

Normative Values of College-Aged Men and Women for the YMCA Bench Press Test for Muscular Endurance

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Abstract The current investigation reports on percentile normative values of college-aged men and women (18-25 years) for the YMCA bench press endurance test (YMCA-BPT). Previously reported normative values did not include the sample size or population specific information. Participants in this investigation were healthy, men and women who completed a standardized warm-up and then underwent the procedures for the YMCA-BPT. Demographic data are reported along with YMCA-BPT scores including averages of 34.18 ± 12.51 for men, 25.26 ± 10.20 for women and 29.69 ± 12.26 for the combined group (repetitions \pm standard, respectively). Percentile scores by gender are also reported.

Keywords: muscular endurance, fitness assessment, physical fitness, upper-body endurance

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test. However, it is important that the norms are relevant to the population to maintain their value.

1. Introduction

Physical fitness, a multi-faceted parameter, is comprised of cardiorespiratory fitness, body composition, flexibility and muscular strength and endurance. Muscular endurance (ME), the ability to sustain a given level of submaximal force or repetitions of that force over time [1], is inversely proportional to intensity [2]. In addition, ME is a common measure selectively associated with physical performance [1] and has also been used as a predictor of health [3]. The Young Men's Christian Association (YMCA) Muscular Endurance Bench Press Test (YMCA-BPT) is a protocol specifically used to assess upper body ME that was first reported in 1989 [4] in the well-known text, "Y's Ways to Fitness." However, the normative values utilized for comparisons of performance were reported with no information on the total number or characteristics of the participants beyond age and gender.

The purpose of the current investigation was to re-evaluate and report new percentile norms for the YMCA-BPT for a college-aged population (18 -25 years) of men and women. A previous version of the American College of Sports Medicine (ACSM) guidelines [5] references the norms of this test that are now more than 20 years old. Overall, normative referencing is a valuable tool that allows an individual to be compared by their test score to a population of peers' performance of the same

2. Material and Methods

2.1. Participants

Two hundred healthy participants, men (n=100) and women (n=100), between 18-29 years of age were recruited from a university population to participate in this project. Participants were healthy, had not been involved in varsity or club athletics (i.e., organized sports teams) in the last six months preceding data collection, had no orthopedic limitations that would have impaired their ability to perform physical tasks, and did not consume alcohol or participate in acute exercise (i.e., physical activity above their daily routine) within twelve hours prior to laboratory testing. The university's Institutional Review Board approved the study and all methods were carried out in accordance with approved institutional guidelines and regulations. All participants provided written informed consent to participate.

2.2. Overview of Procedures

Following the informed consent process, demographic information and anthropometric measurements were collected. Height was measured using a stadiometer

(Invicta Plastics Limited, Leicester, England) to the nearest centimeter, while weight was measured using a digital scale (BWB-800, Tanita Corp, Japan) to the nearest tenth of a kilogram. Each participant completed an aerobic warm-up and a total of seven stretches designed to stretch all major muscle groups. Following warm-up each participant was instructed on the testing protocol, sat quietly for five minutes, and then performed the test.

2.2.1. Warm-up

All participants completed an aerobic warm-up consisting of treadmill (TMX425 Trackmaster, Full Vision, Newton, KS) walking for five minutes at a self-selected speed between 2.5 to 3.5mph (4.0 to 5.6kph) and 1.0 to 5.0% grade incline. Upon completion, participants performed a series of static stretches targeting the major muscle groups of the legs, trunk, shoulder/chest, and back. Following the stretching protocol each participant underwent barbell bench press familiarization. Using a flat bench with barbell rack that each individual completed five repetitions at 15lbs (6.8kg) for women and 45lbs (20.4kg) for men; Ultra Lite 6 foot (1.8m) aluminum Olympic barbell and weight plates, Hampton, Inc, Ventura, CA) at a pace of 30reps/min via metronome tones at 60beats/min (tone in-synch with top and bottom of bench press cycle; Franz Metronome, New Haven, CT) followed by two repetitions with the testing weight of 35lbs (15.9kg) for woman and 80lbs (36.3kg) for men at the same pace.

2.2.2. Muscular Endurance Testing

The YMCA-BPT protocol [4] was assessed with the participant lying supine on the flat bench with their feet flat on floor. The barbell was handed to the participant by a spotter in the down position (their elbows flexed and palms up), gripping the barbell with hands shoulder-width apart. The metronome was set at 60beats/min, on the sound of the tone the participant pressed the barbell up fully extending the elbows; this was counted as one repetition. In order to continue, participants were required to stay in-synch with the metronome during both the down and extended positions. Participants continued repetitions until fatigue or until the 30reps/min pace could not be sustained; if the participant paused between repetitions they were immediately prompted to continue and if they did not continue immediately the test was considered finished. Participants were encouraged to breathe regularly and perform maximally with a trained and suitable spotter(s) in the standing position over and behind the head of the participant or spotters at each end of the barbell. The maximal number of repetitions were recorded [4].

