The Relationship between FFM and Vertical Jump in Male and Female Division One Collegiate Swimmers

Brady Fields, Steven LaFlamme, & Steven Couch
Exercise Science, Gardner-Webb University, Boiling Springs, NC 28017

This project does not attempt to produce generalizable knowledge. It Is dedicated to the practice of developing skills and demonstrating understanding of the research process

Introduction

- ❖ According to García-Ramos et al. (2016), the vertical jump is an essential factor that affects the push-off and start phases of the sport of swimming, which are crucial elements for improving stroke performance and efficiency.
- ❖ Explosive training strategies with resistance and light load work help improve power in the pushing motion. This may be done through plyometric training for out of the water workouts, or resistance training in the water (Makaruk et al., 2020).
- ❖ According to Sheppard et al. (2008), the vertical jump is considered a successful performance indicator in swimming.
- ❖ According to McArdle et al. (2015), the term body composition can be interchanged with the term fat-free mass or lean body mass. This is used to determine an individual's overall health and lifestyle.
- ❖ It was seen that males have a lower body fat percentage, or fat free mass, than females (McArdle et al., 2015).
- ❖ According to Caia et al. (2016), it was found that body composition played a role in determining the vertical jump ability of athletes.
- ❖ In theory, less body fat composition would mean more muscle mass and stronger connection with muscular recruitment in the body (Caia et al., 2016).
- ❖ The purpose of this lab was to determine if body composition played a role in the ability to perform a vertical jump test among collegiate swimmers.
- ❖ It was hypothesized that a lower body fat percentage would lead to an overall higher vertical jump. Since males statistically have lower body fat percentages when compared to women, it can also be shown that males would have higher vertical jump values.

Methods

- ❖10 division one collegiate swimmers, 5 male and 5 female, volunteered for this study
- ❖Age and gender were collected prior to the start of the study
- ❖Height and weight were gathered using a Detecto weight and height scale
- ❖Age, gender, height, and weight were inputted into an Omoron Bioelectrical Impedance Analysis device (BIA) which calculated body fat percentage and body mass index (BMI)
- ❖Subjects were given instruction related to a standardized warmup derived from a study completed by Perrier et al. (2011), consisting of: easy skips with arm swings, skip for distance using arms to drive forward, skip for height using arms to drive upward, backwards run, lateral shuffle, walking lunges, high knees, and straight leg strides
- ❖All movements were performed for 40 meters with 20 seconds rest between each movement
- ❖Subjects were informed and instructed on proper countermovement jump technique
- ❖Three maximal countermovement jumps were completed and recorded using a Just jump-mat
- ❖One minute of rest was taken between each of the trials
- ❖Subjects completed a 64.37-meter lap as a cool down

Results

Table 1:

Male Subjects

Statistics	Average	Standard Deviation	Range (low-high)
Age*:*	21.4	0.55	21 – 22
Height (in):	71.1	3.10	67.3 – 73.2
Weight *(lbs):*	170	15.49	152 – 189
FFM (%)*:*	89.06	2.70	85.8 – 91.9
CJ (in)*:*	28.58	2.37	24.5 – 30.4

Note. BF = body fat, CJ = countermovement jump, in = inches, lbs = pounds

Table 2:

Female Subjects

Statistics	Average	Standard Deviation	Range (low-high)
Age*:*	20.6	0.55	20 – 21
Height (in):	65.3	2.33	63 – 68.5
Weight *(lbs):*	150.2	20.61	126 – 182
FFM (%)*:*	75.88	2.40	73.5 – 78.6
CJ (in)*:*	19.68	3.15	16 – 23.3

Note. BF = body fat, CJ = countermovement jump, in = inches, lbs = pounds

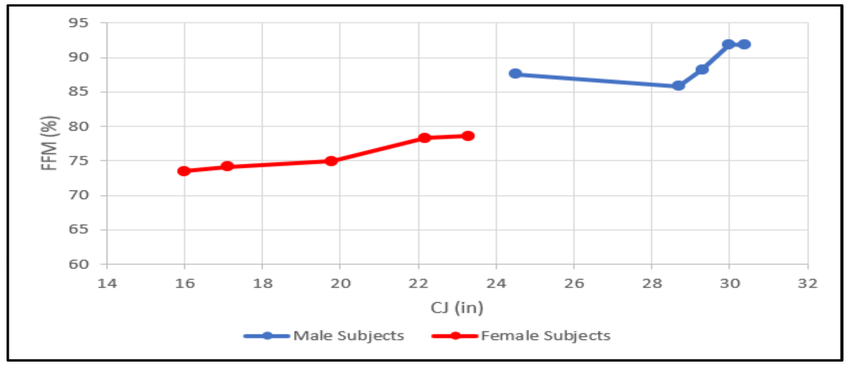

Figure 1. Fat Free Mass Compared to Maximal Countermovement Jump Across Gender. This figure presents fat free mass relative to maximal countermovement jump across gender in division one collegiate swimmers.

Male subject data, including age, height, weight, FFM, and countermovement jump (CJ), is reported in Table 1. Similarly, female subject data, including age, height weight, FFM, and CJ is reported in Table 2. Countermovement jump to FFM ratio for the male subjects presented as 0.32. Countermovement jump to FFM ratio for the female subjects presented as 0.26. The male subjects displayed both higher FFM and CJ values when compared to the female subjects. When compared to FFM, average CJ values were slightly higher in the male subjects when compared to the female subjects. FFM and CJ values presented a moderate correlation for the male subjects (r=0.55). However, FFM and CJ values presented a very strong correlation for the female subjects (r=0.97).

Discussion

- ❖According to Rubio-Arias et al. (2017), males present higher muscle thickness than women suggesting the higher muscle thickness in men equates to higher vertical jump
- ❖The male subjects in this study presented an average countermovement jump of 28.65 ± 2.26 in/s^2 whereas females presented 19.70 ± 3 in/s^2 which would concur with the study
- ❖According to Caia et al. (2016), body composition is a crucial variable when examining vertical jump and further suggests a lower body composition would mean both a larger percentage of muscle mass as well as a stronger neural connection equating to a higher vertical jump
- ❖The male subject in this study presented higher FFM values as well as higher CJ values, the female subjects in this study with the highest FFM also presented the highest CJ values
- ❖According to Roy et al. (2015), subjects which presented higher FFM have an advantage when completing the vertical jump
- ❖The male and female subjects in this study presented FFM values of 89.06 ± 2.7, and 75.88 ± 2.4 respectively
- ❖The male subjects presented both higher FFM and CJ values which agrees with the findings of Roy et al. (2015).

Conclusion

- ❖ It was found that among both the female and male swimmers that body composition and vertical jump performance share a negative correlation
- ❖ Lower body fat composition improved vertical jump value
- ❖ There were several limiting factors in this study:
- ❖ Two of the researchers involved in this study also took part in it hindering the validity of the study
- ❖ Proper footwear or apparel was not specified prior to the study which decreased CJ performance
- ❖ Subjects were tested at differing times of day which could, in theory, influence results
- ❖ Some subjects were more experienced in completing the countermovement jump and therefore there was a skill gap between several of the subjects
- ❖ Further research should examine the effects of body composition and recruitment of muscles used in the vertical jump when comparing both male and female subjects

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