Effect of Warm-up With Different Weighted Bats on Normal Baseball Bat Velocity

Brian S. Montoya, Lee E. Brown, Jared W. Coburn, and Steven M. Zinder

Human Performance Laboratory, Department of Kinesiology, California State University, Fullerton, California

Abstract

Montoya, BS, Brown, LE, Coburn, JW, and Zinder, SM. Effect of warm-up with different weighted bats on normal baseball bat velocity. *J Strength Cond Res* 23(5): 1566–1569, 2009– Traditionally, baseball players have used a heavy bat for warm-up before competition. Because bat velocity is an essential component to hitting a baseball, and because players warm up differently, there is a need to investigate the best way to maximize post warm-up bat velocity. The purpose of this study was to determine the effects of warm-up with different weighted bats on normal baseball bat velocity. Nineteen recreational male baseball players (age, 24.5 ± 3.9 years; height, 181.1 ± 8.4 cm; body mass, 87.9 ± 18.4 kg) participated in this study. Three different randomized warm-up conditions were completed and analyzed for velocity and for their effect on post warm-up normal baseball bat velocity. Subjects were instructed to perform 5 maximal swings with each of 3 different weighted bats–light (LB = 9.6 oz), normal (NB = 31.5 oz), and heavy (HB = 55.2 oz)–followed by 30-second rest and then 5 swings of the NB. Analysis of variance revealed that warm-up velocity of the LB (63.57 ± 3.58 mph) was significantly ($p < 0.05$) faster than that of NB (51.25 ± 3.01 mph) and HB (41.79 ± 3.01 mph), whereas warm-up velocity of NB was also significantly faster than that of HB. For post warm-up, LB (52.29 ± 2.68 mph) and NB (50.60 ± 3.04 mph) produced significantly faster velocity of the normal bat than the HB (48.26 ± 2.98 mph). Warming up with 5 swings of a light or normal bat appears to increase post warm-up velocity of the normal bat when compared with warming up with a heavy bat after a rest period of 30 seconds. Within the bat weight spectrum of this study, it is suggested that when preparing to hit, 5 warm-up swings with either a light or normal bat will allow a player to achieve the greatest velocity of their normal bat.

Key Words hitting, specificity, speed

Address correspondence to Dr. Lee E. Brown, leebrown@fullerton.edu.

23(5)/1566–1569

Journal of Strength and Conditioning Research

Introduction

Baseball is a game of many skills, including fielding, throwing, and hitting. Within a practice session, a tremendous amount of time is spent training the baseball swing to enhance performance in game situations. There are many variations of the swing (10,14), but they all share one very important common aspect: bat velocity. Bat velocity is commonly referred to as bat speed or swing velocity and is an important component to successful hitting (4,6). Because the pitched baseball is coming at the batter at a very fast velocity, the bat must be swung at a fast velocity to hit the ball (1). Once the hitter decides to swing, the velocity of the baseball bat is important because maximum bat velocity meeting maximal ball velocity will produce maximal force against the baseball, thus resulting in maximal velocity and distance of the hit ball (1). In an attempt to increase bat velocity, coaches have players warm up using different techniques (3,9). Also, different training programs to increase bat velocity are specific to the muscles involved (7,12,13,15). Therefore, it would also seem appropriate to have warm-up programs follow the same rule of specificity.

Traditionally, baseball players have used a heavy bat in the on-deck circle for warm-up before competition. Many players stretch or swing a heavier bat to get themselves ready to compete when it is their time to bat. This warm-up consists of similar swings of varying velocities and bats of different weights. These warm-up swings are easy to perform, but they may increase or decrease normal bat velocity (8,11). Most players who participate in this type of warm-up before their at-bat commonly feel it helps them increase their bat velocity (8). A common warm-up implement seen on the on-deck circle is a baseball bat with a weighted donut placed on it. Players will warm up with this heavy bat and then switch back to their normal bat with the intent of increasing swing velocity. However, previous research has shown that swinging a heavy bat in warm-up produced a decrease in normal bat velocity of college players (8). They also demonstrated that players felt the warm-up helped them increase bat velocity because after the warm-up with a heavy bat, the normal bat felt lighter and felt they could swing it faster (8). In this case, the donut had a positive mental effect yet a negative physical effect on actual normal bat velocity.

