IMMEDIATE EFFECTS OF WARM UP BY OVERWEIGHED BAT IMPLEMENT ON BAT SWING VELOCITY

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The purpose of this study was to investigate the immediate effects of warming up by overweighed bat implement on bat swing velocity. Five softball players worked in this experiment and processed the following steps: swing official bat with and without overweight warm-ups (5 and 10 times). The maximal velocity of official bat swing was recorded by a 3-D cinematograph. By one-way ANOVA, the results were described as follows: the maximal velocity of official bat swing after 5-swingings of the overweight bat was greater than that without warm up ($F=9.28$, $p<.05$), and the maximal velocity of official bat swing, after 10-swingings of the overweight bat, with the increasing tendency, but without significant difference compared to swinging without warm up.

KEY WORDS: official bat, overweighed bat, swing velocity.

INTRODUCTION: Baseball and softball are popular exercises nowadays. It is easy to see the popularity according to its development in schools and companies. Since baseball and softball are formal items in Olympic games, some countries have been practising them quite well. Some techniques and skill performances have already shown delicacy and exquisiteness rather than taking the offensive and defensive like before. Nowadays, baseball and softball emphasize on "velocity". For instance, how to increase the swing velocity at the instant of hitting the ball is one of the main problems in which the coaches are interested. As far as batting is concerned, it is a key point for getting scores and is essential in the training process. A batter usually warms up with overweighed swinging with alternative bats or adds lead lumps on-deck circle. According to the results that researchers obtained most contestants felt the swing velocity would increase, if the overweighed bats to warm up. In the study of Sergo & Boatwright(1993) it was proved that to practice for a period of time was required in order to improve the batting velocity. Does it really increase the batting velocity warming up with an overweighed bat? Or is it just for the psychological effect? It is necessary to process some relevant researches in order to clarify this matter. The concrete purpose is are interested, first, to discuss the immediate effects of official bat swing velocity, after swinging the overweighed bat; and second, to search whether overweighed-bat swing warm up helps increase the swing velocity, after the second batter enters into the batter's box (about two minutes later averagely).

METHODS: Five softball national team players took part in this study, and their personal data are mentioned in Table1. In order to avoid affecting the swing velocity, the participants would not be completely informed of this experimental purpose.

Table 1. Participants' information.

	Age (year)	Height (cm)	Weight (kg)	Experience (year)
Mean	22.2	162.2	61.4	9
SD	2.8	4.8	4.9	3

N=5

3D space photographic analysis was used in this study. Two Redlake high-speed video cameras (frequency 250Hz; shutter 1/2000) installed 25 m far from participant's position were synchronized to film the participant's swinging motion. The data were analyzed with motion analysis system(Peak Performance) and statistical software SAS. The actual swing velocity would be proceeded and analyzed by the repeated measures of one-way ANOVA and would be compared to HSD to test the hypotheses. The alpha level for all statistical tests was set at the level of 0.05. After warming up for ten minutes, according to the principle of counter balance, every participant was allotted five swinging sequences to test official bat swing after

every step mentioned below: 1.Official bat swinging (weight: 737.087 g). 2. Official bat swinging after 5-swingings of overweighed bat (weight: 1150 g). 3. Official bat swinging after 2-minute rest after step 2. 4. Official bat swinging after 10 swings of overweighed bat. 5. Official bat swinging after 2-minute rest post to step 4. Batting Tee was made a few adjustments to the appropriate individual height and getting ready. Participants started to swing, after the indicator lamp was on. Participants swung once with the official bat as a reference material for swing velocity; they swung the official bat after separately swinging the overweighed bat five and ten times, and then swung the official bat after two minutes rest. The whole process of official bat swinging was filmed to calculate the velocity of the proximal-end point of the bat.

