

The relationship between rapid weight loss indicators and selected psychological indicators on success of Croatian wrestlers

Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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Abstract

Background and Study Aim:

Reasons why wrestlers and athletes of other combat sports (boxing, judo, taekwondo, etc.) reduce weight loss are better anthropometric characteristics of wrestlers (longitudinal and skeletal volume) compared to opponents in lower weight categories, better focus and motivation of wrestlers, etc. Main cognitive goal of this research was knowledge about the relationship of rapid weight loss indicators and selected psychological indicators on success of Croatian wrestlers.

Material and Methods:

The research was conducted on 200 Croatian Greco-Roman style wrestlers. The amount of weight loss, the percentage of weight loss, and specific urine density (USG) were determined. Profile of Mood States Questionnaires (POMS), pre-competition anxiety (SCAI-2), goal orientation (TESQ), and intrinsic motivation (IMI) were used.

Results:

Statistically significant correlation ($p = 0.003$) of rapid weight loss indicators and selected psychological indicators, with success was determined. Statistically significant correlation was found in the POMS variables (fatigue, $p = 0.014$), pre-competitive anxiety (self-confidence, $p = -0.017$), task orientation ($p = 0.019$) and intrinsic motivation (competence, $p = -0.025$).

Conclusions:

Successful wrestlers, despite being dehydrated, are less tired, more interested, more satisfied, have greater confidence and are more task-oriented than less-successful wrestlers. It is assumed that there are differences between age groups of wrestlers which should be investigated by future research.

Keywords:

anxiety • goal orientation • intrinsic motivation • moods • psychology • wrestling

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Weight loss – *noun* the fact of losing weight or of becoming thinner [54].

Rapid weight loss (RWL) – rapid methods result in weight loss by 3 to 6 percent in the interval of 24 to 72 hours before the competition [9].

Urine test – *noun* a test performed on the urine sample of an athlete that detects the markers or metabolites of banned substances [54].

Urine sample – *noun* a small volume of urine provided by an athlete for drugs testing or to allow a diagnosis of a medical condition, e.g. diabetes [54].

Urine specific gravity (USG) – the density of urine compared with the density of water [55].

Moods – a set of feelings, ephemeral in nature, varying in intensity and duration, and usually involving more than one emotion [56].

Intrinsic motivation – *noun* motivation to achieve a goal for reason of pride, enjoyment and self-worth [54].

INTRODUCTION

Success in combat sports as well as wrestling can be defined as sparing wrestlers by body mass, skills, strategies, relative strength and conditional preparedness [1]. Competition in weight categories produced development of methodical procedure of weight loss to wrestler best strength-conditional ability in lower weight category [2]. The main part of the training process of older age groups of wrestlers is regulation (decreasing) of body mass. The older age groups of wrestlers (juniors and seniors) reduce body mass by 5-10 kg before an important competition. The best wrestlers reduce body mass up to the optimal limit (confirmed by experience) so they can reproduce their maximal working capability. Body mass reduction is common occurrence in combat sports. Even 60% of martial arts athletes use rapid weight loss (RWL) methods [3]. Rapid weight loss applies 40-90% high school wrestlers, student wrestlers as well as wrestler on international level [3, 4-8], it's characterized by body mass reduction in the 3-6 % in period of 24-72 hours [9] and varies around 5-10% between two consecutive categories in boxing and judo [8]. Different methods of rapid dehydration (running, sauna, training in rubber suits, etc.) are primary and most preferred methods of rapid weight loss [5, 10] with significant reducing of liquid intake and increasing of exercise before competition [11]. Under rapid weight loss dizziness, low concentration, fever, increased heart rate, headache, irritability, disorientation usually occurs. [12, 13]. Effects of weight loss can have adverse physiological effects on the body like a higher heart rate, impaired circulation and respiratory function, impairment of thermoregulatory processes and the risk of excessive body temperature, decreased renal blood flow and possible kidney problems as well as salt reduction in the body [14].

Reasons why wrestlers and athletes of other combat sports (boxing, judo, taekwondo, etc.) reduce body mass are better anthropometric characteristics of wrestlers (longitudinal and skeletal volume) compared to opponents in lower weight categories, better focus and motivation of wrestlers, etc. High level of strength-conditional preparedness provides wrestlers a high level of mental preparation which is an important part of competition preparation, stress coping and creating a sense of raising the focus [15]. Considering anthropometrical characteristics during weight loss period, it can be said that wrestlers who gradually decrease body weight have a pronounced

longitudinal dimensions (body height, range of arms and legs) comparing with wrestlers who do not reduce body weight [16, 17].