Other studies have examined the effects of warming up on bat velocity with a wide range of weighted bats. One study demonstrated that bats weighing between 27 and 34 ounces produced the greatest amount of post warm-up normal weight bat velocity with the lightest and heaviest bats producing the slowest post warm-up velocities (5). Similarly, other studies have also demonstrated decreased bat velocity when a warm-up with a heavy bat was performed and then compared with a light and regular bat (2,11).

Because there are a multitude of recreational baseball players currently participating in various leagues throughout the nation and there is a paucity of research on this population, we sought to investigate them. Also, based on some conflicting previous research, there is a need to investigate the effect of weighted bat warm-up on bat velocity using traditional (heavy donut) and nontraditional (light plastic bat) means. Therefore, the purpose of this study was to determine the effect of warm-up with different weighted bats on normal baseball bat velocity in recreational players.

Methods

Experimental Approach to the Problem

We were interested in investigating what effect traditional on-deck circle warm-up routines had on ultimate baseball bat swing velocity in recreational players. Therefore, this study used a repeated-measure design by having subjects swing 3 differently weighted bats 5 times and then swing a normal bat after 30 seconds of rest. This activity mimics that done in a real baseball game situation from the on-deck circle to home plate.

Subjects

Nineteen recreational male baseball players participated in this study (age, 24.5 ± 3.9 years; height, 181.1 ± 8.4 cm; body mass, 87.9 ± 18.4 kg). All subjects had previous competitive athletic baseball experience at either the high school or junior college level. Only position players (no pitchers) who participate in hitting during recreational games were allowed to participate. Each subject read and signed a university institutional review board–approved informed consent form before participation.

Procedures

On the first visit, each subject completed a general warm-up by cycling for 3 minutes on an upper-body ergometer at 50 rpm and was then randomly assigned to one of 3 conditons: light bat (33 in./9.6 oz), normal bat (33 in./31.5 oz), or heavy bat (33 in./55.2 oz). The choice of different bat weights was made according to the normal average bat weight used by subjects and previous research (4), a commerically available average donut (23.7 oz) and a commerciallly available light plastic bat. To maximize velocity in our study, we used a much lighter plastic warm-up bat than previously used (2,4–6).

All subjects stood on a batter's box grid and had their rear heel position recorded to ensure body position replication on subsequent visits. The batter's box grid was a 3 × 5-foot rectangle comprised of 2-in. squares, which ensured the subject was in the same starting position for every swing. The grid was situated in front of a custom bat velocity measurement device, which consisted of 2 vertical photoelectric sensors (Model E3Z; Omron Electronics, Schaumburg, IL) seperated by 45 cm (the depth of home plate) (Figure 1). The sensors were situated so they were coincident with the front and rear of the simulated home plate. Therefore, each subject positioned themselves at the plate in the same manner they would in a real hitting situation. Subjects swung the bat through the device breaking the 2 sensor lights in succession, which sent signals to a data acquisition computer sampling at 10,000 Hz (as a result of very high bat velocity and a very short distance between sensors) running custom LabView (version 7.1; National Instruments, Austin, TX). Distance traveled (45 cm) was then divided by time (4 decimal places) between the 2 signals, resulting in average bat velocity. Reliability measurement on this procedure with a subset of 9 subjects resulted in a significant ($p < 0.001$) intraclass correlation coefficient of 0.94.

After the general warm-up, subjects were not allowed any familiarization swings. Each subject then completed 5 maximal warm-up swings (i.e., swing as fast as possible) with each of the 3 different bats on 3 different days separated by at least 48 hours. After each swing, they were instructed to reset

