

NORMATIVE DATA FOR THE STANDARD PUSH-UP TEST IN DIVISION I FEMALE STUDENT-ATHLETES

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Introduction

The push-up test is a well-established evaluation of muscular endurance that is often used by athletes and recreationally active individuals (3). However, the normative values used to interpret performance for women are largely based on push-ups conducted in a modified stance (MPU) (with knees on the ground, lower leg flat on the ground and ankles plantar flexed) versus the standard push-up (SPU) protocol designed for men (pivot point is the toes), despite the load difference between push-up protocols being less than the gender strength gap (5,6). For athletic females the SPU protocol may be a more appropriate measure of functional muscular endurance given their athletic status (5,7). A recent study (1) developed normative values for both recreationally active and not currently active college-age females using the SPU protocol. However, this is one of the only publications providing such data in college-age females, and no such data has been published for college female student-athletes. For women willing and able to performance push-ups in the standard position there is a dearth of available normative values to which their performance scores can be compared. The purpose of this study was to present normative data for the SPU for healthy female collegiate student-athletes and compare SPU performance to their bench press (BP) to body weight ratio (BP-BW_R) and body mass index (BMI).

Methods

Participants

Ninety-nine Division I female student-athletes (SA) volunteered to complete a SPU protocol, including:

- 21 field-hockey (19.1 ± 1.0y; 165.9 ± 6.5cm; 63.4 ± 6.5kg) SA
- 18 softball (19.8 ± 1.6y; 169.6 ± 7.1cm; 73.5 ± 10.4kg) SA
- 10 tennis (20.4 ± 0.8y; 164.8 ± 8.8cm; 61.0 ± 12.2kg) SA
- 29 lacrosse (19.5 ± 1.4y; 168.3 ± 6.9cm; 66.4 ± 10.7kg) SA
- 12 basketball (20.3 ± 1.6y; 175.3 ± 8.8cm; 74.1 ± 8.8kg) SA
- 9 volleyball (19.5 ± 1.4y; 174.4 ± 9.9cm; 68.0 ± 7.4kg) SA

Clearance to participate was obtained from the head athletic trainer and team physician. The research protocol was approved by the University Institutional Review Board prior to participant enrollment.

Measures

Athletes were instructed to avoid strenuous activity the day prior to data collection for either the SPU or the BP and wore exercise attire to perform all testing.

Measures cont.

Each subject performed the same standard warm-up consisting of a general and specific (to the movement patterns inherent in the respective test) phase. The following measures were taken across two days, with height, weight, and SPU scores on day 1 and bench press (BP) scores on day 2 (2-5 days apart).

BMI: A standard scale and stadiometer (standing measure) were be used to determine weight in kilograms (BW) and height in centimeters. BMI was calculated using the equation: $BMI = BW / \text{height in meters}^2$.

SPU: The SPU scores were determined using previously published methods (1,2). Correct form was modelled and verbally cued by trained test administrators. For the SPU test each subject assumed a front-leaning position with the hands about shoulder width apart. Hands were placed forward to the shoulder link. The back, buttocks, and legs were kept straight from the head to the heels (Figure 1). The test began with the subject bending the elbows and lowering the entire body until the top of the upper arms, shoulders, and low back were aligned and parallel to the floor. The subject then returned to the starting position by extending the elbows. During the SPU the chest was lowered to ~2 inches from the ground with the elbows at 90 degrees (and fingers stay pointing forward) for each repetition (Figure 2). The subject could not rest by lying on the ground or pausing in the upright position for more than a second before continuing. The score was the number of push-ups completed correctly, allowing for one corrective flaw from the administrator.

Figure 1



Figure 2



BP and BP-BW_R: A 3-RM BP was conducted to evaluate upper-body muscular strength. Spotters and an NSCA-CSCS were present at all times. Testing for each lift incorporated a warm-up of repetitions at a low intensity weight prior to the assessment, and at least 3 minutes rest was be provided between lifting attempts in accordance with established protocols (4). The BP-BWR was determined by dividing BP by the SA BW. Categorical values of less than 50%, 50-74.9%, and ≥75% were established for comparison.

Statistical Analysis

Descriptive statistics, categorical and percentile (%T) distributions were calculated using SPSS version 28 (IBM Corp, Armonk, NY).

