

The Effect of Weight and Height Change Caused by Age-Related Growth on the Biomechanical Parameters of Wrestlers

David Khachidze¹, Manana Khachidze²

¹Faculty of Physical Medicine and Rehabilitation, Georgian State University of Physical Education and Sport, Georgia

²Department of Computer Sciences, Faculty of Exact and Natural Sciences, Iv.Javakhishvili Tbilisi State University, Georgia

Abstract:

Background: Every country has distinctive sports that is based on the national traditions and the results are reflected in various international achievements. "Georgian Wrestling" is one of such types of sports for Georgia. Sports linked to the mentioned type are the most popular and productive sports in Georgia. Georgian athletes are very successful in Judo, Sambo, Greco-Roman and Freestyle wrestling. The paper analyzes the results of athletes by age changes, taking into account the dynamics of their weight categories and the corresponding height change.

Materials and Methods: The data for the study is taken from the 2016-2019 Georgian National Championship in Sambo according to all weight categories of two age groups - Cadets and Juniors. Number of athletes according to weight categories: Cadets – 48 kg - 14, 52 kg - 17, 56 kg - 38, 60 kg - 45, 65 kg - 61, 70 kg - 46, 75 kg - 47, 81 kg - 31, 87 kg - 18, +87 kg - 21; Juniors – 48 kg - 13, 52 kg - 14, 57 kg - 14, 62 kg - 19, 68 kg - 37, 74 kg - 40, 82 kg - 29, 90 kg - 20, 100 kg - 12, +100 kg - 10. Results of 211 athletes from age of Cadets to age of Juniors were analyzed based on annual data over four years. The collected data reflect the weight change of athletes, the age-related change in weight-to-height ratio.

Conclusion: One of the most important influences on the stability of a wrestler's sporting results is their individual anthropometric (height, weight, body proportions) characteristics, which, on the one hand, represent the body fat percentage and on the other hand, individual psychophysiological factors. For the career growth of a young, promising athlete, it is important to select the appropriate weight for their height, which will have a positive impact on improving biomechanical parameters.

Key Word: Biomechanical Parameters; Weight and Height Change.

Date of Submission: 01-06-2020

Date of Acceptance: 16-06-2020

I. Introduction

Involvement of the younger generation in sports activities is a prerequisite for a healthy lifestyle. Every country has distinctive sports that is based on the national traditions and the results are reflected in various international achievements. "Georgian Wrestling" is one of such types of sports for Georgia. Sports linked to the mentioned type are the most popular and productive sports in Georgia. Georgian athletes are very successful in Judo, Sambo, Greco-Roman and Freestyle wrestling.

Most of the Georgian athletes which are successful in the above-mentioned sports varieties started their careers at an early age. Their physical and physiological characteristics change with age. The variability of these characteristics accordingly influences the biomechanical performance of the athlete, which ultimately affects the sporting results.

Numerous researches have been conducted to study the biomechanical parameters for different sports. Studies show that athlete's weight is one of the characteristics that has a significant impact on an athlete's anthropometric characteristics. Weight variability also affects different physiological parameters - heart rate, oxygen uptake, hematological, biological and hormones indicators; there are corresponding changes between serum leptins and bone markers. During stable weight, weight loss, and weight gain saliva secretion is altered, and there is depressed humoral immunity after weight reduction. In martial arts, where competitors are divided into weight categories, weight and its changes are often the crucial factor for sporting results. However, it should be noted that weight change is unavoidable for athletes in lower-age categories (under 25). The rates of fat, muscle mass, and muscle density vary according to age groups. These indicators affect the aerobic capacity and volume, which is reflected in the lower dynamic strength. Thus, it is important to analyze the dynamics (both positive and negative) caused by this change in order to plan the proper management of the physiological

development of the young athlete, the later resulting in maximum growth of lean tissue, reduction of fat in the body and selection of the optimal weight category to achieve a stable result.

Objectives of the study

The aim of the study is to analyze the results of athletes according to age changes, taking into account the dynamics of their weight categories and the corresponding height change.

Significance of the Study

The results of the presented research can be used to improve sports achievements, to plan the right physical development for a young (adolescent) wrestler, by selecting the optimal weight category, taking into account the height.