The main problem of inadequate body weight regulation is not visible only in wrestling, the same problems occur in other combat sports as boxing, judo, taekwondo, kickboxing athletes and martial mixed arts practitioners [8, 14, 18-20] as well as other sports with weight categories as rowing and equitation [3] or weight lifting. All research studies but one have indicated negative psychological aspects of RWL; the exception is a study presenting a theory that wrestlers successful in RWL gain mental advantage over their opponents [15]. Due to all of the above, it is necessary to carry out research regarding the correlation between rapid weight loss and psychological indicators with wrestling success.

Main cognitive goal of this research was knowledge about the relationship of rapid weight loss indicators and selected psychological indicators on success of Croatian wrestlers.

MATERIAL AND METHODS

Subjects

The subjects were 200 wrestlers (74 cadets; 64 juniors; 62 juniors) who were competing at national Greco-Roman style championships, which represents approximately 70% of the population of Croatian wrestlers. Wrestlers who did not rapidly reduce their body mass were extracted from the subjects and finally a sample of subjects were 96 wrestlers. The age of subjects was 18.50 ± 3.58 years with 7.78 ± 4.06 experience. The subjects were of good health status checked at the sports clinic at least 6 months before the competition. Participation in this study was voluntary and anonymous. The cadet wrestlers had to produce written parental permission. All subjects gave their informed consent for inclusion before they participated in the study.

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the Faculty of Kinesiology, University of Zagreb.

Variables

The sample of variables used in this research consists of 21 variables: 3 variables of rapid weight loss indicators and 17 psychological variables

and placement in the national championship as a criterion variable. The criterion variable is reverse scaled which means that a smaller number of results indicate a better placement. Weight loss data as well as other psychological variables were collected through a questionnaire and specific urine density was measured to confirm wrestlers in acute dehydration state. Hydration status (urine specific gravity – USG) was determined by AtagoPal 10s Tokyo, Japan refractometer whose accuracy was ± 0.001 with a reliability of $R = 0.998$ [21]. Wrestlers – POMS (Profile of Mood States Questionnaires: anger, tension, depression, vigour, fatigue, confusion, happiness and calmness) were measured immediately prior to the competition (during the body weight loss) using the Brums scale [22]. Negative moods (anger, tension, depression, fatigue and confusion) are reverse scaled.

A state of pre-competitive anxiety was confirmed by SCAI-2 (competitive State Anxiety Inventory-2) to evaluate cognitive anxiety, somatic anxiety and self-confidence [23]. Goal orientation was assessed by TESQ (Task & Ego orientation in Sport Questionnaire, TESQ) questionnaire [24] translated and adapted in Croatian language [25]. Intrinsic motivation was assessed by IMI (Intrinsic Motivation Inventory) questionnaire [26], adapted and translated in Croatian language [27] to evaluate intrinsic motivation in four dimensions (interest/enjoyment, competence, effort/importance, pressure/tension). The applied questionnaires have good reliability. All necessary data were collected before official weighing and just before the start of the competition. Subjects completed POMS and SCAI-2 questionnaire by rounding up the assertion on the Likert scale 1-4, while TESQ and IMI on the Likert scale 1-5.

Statistical analysis

The data were processed in SPSS program (IBM, version 20). The dependent variable was defined as success and refers to rank on the national championship. Independent variables described rapid weight loss indicators and variables of psychological indicators, (moods, pre-competition anxiety, goal orientation and intrinsic motivation). The paper describes the descriptive indicators (minimum, maximum, mean, standard deviation), of rapid weight loss indicators and psychological indicators of wrestlers. Relation between weight loss indicators and psychological indicators was tested by Pearson correlation

coefficient. Relation between rapid weight loss indicators and selected psychological indicators with the success of Croatian wrestlers was determined by multiple regression analysis on the significant level of $p = 0.005$.

RESULTS

The values of anthropometric characteristic indicate that subjects had average body weight 70.80 ± 15.28 kg, body height 175.42 ± 8.06 cm and 22.84 ± 3.73 body mass index (MBI). The subjects decreased their body weight on average 2.25 ± 2.2 kg and % of body weight loss was $3.15 \pm 3.01\%$. Average values of USG amount 1.027 ± 0.005 g/mL indicated dehydration of wrestlers (Table 1).

