

# Effects of Plantar Flexion Stretching on Flutter Kicking Time in Competitive Age Group Swimmers

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**Abstract:** This investigation examined the effects of plantar flexion (PF) stretching on flutter kicking time in competitive swimmers. A single blind randomized control study was performed with 19 male and female Wichita Swim Club members (13-17 years old), who were divided into two groups: control or stretching. The stretching group performed PF stretches five times a week for 15 minutes a day. Pre-test measures for PF and 50 yard flutter kicking times were recorded initially then retested after four weeks. Results showed a small significant difference between PF stretching versus no stretching on flutter kicking speed in competitive age group swimmers.

## 1. Introduction

It is believed that ankle plantar flexion plays a substantial role in speed by allowing swimmers to propel their bodies forward more efficiently. A study by McCullough and colleagues found that ankle flexibility was a strong predictive measure of flutter kick speed in competitive and non competitive swimmers.<sup>1</sup> However; there is limited research regarding the correlation between PF stretching and flutter kicking time (FKT) in competitive swimmers. Flexibility is a key component of efficient propulsion in competitive swimming. To acquire and maintain flexibility, many swimming programs implement a routine that includes glenohumeral and trunk stretching. However, these programs fail to give strong focus to the ankle. Most swimmers don't participate in a regular ankle stretching regimen and may lack ankle flexibility. The flutter kick maintains the optimal body position to increase propulsion, minimize resistance, and assist an economical body roll.<sup>2</sup> It was hypothesized that improving ankle plantar flexion would have a positive impact on the entire stroke resulting in a more efficient technique. The purpose of this study was to investigate the effect of PF stretching on speed in competitive age group swimmers. "Age group swimmer" refers to swimmers who are under the age of 18. It is hypothesized that there will be a significant difference between PF stretching and no stretching on FKT in competitive age group swimmers after four weeks.

## 2. Experiment, Results, Discussion, and Significance

### Participants

This experimental design used 19 swimmers between the ages of 13 and 17 from the Wichita Swim Club. After they completed an assent form and their guardians' a consent form, the subjects were randomly assigned to a stretching group or control group. The control group was instructed not to do any ankle stretching during this study. This was a single-blind study because the testers, Wichita State University Doctor of Physical Therapy students (WSU DPT), were unaware of group designations. The coach was responsible for recording daily attendance, administering the stretching regimen, and initiating start-time for each trial.

### Procedure

1. Day one, after warm-up, each swimmer drew either the letter A or B, which established their group -- stretching or non-stretching. The swimmers were unaware of which group would perform the stretching regimen. Then an initial measurement of each swimmer's PF and FKT over 50 yards was taken using the following methods.
  - a. A swimmer was asked to sit in a long-sitting position, plantar flex feet as far as was able, and hold that position while a designated WSU DPT student measured the angle of PF of both feet using a goniometer.
  - b. The swimmer proceeded to one of two lanes and performed 50 yards of flutter style kicking with a kickboard placed under the arms to keep the upper extremities stable and a snorkel breathing device to keep head neutral in the water.
  - c. Four other designated WSU DPT students (two per lane) timed and recorded the swimmer's 50 yard time with a stop watch and averaged recorded times.

2. Steps A-C was repeated with the remaining swimmers.
3. The swim coach picked one of two blank envelopes. One envelope held a stretching regimen, while the other included only a piece of paper establishing that this group would be the control group. This was a single-blind study, so the choice of envelope was unknown to the WSU DPT student testers. The swim coach was then instructed by the WSU DPT students in a stretching regimen that selected swimmers would be required to perform independently at the Wichita Swim Club for the duration of the study. The stretching regimen was as follows:
 

Ankle Stretching #1: Swimmer sits on heels with toes flat. Using both hands behind trunk, the swimmer leans back as far as tolerated holding for one minute with a 30 second rest. Repeat three times per day after swim practice.

Ankle Stretching #2: Swimmer sits tall on the edge of a firm chair or bottom level bleacher then points and brings right foot underneath the chair or bleacher. A gentle downward pressure through the right foot is held for one minute, followed by 30 seconds of rest by releasing the pressure and bringing the foot forward into normal sitting position. Repeat this sequence two more times on the right followed by left foot. Perform one time per day.
4. On the fourth Thursday a post-test was done following swim practice repeating steps A-C.

### Data Analysis

After collecting and averaging range of motion (ROM) measurements of both left and right ankles, timed flutter kick trials, and time in/out of the water throughout the study from each swimmer, the data was analyzed comparing the control group to the stretching group by implementing an independent t-test and a correlation coefficient. A significant difference using an alpha level less than 0.05 was used to reject the null hypothesis.

### Results

Of the 19 participants, four people were excluded due to scheduling conflicts on post-testing day. The results indicated a significant difference between the stretching and non-stretching groups on the variable of swim time as well as ROM. Tables 1 and 2 represent the means and standard deviations for pre-test/post-test scores for both groups (stretching and control group) for ROM differences and time differences.

Table 1: Bilateral Ankle PF ROM Differences (degrees)			
Group	Mean	N	Std. Deviation
Stretching	3.8333	9	3.79967
Control	7.1667	6	5.31664
Total	5.1667	15	4.60460

Table 2: Swim Time Difference (seconds)			
Group	Mean	N	Std. Deviation
Stretching	-.5378	9	1.17535
Control	1.0533	6	1.43659
Total	.0987	15	1.47562

### Discussion

The results of this study demonstrated a significant difference between PF stretching and FKT among competitive age group swimmers. It was expected that PF stretching would decrease FKT, and correlate with an increased PF ROM. However, participants in the stretching regimen showed a smaller increase in PF ROM while decreasing FKT compared to those in the control group with a greater increase in ROM and increased FKT. With a small sample group, it is hard to determine if stretching affects speed alone or if other factors such as other sports, age, ankle ROM in other planes, or instrumental error could affect the results. Test-retest reliability was .954 with PF ROM measurements lessening human error. Fatigue may have posed a problem; however, time spent out of the pool after warm-up was measured and found not to be significant. Further studies may be done using different time periods and different types of stretches. Other studies concluded that static stretching before activities decreases athletic performance.<sup>3</sup> Thus, comparing static stretching to other stretching techniques, such as dynamic stretching, may find differing effects on athletic performance and ROM.

### 3. Conclusion

In conclusion, this study indicates that PF stretching is effective to a small degree to improve FKT compared to non-stretching. Both groups showed an increase in PF ROM. The control group showed an increase in FKT while the swimmers in the stretching group had a decrease in FKT. Many factors could have contributed to this unexpected result. Overstretching already excessive PF ROM could have resulted in a negative effect on the PF ROM. These results show that stretching may play a significant part in improving the swimming speed of competitive age group swimmers, but further research with a larger sample size is needed in this area to confirm.

### References

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