# Fitness Norms for the Plank Exercise

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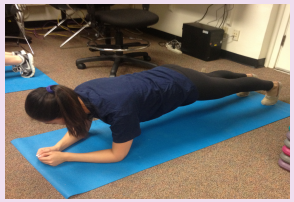
## Abstract

**PURPOSE**: Adequate strength of core musculature is critical for optimal physical performance and postural control. Currently, standards for core musculature strength and stability have not been established. This study sought to determine normative fitness measurements of core musculature endurance using the plank exercise. **METHODS**: 168 collegiate male and female participants (18-25 years of age) were recruited. Participants were instructed in plank positioning: elbows bent at 90° directly below the shoulders, hands unclasped, feet placed hip width apart with ankles at 90° and pelvis tilted in the neutral position. After a 5 min warm-up, participants were told to maintain the plank position as long as possible until complete fatigue was reached. The test was terminated if proper form was broken. The total time held in proper plank position was recorded. **RESULTS**: The mean time held in the plank position was 96.25 ± 43.16 and 116.58 ± 65.49 seconds for females and males, respectively. For females, quartiles showed that the 25th percentile was 63 seconds, the 50th percentile was 90 seconds, while the 75th percentile was 121 seconds. Quartiles for males were 77 seconds, 106 seconds and 128.5 seconds for the 25th, 50th and 75th percentiles, respectively. **CONCLUSION**: This study provides normative values for the plank exercise that can be added to current fitness appraisal protocols to assess core muscular endurance. These data suggest that 1.50 min in females and 1.77 min in males (50th percentile values) could be considered average duration of the plank exercise for this age group. Future testing to include other age groups and levels of fitness will be undertaken to broaden the range of normative values available for fitness testing



## Introduction

The core musculature can be described as the lumbopelvic-hip complex that includes all of the lateral, medial, anterior and posterior muscles of that area (Oliver, Stone, and Plummer, 2010). Others have defined the core as all muscles between the sternum and knees, specifically the abdominals, hips, and lower back region (Fig, 2005). Core strength is necessary because the muscles of this region are used to generate force and provide support for movements. Specifically, core stabilization allows for the optimum control, production and transfer of force to distal limbs in athletic movements (Kibler, Press & Sciascia, 2006). In addition, core strength ensures adequate body balance and alignment (Zattara and Bouisset, 1988).

The plank exercise is widely used to increase core strength and can be used as a measure of core muscular endurance. However, there are currently no established norms for this exercise. Other common exercises such as a push-up or a sit-up have fitness norms in place to classify an individual into a fitness category and help individuals identify gaps in their muscular strength and endurance. Establishing normative values for the plank exercise provides a measure of core strength and endurance that can be related to overall muscular fitness. The purpose of this study was to establish normative values for the standard plank exercise.

## Methods

One hundred sixty eight participants were recruited to participate in this study through on campus advertisements and emails. The study protocol was approved by the Linfield College Institutional Review Board. Subjects who were not apparently healthy as defined by the American College of Sports Medicine Guide for Exercise Prescription (ACSM), were excluded, as well as those who were pregnant. Upon arrival to the lab, participants:

- Read and signed an informed consent and a physical activity readiness questionnaire (PAR-Q)
- Height and weight was measured using a standard scale.
- A warm up was completed by jogging in place for five minutes.

Participants had the proper plank position described and demonstrated for them by a technician. The correct positioning is as follows:

- Feet placed hip width apart with the ankles at 90° and knees straight
- Pelvis tilted into a neutral position, and back flat
- Elbows bent to 90° and placed directly below the shoulders
- Forearms could be angled in, but the hands could not be clasped together

After the instructions on positioning were given, the procedures were as follows:

- Participants were informed to hold the plank position as long as possible
- Timing began when the participant was in the proper positioning and indicated they were ready to begin, and final time was recorded when form was broken
- A technician ensured proper plank position was held and called out the time at 30 second increments to the participant

For statistical analysis, participants were separated by gender and data were analyzed using SPSS (version 21, IBM, New York, NY). Duration of plank values were then grouped into quartiles and the classifications were made.

## Results

**Table 1. Participant Demographics**

| Parameter | Males (n=73) | Females (n=95) |
|---|---|---|
| Age (years) | 19.92 ± 1.51 | 19.15 ± 1.11 |
| Height (m) | 1.80 ± 0.07 | 1.65 ± 0.08 |
| Weight (kg) | 83.14 ± 13.38 | 64.08 ± 10.01 |
| Plank time (sec) | 116.58 ± 65.49 | 96.25± 43.16 |

means ± SEM

**Figure 1. Plank Times: Female**

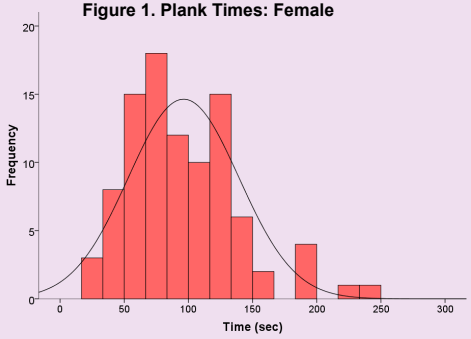



**Figure 2. Plank Times: Male**

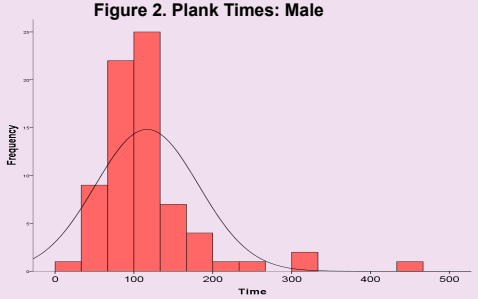



**Table 2. Female Fitness Categories**

| Percentile | Seconds | Fitness Classification |
|---|---|---|
| <25 | <63 | Poor |
| 25-50 | 63-90 | Below Average |
| 50-75 | 91-121 | Good |
| >75 | >121 | Excellent |

**Table 3. Male Fitness Categories**

| Percentile | Seconds | Fitness Classification |
|---|---|---|
| <25 | <77 | Poor |
| 25-50 | 77-106 | Below Average |
| 50-75 | 107-128.5 | Good |
| >75 | >128.5 | Excellent |

## Discussion

The results showed a variety of times participants were able to hold the plank position allowing for the creation of a fitness norms scale ranging from poor <25th percentile, below average 25th -50th percentile, good 50th -75th percentile, and excellent >75th percentile for each gender. Overall the participants represented a variety of fitness levels, however it should be noted that the males who participated in the study overwhelmingly described themselves as being athletes (71 out of 73 males) with 50 of the 73 being active members of an NCAA team at Linfield College. The females showed more variability with 63 out of 95 self describing as athletes and 37 of 95 participating on an NCAA team. On average the male participants were able to hold plank longer than the females at each quartile. An interesting finding was that the mode for both males and females was at 120 seconds, with four participants of each gender ending the test at that time. We feel that participants quit at this time, despite instructions to go to fatigue due to the perception that two minutes is a good time for holding the position based on previous experiences in athletics.

## Limitations

These data are representative of this age only and cannot be applied to individuals younger than 18 or older than 26. Also, this population included a majority of fit individuals, which is not representative of a normal population. Due to the nature of the experiment, those without plank experience likely chose not to participate. Future testing of individuals in older and younger age groups will be necessary to establish a more comprehensive fitness assessment that can be applied across the generations.

## References

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