II. Material And Methods

The data for the study is taken from the 2016-2019 Georgian National Championship in Sambo according to all weight categories of two age groups - Cadets and Juniors. Number of athletes according to weight categories: Cadets – 48 kg - 14, 52 kg - 17, 56 kg - 38, 60 kg - 45, 65 kg - 61, 70 kg - 46, 75 kg - 47, 81 kg - 31, 87 kg - 18, +87 kg - 21; Juniors – 48 kg - 13, 52 kg - 14, 57 kg - 14, 62 kg - 19, 68 kg - 37, 74 kg - 40, 82 kg - 29, 90 kg - 20, 100 kg - 12, +100 kg - 10. Results of 211 athletes from age of Cadets to age of Juniors were analyzed based on annual data over four years. The collected data reflect the weight change of athletes, the age-related change in weight-to-height ratio.

Data processing based on conventional statistical analysis in some cases results in a loss of information, so they were pre-processed through normalization. For each weight category of the Cadets age-group the average weight and average height of the 4 most successful athletes were selected. The number obtained was deemed as an unit for each weight category. As a result, we received normalized data (Table 1).

Table 1. Value and scattering of averages obtained as units of weight and height.

Weight category	Average weight obtained as unit weight (kg)	Weight Std div ± (kg)	Average height obtained as unit height (sm)	Height Std div ± (sm)
48 kg	46	± 1.9	151	± 3.0
52 kg	50	± 1.7	152	± 1.6
56 kg	54	± 1.7	152	± 1.7
60 kg	57	± 2.1	154	± 2.9
65 kg	63	± 2	155	± 2.4
70 kg	67	± 3.2	155	± 3.0
75 kg	72	± 2.9	157	± 2.9
81 kg	79	± 3	160	± 2.5
87 kg	84	± 3.2	164	± 3.3
+87 kg	91	± 3.7	168	± 4.0

After the transition from the Cadets group to the Juniors level, a certain regularity was observed based on the analysis of their results. We divided the weight categories into three groups: Light weight (48 kg, 52 kg, 56 kg), middle weight (60 kg, 65 kg, 70 kg, 75 kg) and heavy weight (81 kg, 87 kg, +87 kg). Although Juniors' weight categories are different, we have divided them accordingly to Cadets' weights – Lightweight (48 kg, 52 kg, 57 kg), middle weight (62 kg, 68 kg, 74 kg, 82 kg) and heavy weight (90 kg, 100 kg, +100 kg). These changes, at first glance, are mostly related to the change in the weight category, but it is not yet possible to draw a final exact conclusion due to the small amount of data (Table 2). Athletes who maintain the appropriate groups of weight categories maintain stability in the results as well.

Table 2. Athlete's results after change the age group

Weight categorial in Cadets	Weight categorial in Juniors	Number of athletes	Results			Remained in the same weight category	Moved to a lighterweight category	Moved to a heavier weight category
			Same	Improvement	Deterioration			
Light								
48 kg	48 kg	12	7	3	2	12	-	-
52 kg	52 kg	14	9	2	3	11	-	3

56 kg	57 kg	18	9	4	5	10	4	4
Middle								
60 kg	62 kg	18	10	5	3	15	-	5
65 kg	68 kg	38	20	9	9	34	-	4
70 kg	74 kg	36	21	10	5	33	-	3
75 kg	82 kg	27	17	4	6	21	-	6
Heavy								
81 kg	90 kg	25	14	10	4	23	2	-
87 kg	100 kg	12	4	5	2	11	1	-
+87 kg	+100 kg	11	5	3	3	11	-	-

III. Discussion

To analyze the outcomes of the study, it is necessary to take into account the results of researchers working in different types of wrestling. Particularly noteworthy are studies in Judo, which include many papers in the field of biomechanics and physiology. As mentioned in one of the works, the results of the Judoka are greatly influenced by the ratio of body weight and height, which is expressed as a percentage of body fat. This percentage represents 7-10% for adult athletes (except for heavyweight category). Constant adherence to the same ratio for athletes of Cadet and Juniors age is difficult to achieve and at the same time it is physiologically unacceptable due to the process of yet unfinished growth.

It should be considered that the muscle density of an adolescent is lower than that of an adult. Nevertheless, the results show that the majority of athletes participating in the study who maintain or improve their athletic performance and remain in the same weight category while moving from Cadets age group to Juniors group, mostly retain their height-to-weight ratio.