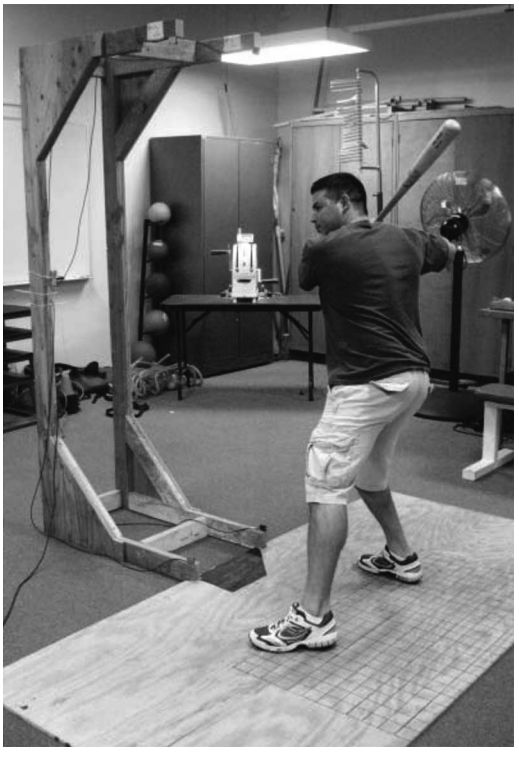

Figure 1. Custom bat velocity measurement device and batter's box grid.

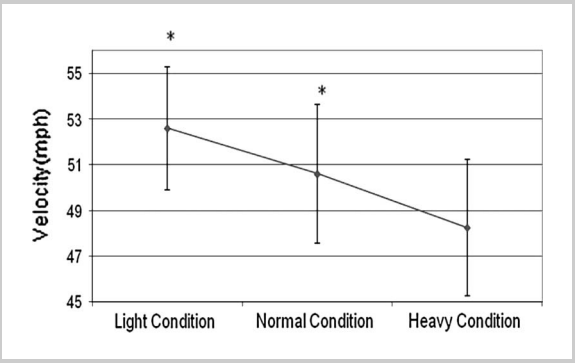

Figure 2. Normal weight bat velocity (mean ± *SD*) after 3 different warm-up conditions. *Significantly ($p < 0.05$) faster than heavy bat condition.

their batting stance (rear heel) on the grid. After the warm-up swings were completed, they rested for 30 seconds and then completed 5 maximal swings with a normal bat through the recording apparatus. The velocity of the 3 warm-up conditions and of the post warm-up normal bat swings were all recorded for analysis.

Statistical Analyses

Two 1 × 3 (bats) repeated-measures analyses of variance were performed to determine differences in warm-up velocity of the 3 conditions and to determine post warm-up velocity of the normal bat. Alpha was set a priori at 0.05. Significant differences among the 3 bats were followed up with pairwise comparisons with Bonferroni correction. Sphericity was not violated in either analysis.

Results

Warm-up velocity of the light bat (63.57 ± 3.58 mph) was significantly ($p < 0.05$) faster than that of the normal bat (51.25 ± 3.01 mph) and the heavy bat (41.79 ± 3.01 mph), whereas warm-up velocity of the normal bat was also significantly faster than that of the heavy bat. For post warm-up velocity of the normal bat, the light bat condition and normal bat condition produced significantly ($p < 0.05$) greater velocity than the heavy bat condition (Figure 2).

Discussion

The purpose of this study was to determine the effect of warming up with 3 different weighted bats on normal baseball bat velocity. The main finding was that a light and normal bat warm-up produced significantly faster post warm-up velocity of the normal bat than a heavy bat condition. As expected, the 3 weighted bats were swung at different velocities during the warm-up conditions. The light bat was the fastest followed by the normal bat and then the heavy bat.

A previous similar study also demonstrated decreased bat velocity when warming up with a heavy bat compared with warming up with a light or regular bat (11). They used warm-up bats that were very close in weight to the ones used in our study, and they used a 5-swing warm-up condition followed by 5 post warm-up swings with a normal bat. They found no difference between light and normal conditions, but velocities of both conditions were faster than that of the heavy condition, thus supporting our research findings.