The values of moods indicated middle values of positive moods (vigour 9.02 ± 3.59 ; happiness 10.29 ± 3.49 ; calmness 9.25 ± 3.17) and lower values of negative moods (anger 2.47 ± 3.41 ; tension 2.69 ± 3.16 ; depression 1.24 ± 2.36 ; fatigue 5.07 ± 3.36 ; confusion 2.13 ± 2.63). It is visible higher values of task orientation (4.02 ± 0.72) compared with ego orientation (3.02 ± 0.90). Higher level of self-confidence (14.25 ± 3.25) and somatic anxiety (12.92 ± 3.94) and average value of cognitive anxiety (10.16 ± 3.36) were established. In intrinsic motivation above average values on subscale interest/enjoy (3.83 ± 0.59), competence (3.79 ± 0.60) and efforts (3.94 ± 0.65) can be seen and average value in pressure/tension (2.73 ± 0.91) as negative indicator of intrinsic motivation (Table 1).

Higher statistically significant correlation was confirmed between % of body weight loss and variables body weight loss (kg) $r = 0.956$; period of body weight loss $r = 0.284$, as well as variables body weight loss and USG $r = 0.460$. Furthermore, the correlation between rapid weight loss indicators and negative moods (anger, $r = 0.306$; depression, $r = 0.225$; fatigue, $r = 0.300$) as well as variables calmness -0.206 , somatic anxiety ($r = 0.168$), self-confidence ($r = 0.275$), task orientation ($r = 0.151$), enjoy ($r = 0.206$) and competence ($r = 0.226$) was confirmed (Table 1).

Multiple correlation analysis

Multiple regression results (Table 2) show that statistically significant correlation was established ($p = 0.003$) of rapid weight loss indicators and selected psychological indicators, on success

Table 1. Descriptive statistics (minimum, maximum, means, standard deviations) for all variables and relation (Pearson correlation coefficient) between rapid weight loss indicators and moods, anxiety, goal orientation and intrinsic motivation (n = 200).

Variable	Descriptive		Rapid weight loss indicators		
	min.-max.	mean SD	body	% of body	period of
Body weight (kg)	40.75-129.70	70.80 ±15.28	-0.054	-0.253*	-0.137
Body height (cm)	140.00-199.00	175.42 ±8.06	-0.099	-0.224*	-0.038
BMI	14.79-37.90	22.84 ±3.73	-0.009	-0.199*	-0.139*
Age (years)	14.10-34.30	18.50 ±3.58	0.116	0.061	-0.070
Experience (years)	1.00-21.00	7.78 ±4.06	0.047	0.051	-0.060
Body weight loss (kg)	0.00-12.00	2.25 ±2.20	1	0.956*	0.276*
% of body weight loss (kg)	0.00-13.23	3.15 ±3.01	0.956*	1	0.284*
Period of body weight loss	1.00-4.00	2.69 ±1.46	0.276*	0.284*	1
USG (g/mL)	1.010-1.037	1.027 ±0.005	0.474*	0.460*	0.292*
Anger	0.00-16.00	2.47 ±3.41	0.276*	0.306*	0.015
Tension	0.00-13.00	2.69 ±3.16	0.065	0.115	0.053
Depression	0.00-14.00	1.24 ±2.36	0.175*	0.225*	0.125
Vigour	0.00-16.00	9.02 ±3.59	-0.046	-0.080	-0.081
Fatigue	0.00-14.00	5.07 ±3.36	0.261*	0.300*	0.164*
Confusion	0.00-13.00	2.13 ±2.63	0.070	0.088	0.084
Happiness	0.00-16.00	10.29 ±3.49	0.003	-0.023	-0.022
Calmness	0.00-16.00	9.25 ±3.17	-0.163*	-0.206*	-0.119
Cognitive anxiety	5.00-16.00	10.16 ±3.36	0.016	-0.011	-0.001
Somatic anxiety	7.00-27.00	12.92 ±3.94	0.168*	0.154*	0.168*
Self-confidence	5.00-20.00	14.25 ±3.25	0.254*	0.275*	0.135
Ego orientation	1.00-5.00	3.02 ±0.90	0.078	0.109	-0.012
Task orientation	1.00-5.00	4.02 ±0.72	0.151*	0.148*	0.025
Interest/Enjoy	1.80-5.00	3.83 ±0.59	0.206*	0.165*	0.022
Competence	1.50-5.00	3.79 ±0.60	0.208*	0.226*	0.042
Efforts	1.75-5.00	3.94 ±0.65	0.059	0.080	0.025
Pressure/tension	1.00-5.00	2.73 ±0.91	0.041	0.022	0.117

*correlations are significant at $p < 0.05$

of Croatian wrestlers with correlation $r = 0.447$. The set of predictor variables were explained 20% of total variance, that can be explain that the selected variables represent only one segment important for success in wrestling.

