DIFFERENCES IN RESTING METABOLIC RATE ACROSS WEIGHT CLASS DIVISIONS IN COLLEGIATE WRESTLERS

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ABSTRACT

PURPOSE
Resting metabolic rate (RMR) accounts for 60-70% of an athlete's total daily energy expenditure and is an important component of determining energy intake requirements. Collegiate wrestling is a weight category sport; therefore, differences in RMR and energy requirements across the 10 weight classes may exist. The purpose of the current study was to examine differences in RMR values across each weight class in wrestlers

METHODS
National Collegiate Athletic Association (NCAA) collegiate male wrestlers participated in the current study (n = 177; Age: 19.6 ± 1.4 yrs.; Height: 176.6 ± 6.6 cm; Weight: 77.6 ± 12.7 kg; Body fat: 12.7 ± 4.2 %). Indirect calorimetry was used to measure RMR. Body fat percentage (BF%) was estimated via skinfold measurements using the Brozek and Lohman prediction equations during routine NCAA weight certification testing in accordance with NCAA policy.

RESULTS
Mean RMR was 2152 ± 306 kcal·d−1 and 27.3 ± 3.8 kcal·d−1 when normalized to body mass for all wrestlers collapsed across weight class divisions (Table 1). When compared to the 125 lb. weight class, wrestlers competing in the 157 lb. weight class, and all five heavier weight classes exhibited significantly higher RMR values (p<0.05). When normalized to body mass, differences between weight classes were no longer significant (p>0.05). Body mass (r = 0.614), fat-free mass (r = 0.633), and BF% (r = 0.170) were all associated with higher RMR values (p<0.05).

CONCLUSIONS
Larger wrestlers competing in heavier weight classes have higher absolute RMR values compared to those in lighter divisions.

PRACTICAL APPLICATIONS

These RMR values can help estimate energy requirements across each weight class for collegiate male wrestlers. It is recommended practitioners individualize nutritional guidelines for heavier wrestlers to ensure adequate energy intake for optimal performance and health throughout the competitive season.

BACKGROUND

Resting metabolic rate (RMR) accounts for 60-70% of an athlete's total daily energy expenditure (TDEE) and therefore identifying this value is an important component of determining an athlete's energy intake requirements. This is particularly important in the sport of wrestling, as wrestlers are continuously attempting to maintain a specific weight as part of their pre-determined eligible weight class. Therefore, the use of a valid approach to determining RMR is imperative for this population as it plays an integral role in energy balance and body weight manipulation.

OBJECTIVE

PURPOSE
The purpose of the current study was to examine differences in RMR values across each weight class in wrestlers.

METHODS

PARTICIPANTS

- National Collegiate Association Division III male wrestlers participated in this study (n = 177; Age: 19.6 ± 1.5 yrs.; Height: 176.3 ± 6.3 cm; Weight: 76.6 ± 10.9 kg; Body fat: 11.4 ± 3.0 %).

STUDY DESIGN

- Indirect calorimetry was used to measure RMR. For this procedure, athletes are instructed to lie in a supine position motionless while a canopy was placed over their heads and shoulders to collect expired gases.

- Analysis was conducted after an initial 10-minute period, and during a 5-minute period in which the coefficient of variation was less than 5% for VO2 consumption. RMR (kcal·d−1) was then determined using the Weir formula.

- All wrestlers completed skinfold assessments for weight certification at the start of the competition season no sooner than September 1st and by November 1st at the latest.

- The skinfold thickness was measured by trained testers, typically athletic trainers or others on the sports medicine staff at the local university, and the values were then entered into the OPC system to subsequently compute an estimate of BF%.

- Body density was calculated using the Lohman equation [20]:

  Db=1.0982 - (0.000815*(Triceps+ Subscapular + abdomen_av))+ (0.00000084*(〖Triceps+ Subscapular + Abdomen〗 ^2)

- BF% was then estimated from body density using the equation by Brozek et al [21].

  BF%=[(4.57/D_b)-4.142]*100

MINIMAL WRESTLING WEIGHT

- MWW was determined by BF% thresholds of 5% (as standard practice) to determine the resulting MWW and MWC.

- The equation below was used for MWW.

$$MWW = \frac{\left(1 - \frac{BF\%}{100}\right) \times Bodyweight}{0.95}$$

STATISTICAL ANALYSIS

- Mean differences between measured RMR across each weight class division were examined using repeated measures analysis of variance (RM-ANOVA). If significant differences were found, post hoc analysis using Bonferonni corrections was completed to determine where differences occurred. All data were analyzed using SPSS (Version 25.0, IBM, Armonk, NY, USA), and displayed as mean ± standard deviation.