As for the athletes whose results have changed, as mentioned above, we do not have an unequivocal results yet because of the insufficient amount of data. Additional data are being sought for future research. The diversity of data, their formalization, will also help us to improve the predictive model, with the help of which it will be possible to determine the outcome of a particular athlete based on the biomechanical parameters which were established because of their earlier weight and weight change.

IV. Conclusion

The research results show that one of the most important influences on the stability of a wrestler's sporting results is their individual anthropometric (height, weight, body proportions) characteristics, which, on the one hand, represent the body fat percentage and on the other hand, individual psychophysiological factors. For the career growth of a young, promising athlete, it is important to select the appropriate weight for their height, which will have a positive impact on improving biomechanical parameters.

References

- [1]. Bunker R., Thabtah F. A Machine Learning Framework for Sport Result Prediction Applied Computing and Informatics. Volume 15, Issue 1, January 2019, pp. 27-33.
- [2]. Burke LM, Cox GR. Nutrition in combat sports. In: Kordi R, Maffulli N, Wroble RR, et al., editors. Combat sports medicine. London: Springer, 2009: 1-20.
- [3]. Endocrinol E. J. Relationships Between Serum Leptin and Bone Markers During Stable Weight, Weight Reduction and Weight Regain in Male and Female Judoists. 2006 Mar;154(3):389-95. doi: 10.1530/eje.1.02103.
- [4]. Glaister M. Multiple sprint work: physiological responses, mechanisms of fatigue and influence of aerobic fitness. Sports Med 2005; 35 (9): 757-77.
- [5]. Hooper, P., Jutai, J. W., Strong, G., & Russell-Minda, E. (2008). Age-related macular degeneration and low-vision rehabilitation: A systematic review. Canadian Journal of Ophthalmology/Journal Canadien D'ophtalmologie, 43 (2), 180-187.
- [6]. Kano's Kodokan Judo Med Sport 2012 N° 65 <http://arxiv.org/abs/1206.1135>
- [7]. Khachidze M., Khachidze D. Determining the Impact of an Athlete's Weight Change on Biomechanical Parameters in Sports Results Planning. ENS 2020, Iv.Javakhishvili Tbilisi State University, Faculty of Exact and Natural Sciences' 8th annual conference. Tbilisi, 3-7 February 2020. <http://conference.ens-2020.tsu.ge/lecture/view/1743>
- [8]. Levitsky, A. G., Matveev, D. A., Potsipun, A. A., Oshina, O. V., & Kholodkova, O. V. (2017). Biomechanical classification of actions in competitive wrestling. Teoriya i Praktika Fizicheskoy Kultury, (10), pp. 66-68.
- [9]. Muntian V. Definition of biomechanical parameters of technical actions in the martial arts. fig share. Journal contribution. 2013. <https://doi.org/10.6084/m9.figshare.669670.v1>
- [10]. Ohta S., Nakaji S., Suzuk i K. , Totsuka M., Umeda T., Sugawara K. Depressed Humoral Immunity After Weight Reduction in Competitive Judoists. PMID: 12164364. DOI: 10.1002/bio.686
- [11]. Sacripant A. Biomechanical Classification of Wrestling Standing Techniques. Proceedings, 6 International Symposium on Biomechanics in Sports (1988). Bozeman, Montana, July, 1988. pp. 253-265.
- [12]. Sacripanti A Biomechanical Reassessment of the Scientific Foundations of Jigoro.

- [13]. Toda M., Morimoto K., Fukuda S., Umeda T., Nakaji S., Sugawara K. The effect of the weight reduction on the salivary cortisol levels of judo players. *Environ Health Prev Med.* 2001 Jul; 6(2): 113–116. doi: 10.1007/BF02897956.
- [14]. Torres-Luque G., Hernández-García R., Escobar-Molina R., Garatachea N., Nikolaidis P.T. Eling Douwe de Bruin, Physical and Physiological Characteristics of Judo Athletes: An Update. *Sports (Basel)*. 2016 Mar; 4(1): 20. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5968945/>
- [15]. Vidalin H, Dubreuil C, Coudert J. Judokas ceinture noire. Suivi physiologique: études biomécanique et bioénergétique – suivi de l'entraînement. *Med Sport* 1988; 62 (4): 184-9.

David Khachidze, et. al. "The Effect of Weight and Height Change Caused by Age-Related Growth on the Biomechanical Parameters of Wrestlers." *IOSR Journal of Sports and Physical Education (IOSR-JSPE)*, 7(3) (2020): 58-61.