A set of 20 variables was analysed, 3 variables relate to indicators of rapid weight loss and 17 variables to selected psychological indicators. The summary results of multiple regression analysis (Table 3) indicate a statistically significant correlation of four variables of the selected psychological indicators with the success of Croatian wrestlers. The highest positive correlation with the criterion variable was observed in

the variables fatigue and task orientation, while the negative correlations were expressed in confidence and competence.

DISCUSSION

The values of body weight loss in this research are in compliance with previous studies [7, 16, 17], while in other research higher weight loss was determined [6, 14, 19, 28]. Percentage of body weight loss in this research was lower than other research [6, 19, 29, 30]. Even lower values of percentage body weight loss they can still negatively affect the wrestler's abilities,

Table 2. Results of multiple regression

Multiple R	Multiple R ²	Adjusted R ²	F	SE of estimate	p-value
0.447	0.200	0.110	2.233	3.907	0.003*

SE standard error; *statistically significance (p<0.005)

Table 3. Regression summary results.

Variable	Standardized coefficient β	b	SE of b	t	p-value
Intercept		9.859	2.786	3.539	0.001
Body weight loss	0.159	0.472	0.084	0.337	0.737
% of body weight loss	-0.267	0.351	-0.193	-0.759	0.449
Period of body weight loss	0.133	0.208	0.047	0.641	0.523
Anger	-0.201	0.145	-0.166	-1.387	0.167
Tension	-0.202	0.163	-0.154	-1.239	0.217
Depression	0.102	0.226	0.058	0.451	0.653
Vigour	0.104	0.120	0.090	0.865	0.388
Fatigue	0.265	0.107	0.215	2.470	0.014*
Confusion	0.042	0.186	0.027	0.227	0.821
Happiness	0.040	0.128	0.034	0.316	0.752
Calmness	-0.129	0.131	-0.098	-0.980	0.328
Cognitive anxiety	0.038	0.106	0.031	0.361	0.718
Somatic anxiety	-0.019	0.089	-0.018	-0.214	0.831
Self-confidence	-0.269	0.112	-0.211	-2.404	0.017*
Ego orientation	-0.304	0.364	-0.066	-0.836	0.404
Task orientation	1.380	0.585	0.239	2.358	0.019*
Enjoy	1.092	0.638	0.155	1.711	0.089
Competence	-1.652	0.729	-0.239	-2.268	0.025*
Efforts	-0.841	0.606	-0.132	-1.387	0.167
Pressure	0.038	0.379	0.008	0.100	0.920

B unstandardized coefficient beta; SE standard error; *statistically significant variable (p<0.005)

performance, psychological state, competitive result and health [31, 32]. Body weight loss through dehydration is a common tactic before competition among Croatian wrestlers, because of high degree of dehydration is expected due to the very short period of weight loss. The USG limit value for dehydration is 1,020 g/mL [21, 33, 34]. Considering the established situation in this research, it can be concluded that the subjects are moderately and very dehydrated as well as in previous research [35]. The current study's findings are in line with the findings of research studies on other combat sports [36]. Dehydration

confirmed by specific urine weight, urine colour and weight loss, results in a partially significant increase in fatigue (70%) [42, 37].

Based on multiple regression results statistically significant correlation was established (p = 0.003) of rapid weight loss indicators and selected psychological indicators on success of Croatian wrestlers with correlation r = 0.447. The set of predictor variables were explained 20% of total variance, that can be explain that the selected variables represent only one segment important for success in wrestling. Other part of variance can be explained by other variables that also contribute to

wrestling success such as aerobic and anaerobic endurance [38, 39], beginning of wrestling practice, experience [40], anthropometrical characteristics [41], especially range of arms and legs [42].

The statistically significant correlation between fatigue and success of wrestlers ($p = 0.014$) indicates that successful wrestlers who rapidly reduce their body weight are less tired compared to less successful wrestlers. The best placed wrestlers with low levels of fatigue likely possess a high level of self-confidence, low levels of anxiety, but also a high level of intrinsic motivation. The appearance of fatigue occurs as a result of hard training, but also the rapid weight loss with the occurrence of acute dehydration. Correlation of fatigue and success of wrestlers is in compliance with previous studies [1, 19] and shows that wrestlers have high values in the variables tension, anger, fatigue and confusion during weight loss. Negative effects of dehydration are increase in fatigue, anger, anxiety and confusion and decrease of positive moods [43]. However weight loss (kg) and percentage of body weight loss, while monitoring their hydration status, recommending for assessing mood states [35].