Results

- Average SPU scores across all athletes was 17.5 ± 8.4 , with the average score above the 50th %T for the study sample (25th %T = 12; 50th %T = 16; 75th %T = 22).
- Field hockey and basketball players had the highest SPU scores (18.7 ± 8.9 and 18.4 ± 7.6 , respectively), but there was no significant difference across sports ($p > 0.05$) (Figure 3).
- SPU scores were significantly correlated with BP-BW_R ($r = 0.62$, $p < 0.05$), with athletes showing a BP-BW_R greater than 75% performing significantly more push-ups ($p < 0.05$) (Figure 4).
- SPU scores were significantly correlated with BMI ($r = -0.23$, $p < 0.05$), but no significant differences existed across BMI classifications.

Figure 3

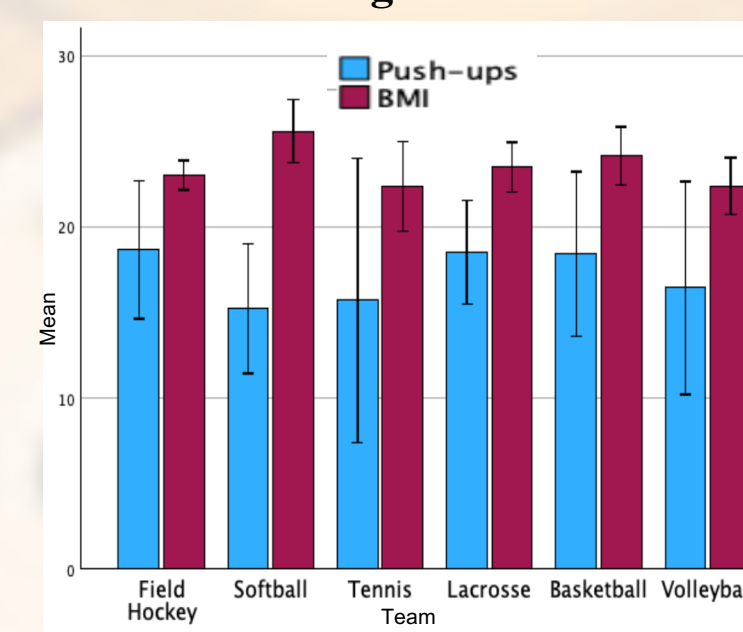
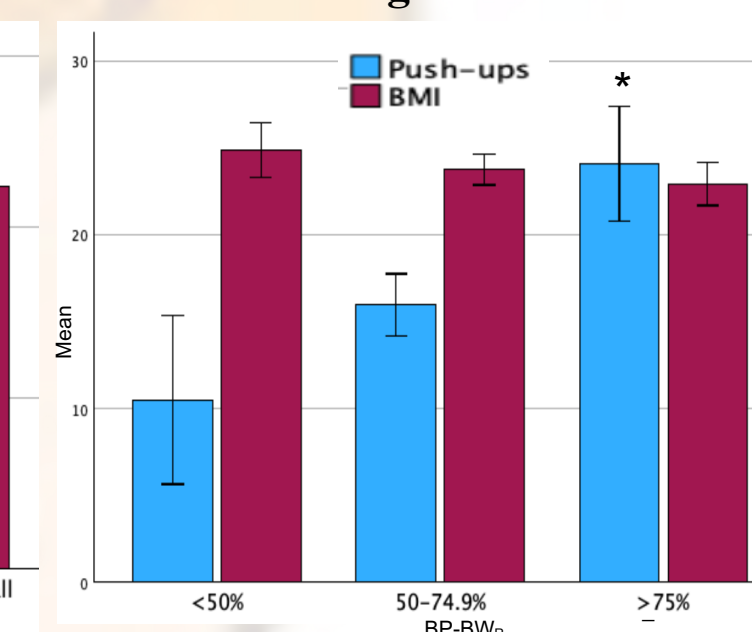


Figure 4



Conclusions

Average SPUs in the study sample fall within the 'fair' category compared to SPU norms for men of the same age range (and the 'good' category for MPU norms for females of the same age) (2). The SPUs completed by female athletes is also greater than the SPU completed by females in the general population, including those who regularly engaged in resistance-training (1).

Practical Applications

The binary gender format for push-up test administration and interpretation may not be accurate or appropriate for female athletes who have the physical ability and desire to perform the SPU test. The availability of SPU norms for female collegiate athletes is a useful resource for test interpretation. However more research is needed to further development normative values based on a larger sample size, as well as values representative of female athletes in a wider range of sports.

References

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