RESULTS

- Mean RMR was 2152 ± 306 kcal·d−1 and 27.3 ± 3.8 kcal·d−1 when normalized to body mass for all wrestlers collapsed across weight class divisions (Table 1).

- When compared to the 125 lb. weight class, wrestlers competing in the 157 lb. weight class, and all five heavier weight classes exhibited significantly higher RMR values (p<0.05).

- When normalized to body mass, differences between weight classes were no longer significant (p>0.05).

- Body mass (r = 0.614), fat-free mass (r = 0.633), and BF% (r = 0.170) were all associated with higher RMR values (p<0.05).
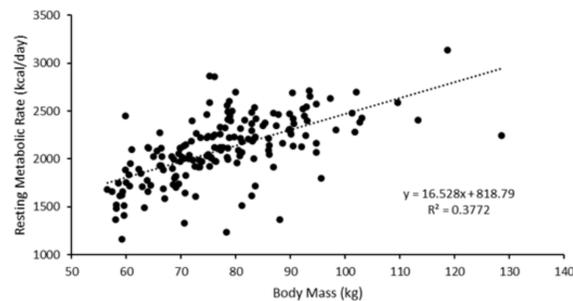

Figure 1. Relationship between resting metabolic rate and body mass
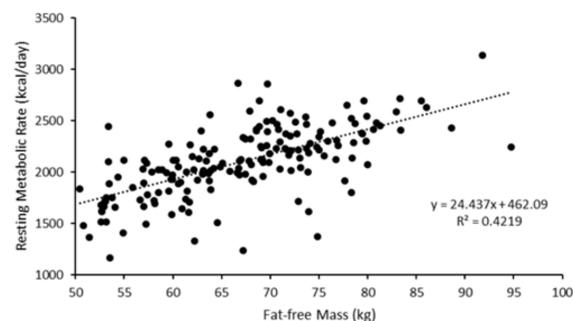

Figure 2. Relationship between resting metabolic rate and fat-free mass.

RESULTS

Table 1. Summary of resting metabolic rate across each weight class.

Weight Class (lbs.)	N	BF (%)	RMR (kcal·d−1)	Mean Difference (kcal·d−1)	RMR/kg (kcal·d−1)	Mean Difference (kcal·d−1)
125	18	10.6±2.3	1734±295		29.2±4.7	
133	17	11.0±2.9	1751±202	-17	27.9±3.2	1.4
141	17	11.6±2.7	1854±236	-120	28.1±3.2	1.2
149	19	12.3±2.9	2034±322	-300	28.3±4.4	0.9
157	17	12.2±4.0	2098±227	-364*	28.1±2.4	1.1
165	24	11.6±3.3	2197±341	-463*	28.5±4.4	0.7
174	25	12.8±4.5	2158±243	-424*	26.2±3.1	3.0
184	15	13.9±2.1	2210±292	-476*	25.1±3.1	4.1
197	17	17.3±6.7	2390±175	-656*	25.2±3.4	4.1
285	8	15.9±5.8	2644±268	-910*	26.1±1.3	3.2

BF = body fat; RMR = resting metabolic rate; RMR/kg = resting metabolic rate normalized to body mass (kg); kcal·d−1 = kilocalories per day. Mean difference = values compared to those of the 125 lb. weight class division. *Denotes significant difference (p<0.05).

DISCUSSION

- The findings of the current study demonstrate that resting metabolic rate (RMR) significantly differs across weight class divisions in collegiate male wrestlers, with those in higher weight classes exhibiting greater absolute RMR values.

- In this cohort of NCAA Division III male wrestlers, both body mass and FFM were moderately to strongly correlated with RMR (r = 0.614 and r = 0.633, respectively), reinforcing previous literature indicating that metabolically active tissue contributes substantially to resting energy expenditure and that RMR is largely influenced by body size and composition, specifically, fat-free mass (FFM).

- The lack of statistically significant differences in RMR when values were normalized to body mass further underscores the influence of body size on absolute energy needs and suggests that while heavier wrestlers possess greater total energy demands at rest, their relative metabolic demands per kilogram of body mass are similar to those of lighter counterparts.

- These findings have practical implications for individualized energy intake recommendations, as practitioners can estimate relative metabolic demands more consistently across weight classes, specifically when normalized to body mass.

- These data emphasize the importance of considering both absolute and relative RMR when estimating energy requirements and support the need for individualized nutrition strategies based on weight class, body composition, and metabolic demands.

- Given the unique physiological characteristics of wrestlers, the development of a wrestler-specific RMR prediction equation is warranted to enhance the accuracy of energy intake recommendations.

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