2.3. Data Analyses

Data Analyses. Data was analyzed using SPSS 25.0 (SPSS, Inc, Chicago, IL) and is reported as means \pm standard deviations, range, and percentiles.

3. Results

Anthropometric and demographic information and descriptive results are included in Table 1, while Table 2 illustrates the percentile scores for men and women.

Table 1 Anthropometric and YMCA Bench Press Test Data

Variable	Men	Women	Combined
n	100	100	200
Age (years)	21.56 \pm 1.96	20.94 \pm 1.76	21.25 \pm 1.88
Height (cm)	177.28 \pm 6.34	164.80 \pm 6.52	171.01 \pm 8.96
Body Mass (kg)	79.80 \pm 12.34	66.53 \pm 9.69	73.13 \pm 12.91
BMI (kg/m ²)	25.39 \pm 3.68	24.53 \pm 3.53	24.96 \pm 3.62
Bench Press Repetitions			
(#)	34.18 \pm 12.51	25.26 \pm 10.20	29.69 \pm 12.26
(Range)	4 - 79	0 - 51	0 - 79

Values expressed as M \pm SD.

Table 2. YMCA Bench Press Test Percentile Scores

Percentile	Men	Women
90	50	36
80	43	32
70	40	31
60	37	30
50	36	26
40	32	23
30	29	20
20	23	17
10	17	13

Number of repetitions.

4. Discussion

The current investigation provides updated normative values for the YMCA-BPT derived from a large group of college-aged men and women. The YMCA-BPT is a common test to assess upper-body muscular endurance that is taught throughout collegiate-coursework in exercise science and often utilized in regimens to assess physical fitness and athletic performance. The guidelines for the YMCA-BPT, including normative values to interpret individual performance on this test, were originally published in 1989 in the *Y's Way to Physical Fitness* [4]. In fact, the National Council of YMCA of the United States has been a leader in the promotion of physical fitness since the mid-1960s; during the first YMCA national consultations on physical fitness in the early-to mid- 1970s, a group of experts in the field of physical fitness, physiology and sports medicine joined together and introduced standards for physical fitness which was published as *The Y's Way to Physical Fitness* [6]. Since the first edition of the *Y's Way to Physical Fitness* [6], it has been updated, revised and edited several times in order to include new tests and updated normative values based on the specific needs of the community and an overall comprehensive approach towards greater physical fitness [7,8]. However, the normative data for the YMCA-BPT from which to compare individual's performance was provided at that time without a scientific reference - no detailed information for testing methodology, specific subject numbers or characteristics (beyond age and sex).

Research delimitations, methodologically established parameters placed on data collection, are necessary to

establish guidance in interpretation of the results and are well established in the current investigation. Moreover, the limitations, the generalized applicability of the results, which in one sense is a limitation of this investigation, was chosen as the intent was to evaluate college-aged men and women. Normative data for a test provides a valuable tool for comparing performance within specified limits. However, in addition to the present data providing definitive participant characteristics and detail sufficient to compare to the sample an end-user will apply this data to, the need to re-evaluate physical fitness performance test normative data is often less evident. As the original data was over 20 years old, it is important to consider how changes in physical activity over the last few decades as frequently reported in the adolescent [9] and adult populations [10]. Clearly, changing patterns of physical activity may have significant influence on physical performance [11] and likely muscular endurance. In addition, in the United States, average height and weight [12,13] and the incidence of obesity [14] have increased over the last few decades. Given the plethora of anecdotal evidence and the literature to highlight that, to some extent, physical dimensions are proportional to measures of muscular strength and may also influence muscular endurance [15], all told, it is worthwhile to re-evaluate normative values of physical performance tests. Moreover, the current data is derived from a group of men and women who are largely in line with the current mean height, weight and body mass index of the population in the US for this age group [16].

Other popular tests are often used to assess upper-body muscular endurance based on push-ups and chin-ups completed by an individual [4]. These tests are considered good field tests (i.e., limited equipment necessary to complete), however, since they are body weight dependent for resistance they are considered more difficult for participants to complete and do not standardize the workload between participants. Therefore, proposed benefits of utilizing the YMCA-BPT is to predict 1RM strength [17,18] and to compare muscular endurance amongst participants without having to correct for body weight [17]. Additionally, the YMCA-BPT requires minimal form development, for those unfamiliar the testing modality, thus, advocates for this test believe novices are more effective in the execution of the repetition and reduced risk for injury when compared with the push-up or chin-up exercise tests [19].

5. Conclusions

Normative data is an important aspect of any test. Whereas previously published normative values for the YMCA-BPT did not illustrate the sample size, anthropometric or demographic information for the age group reported on, the present investigation provides these details. Reporting individual performance in comparison to normative values is an important form of feedback as their performance relative to peers may provide insight into strengths and weaknesses of their overall health or may provide more information to aid in the development of an exercise prescription to improve their own physical fitness.

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Statement of Competing Interests

The authors have no competing interests.

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