The statistically significant correlation ($p = 0.019$) was confirmed between task orientation and wrestler's success. Correlation indicates that the successful wrestlers who rapidly reduce their body weight are more task oriented in relation to the less successful wrestlers. We can assume, that is related to the specific circumstances of weight reduction in wrestling and different age groups in the sample of subjects. Considering the focus in terms of weight loss, it can be said that the successful wrestlers are more task oriented because of hunger and intense thinking about their goal. One of the reasons of why successful wrestlers have more task orientation is that they have more experience and have an optimal level of task orientation compared with less successful wrestlers. Task orientation during weight loss period produces better performance in competitions [44, 45], so it is logical that 87% of wrestlers tend to be task-oriented [46]. So, it is important that wrestlers have optimal level of task orientation in a period of weight loss. In this scientific research, a sample of subjects was made up of different age categories and age can influence the relationship between orientation and results [47] and wrestlers with longer sports careers show good task orientation [48]. It is assumed that there are differences between age groups of

wrestlers (cadet, juniors, seniors) in indicators of rapid weight loss as well as selected psychological indicators, which should be investigated and confirmed by future research.

Self-confidence as positive component pre-competition anxiety was statistically significant ($p = 0.017$) correlated with success of wrestlers. Correlation indicates that the successful wrestlers who rapidly reduce their body weight are more confident in relation to the less successful wrestlers. Confident athletes believe in themselves, in their ability to acquire the necessary skills and achievement of objectives, while less confident athletes constantly reviewed themselves, had doubts in their own capabilities, doubted they were good enough [49]. Increasing self-esteem reduces cognitive anxiety that can be caused by negative expectations about success and negative self-evaluation [23]. Athletes who are more optimistic demonstrate less emotional exhaustion and a better perception of personal satisfaction and performance [50]. In the opinion of wrestling experts, confidence may be connected with competence because when reducing body weight wrestlers feel stronger and more voluminous. Self-confidence can be improved by forgetting defeat, developing positive affirmation towards one's work, documenting success, visualizing, etc. [51].

Competence as positive component intrinsic motivation was statistically significant correlated with success of wrestler ($p = 0.025$). Wrestlers who rapidly reduce their body weight have a high level of perceived competence, apart to achieving better results, are more interested, more content, enjoy more in performance, have a higher level of self-confidence and a better focus on the task. Competence was correlated with indicators of intrinsic motivation as interest/enjoyment [52], which confirms research [35] in which it was found that wrestlers during a moderate weight loss have a high level of intrinsic motivation and high-value components in interest/enjoyment. A positive correlation was established of an athlete's intrinsic motivation and positive moods [53], so it can be assumed that cadets have lower values in the variables of positive intrinsic motivation (interest/enjoyment, perceived competence and pressure/importance) and higher values in the variable of negative intrinsic motivation (pressure/pressure) compared with juniors and seniors, which should be confirmed by future researchers.

CONCLUSIONS

Most wrestlers lose their weight in average 2.25 ± 2.20 while maximum value of weight loss amounted to 12.00 kg. Average values of percentage weight loss amount to 3.15 ± 3.01 while maximum value of weight loss amount to 13.23% of body mass. Wrestlers start reducing their body mass approximately one week before a competition. Values of urine specific gravity (1.027 ± 0.005) indicated an acute dehydration of subjects. Applying multiple regression analysis, statistically significant correlation was established ($p = 0.003$) of weight loss indicators and selected psychological indicators, with success of wrestlers. Statistically significant correlation was established in variables for moods assessment (fatigue, $p = 0.014$), pre-competition anxiety (self-confidence, $p = -0.017$), goal orientation (task orientation, $p = 0.019$) and intrinsic motivation (competence, $p = 0.025$).

The results of this study indicate that successful wrestlers who rapidly reduce their body weight, except of better results, despite being dehydrated are less tired, more interested, satisfied, have greater competencies, enjoy more performance, have greater confidence and are more task-oriented than less successful wrestlers. It is assumed that there are differences between age groups in indicators of rapid weight loss as well as selected psychological indicators, which should be investigated and confirmed by future research to easily and accurately (individually) approach the process of weight loss as well as mental preparation of wrestlers for the competitions.

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