{max}$ ( $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ )	Bench press ( $\text{kg}\cdot\text{kg}^{-1}$ )	Squat ( $\text{kg}\cdot\text{kg}^{-1}$ )
Result	77	50	56	85	112

**Table 3-** Bilateral visual reaction time, flexibility, agility and speed

Test	Sit-and-reach (cm)	Trunk-and-neck extension	Shoulder-and-wrist elevation	Visual reaction time (ms)	4×9-m shuttle (s)	40-yd sprint (s)
Result	45	0.64	0.54	229	7.6	4.57

## Discussion

The results of anthropometric measurements indicated that the arm-span of the subject was 7 cm more than his height (174 cm versus 167 cm). Because having long arms is a mechanical advantage in Greco-Roman wrestling, this trait is probably one of the reasons for successful performance of the subject in techniques such as the reverse lift, back arch and gut-wrench. Also, the subject's BF% was lower than the Iranian national norm in 55-kg weight class Greco-Roman wrestling (8.4 versus 10). The BF% for the subject in this study is similar to that reported in other studies (HORSWILL et al., 1988; SCHMIDT et al., 2005; VARDAR et al., 2007; MIRZAEI et al. 2009). Ideal fat percent, justified the better performance of athletes that must compete in a specific weight class. Subject's height was higher than national norm of 55-kg weight class wrestlers (167 cm versus 161.1 cm). According to the FILA database, subject's height was also higher than the average height of elite Greco-Roman wrestlers in Russia, Azerbaijan and USA (162, 160 and 160, respectively). Subject's height being longer than other elite wrestler in 55-kg weight class might be a mechanical advantage in his successes.

The results of pull-up and sit-up tests were higher than the national norms in 55-kg weight class Greco-Roman wrestling (50 versus 37 and 77 versus 71 respectively). The level of muscular endurance (Table 2) is very close to that reported by Mirzaei et al. (2007). They reported a mean

of 70 for the bent-knee sit-up test and mean of 35 for the pull-up test. High muscular endurance of wrestler allows good stability in the attack and defense position.

Two different protocols were used in the assessment of  $\text{VO}_2\text{max}$  (Gas analyzing method for the subject and Bruce test for the national norm). However, the  $\text{VO}_2\text{max}$  of the subject was higher than the national norm (56 versus 51.6). This result is in agreement with Horswill (1992) that determined the physiologic profile of successful wrestlers. Horswill noted that the range of  $\text{VO}_2\text{max}$  for successful wrestlers was 52-63  $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ . In another study, Horswill et al. (1988) reported mean  $\text{VO}_2\text{max}$  of elite junior wrestlers of  $52.6\pm 2$ . This study is also in agreement with the current study.  $\text{VO}_2\text{max}$  values calculated in this study were higher than the results of Mirzaei & Ghafouri (2007) for the 55-kg weight class (56 versus 45) and was lower than the values reported by Yoon (2002) (60  $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ). This difference may partially be explained by comparing the testing protocol employed in this study. On the other hand, changes in wrestling's rules decreased the contribution of the aerobic system (compared to anaerobic system) for energy production during wrestling. Yoon (2002) proposed aerobic capacity as one of the most important physical factors to achieve good results in wrestling competitions. Perhaps the greatest benefit of aerobic training is the wrestler's ability to operate at high percent of their individual aerobic capacity.

The result of visual reaction time test was better than the national norm (229 ms versus 391 ms). This ability supports the fast reactions of the subject to perform techniques quickly in competition. The results of speed and agility tests were better than the national norm (4.57 s versus 5.14 s and 7.6 versus 8.78 s, respectively). This advantage is important in the success of subject and contributes to his rapid performance of techniques. His results are also better than the values reported by Mirzaei et al. (2009) in junior freestyle wrestlers (5.07 in the speed test and 8.7 in agility test) and senior freestyle wrestlers (5.1 s in speed test and 8.43 in agility test).

In the flexibility tests, results of trunk-and-neck extension and shoulder-and-wrist elevation tests were lower than the national norm in the 55-kg weight class of Greco-Roman wrestling (0.64 versus 0.72 and 0.54 versus 0.59 respectively). However, it was higher than the national norm in sit-and-reach test (45 cm versus 41 cm). A slight weakness was indicated in the subject's trunk-and-neck extension and shoulder-and-wrist elevation tests in relation to the national norms in 55-kg weight class of Greco-Roman wrestling. Therefore, it is recommended that special attention should be paid to flexibility exercises of subject. Because of differences in testing methods, a direct comparison of the results with other studies is not always possible. However, Yoon (2002) reported that the flexibility of elite wrestlers is higher than lower-level wrestlers.