Our findings are also similar to those of another study (8), which found that a decrease in normal bat velocity occurred when male and female college players warmed up with a weighted implement. Their main finding was that after warming up with 5 swings of a heavy bat, the first post warm-up swing with a normal bat was significantly slower. However, the mean velocity of the next 4 swings was not significantly slower. The heavy bat warm-up condition in our present study produced significantly slower maximum velocity of the normal bat than did the light and normal warm-up conditions. The main difference between our studies was that their time between warm-up swings was 15 seconds, whereas we only allowed our subjects enough time to reset their rear heel stance and then swing again when ready (approximately 5 seconds). The additional 10 seconds supplied by the previous study may have allowed any effects of the heavy bat condition to wear off and the last 4 swings to return to a normal velocity.

Yet another study demonstrated that bats weighing between 27 and 34 ounces produced the greatest amount of post warm-up velocity of the normal bat (5). We found that a bat as light as 9.6 oz produced the same amount of velocity as a normal bat of 30 oz and that both produced more velocity than the heavy bat. The heaviest bat used by the previous study was 64 oz and the lightest bat was 23 oz, with each producing the slowest normal bat velocities. However, their warm-up condition was 4 swings followed by 2 swings of a normal bat compared with our warm-up condition, which was 5 swings followed by 5 swings with a normal bat. Therefore, our conditions consisted of greater extremes in regard to swing dose and bat weights, which may explain the different results.

In a similar study, Division I-A baseball players used variable velocity warm-up with a spectrum of bats from lightest to medium to heaviest (2). They found that medium bats increased normal bat post warm-up velocity, whereas the lightest and heaviest bats decreased normal bat velocity after the warm-up. We found similar results with regard to the heavy bat but different results with regard to the light bat. Our light bat warm-up had the same effect on the normal bat as warming up with the normal bat and both produced faster velocities than a heavy bat warm-up. This may be explained because the other study only used a 3-swing warm-up and a 3-swing post warm-up test, whereas we used 5 swings for both. Once again, our greater volume could possibly explain the differences.

In our study, we measured and analyzed the maximum post warm-up velocity of a normal bat, whereas previous studies have used mean velocity. Maximum velocity as well as mean velocity may be important aspects after warm-up in the

on-deck circle. If a batter swings at the first pitch, then post warm-up maximum velocity may be more appropriate. However, if the batter swings numerous times, then mean post warm-up velocity may be more appropriate. We felt maximum velocity would be a more useful indicator of performance because maximum bat velocity results in greater batted ball velocity (1).

Another difference between our study and previous studies was subject population. Most previous studies used college baseball players, whereas we used recreational players. Therefore, college baseball players might be engaged in a regular practice schedule as compared with our recreational players who may only play on the weekends. This difference might allow recreational players to demonstrate a greater post warm-up effect as a result of being less trained and beginning with lower swing velocity, thus leading to a greater potential training effect.

Also, our study used extreme differences in bat weights. We used a much lighter bat than previously used but similar normal and heavy bats when compared with other studies (2,4–6). This extreme in bat weight may account for our results. We also only had 2 different physical bats (light and normal) and used a donut attached to the normal bat to make up the heavy bat, therefore making them the same with regard to length but varying only in weight. Using different swinging implements such as a power swing or a different bat for each weight (5) may alter other biomechanical aspects (11,14). The conditions in our experiment were very practical to the real on-deck circle situation in that all was needed in the laboratory was a normal bat, a donut, and a light plastic bat.

Although the present study used recreational baseball players, we feel the results might transfer to an athletic population. Our subjects all had competitive athletic experience in high school or junior college, meaning that they were closer to an athletic population than a sedentary population. Also, previous research (2,4–6) using athletes have shown similar results to ours, albeit with slightly different implements. Therefore, there is a need for future research in this area with high-level athletic populations and women while using extreme bat weight differences like in this study.

Practical Applications

When preparing to hit in a real game situation, a player in the on-deck circle is not only trying to warm up the muscles used during the swing but also attempting to maximize bat velocity when they step up to the plate. Traditionally, this has been accomplished through the use of a heavy donut attached to the bat; however, this may be detrimental to bat swing velocity. Within the bat weight spectrum of this study, it is suggested that 5 warm-up swings with either a very light bat (approximately 10 oz) or a normal bat (approximately 31 oz) will allow a player to achieve maximum velocity of their normal bat. The use of warm-up swings with a heavy donut attached to the bat is discouraged because this appears to reduce speed when returning to the normal bat.

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