Hip and leg strength is a prerequisite for the successful performance of techniques such as the high-dive and lifting of the opponent as in the reverse-lift. Therefore, this subject's success in the skillful implementation of such techniques against international competitors is made possible through his lower body strength.

The value recorded in his squat test was higher than national norm (1.83 versus 1.79). The result of the bench press test was lower than national norm (1.39 versus 1.48). The muscular strength results in our study are similar to those reported by Mirzaei et al., 2009 (1.4 and 1.9 for bench press and squat respectively). It has been noted that, in general, successful wrestlers showed a higher dynamic and isokinetic strength than unsuccessful wrestlers (YOON, 2002).

In conclusion, the performances of our subject on the physical fitness tests in this study were generally better than the national norms for the 55-kg weight class and may help in part to explain his success. These traits are used by our subject, to employ his high skill (technical - tactical) and psychological ability that weren't investigated in the present study, but are also essential elements for success.

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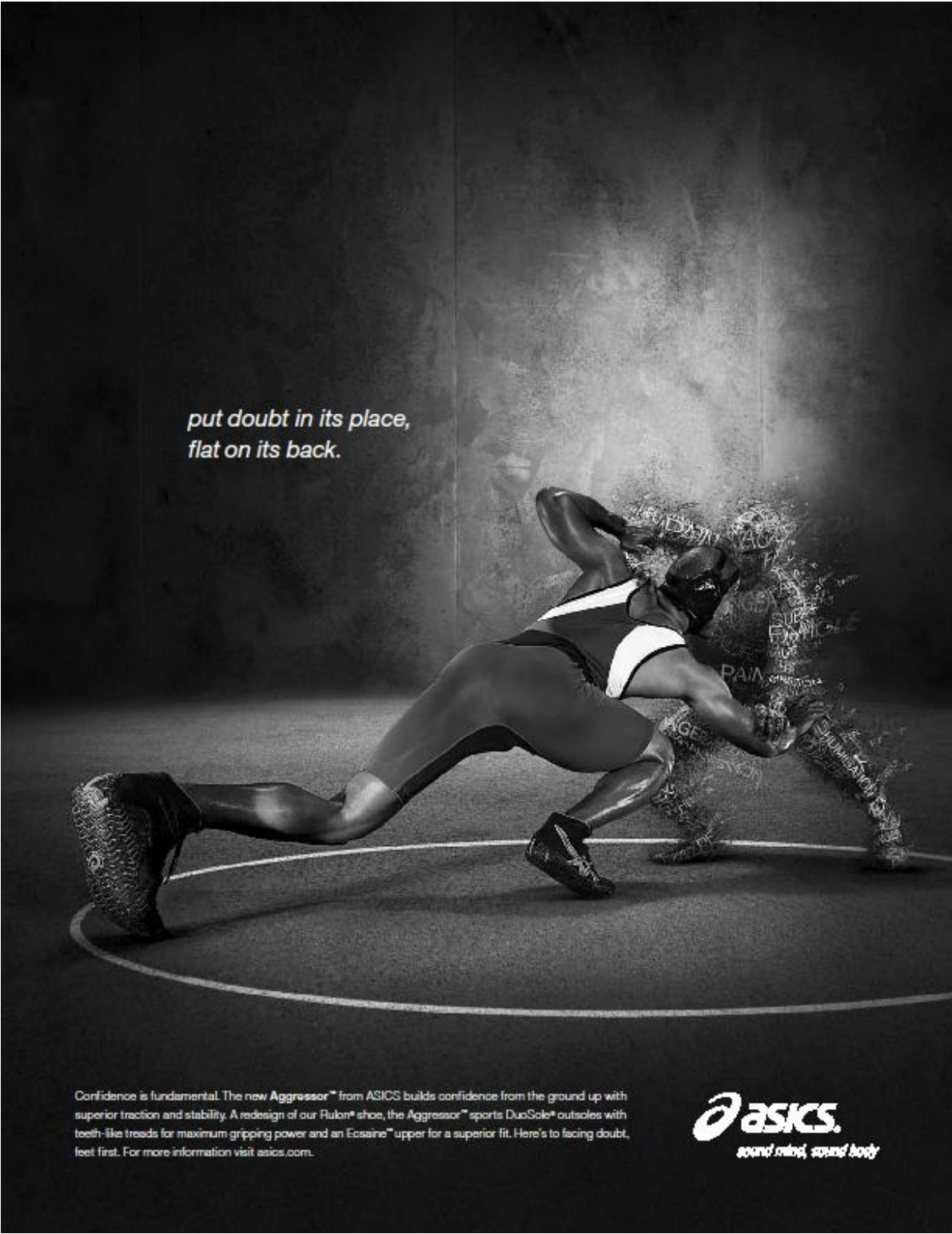
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