RESULTS: *Performing differences of swing velocity between after 5-swingings of overweighed bat and after two minutes additional rest:* Table 2 showed the parametric differences of the performance. According to Figure1, the maximal swinging velocity (MSV) with and without 5-swingings of overweighed bat warm-up was 27.68±0.54 m/s and 25.74±1.6 m/s, respectively. That difference reached the significant level ($F=9.28$, $p<.05$)with increasing bat velocity. Figure1 also showed that the maximal velocity after two minutes rest was 26.93±2.6 m/s, the difference compared to that of the official bat swinging was not significant ($F=1.53$, $p>.05$). In the analysis of Figure 1, the swing velocity after rest was close to the swing velocity of using an official bat. *Performing differences of swing velocity between after 10-swingings of overweighed bat and after two minutes additional rest:* Table 2 showed the parametric differences of the performance. According to Figure1, the MSV with 10-swingings of overweighed bat warm up was 27.99±1.71 m/s, but there was no significant difference compared to the official bat velocity ($F=5.79$, $p>.05$). After two minutes rest, the swing velocity was 26.97±2.72 m/s, there was no significant official bat velocity ($F=1.47$, $p>.05$). According to Figure1 the maximal linear velocity was closer to the official bat swing velocity when the swing velocity decreased. This indicates the dominance of swing velocity decreased after two minutes rest.

Table 2. The original data of the maximal linear velocity of swinging the overweighed bat five, ten times and of the official bat.

Participants	The types of swinging				
	Official bat	After swinging overweighed bat five times	After two minutes rest	After swinging overweighed bat ten times	After two minutes rest
1	26.18	27.35	30.97	30.69	26.45
2	25.62	27.44	26.06	26.09	25.55
3	23.20	27.63	24.45	27.74	24.10
4	27.60	28.63	27.92	28.27	27.44
5	26.09	27.34	25.23	27.14	31.33

Unit: m/s

DISCUSSION: *Official bat swing after swinging overweighed bat:* After 5-swingings of the overweighed bat warm-up, the MSV through exchanging into given units increases from 25.74 m/s up to 27.68 m/s, and an increasing percentage was about 3-19% with significant difference. On swinging the overweighed bat ten times as a warm up, the maximal linear velocity through exchanging into given units increased from 25.74 m/s up to 27.99 m/s, and an increasing percentage was about 1-19% without significant differences. However, the swing velocity was obviously increasing. The result of this experiment revealed that softball players adapted to physical stimulus of overweighed-bat weight and raised the thresholds of weight following the conducting overweighed-bat swing. Therefore, they felt the official bat weight lighted and strengthened control over the bats. This result showed that the softball players' feeling of batting swing corresponds to the realistic consequence. That is, some receptors will lose sensitivity when someone is individually subjected to a string of consecutive stimulus. That meant nervous movement and consciousness will not reflect the

physical reality any more (Shao, 1993).

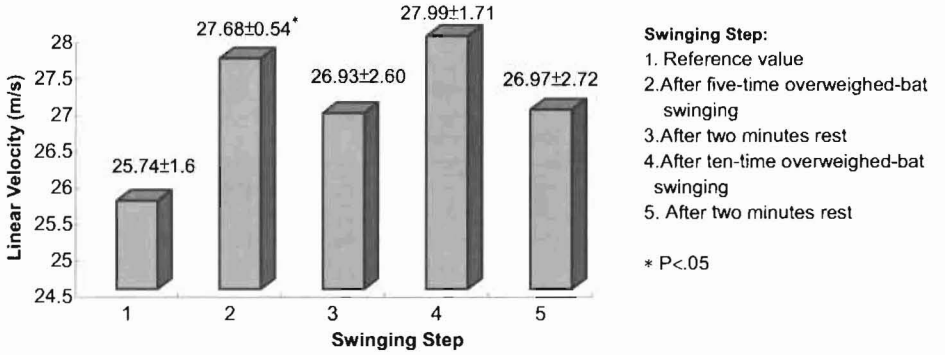

Figure 1. Maximal linear velocity.

After two minutes rest: Softball players swung the overweighed bat five times and then took a two-minute rest. The maximal linear velocity of official bat swing was decreased from 27.68 m/s down to 26.93 m/s, and the decreasing percentage was approximately 2-13% without significance (P>.05), compared to reference value 25.74 m/s. Softball players swung the overweighed bat ten times and then took a two-minute rest. The maximal linear velocity of the official bat swing was decreased from 27.99 m/s down to 26.97 m/s, and the decreasing percentage was approximately 2-17% without significance (P>.05), compared to reference value 25.74 m/s. That was because the force of the muscular contraction sense was transmitted from neural motor signals to the motoneuron, so that the muscle produced motions. These motor signals transmitted to CNS once more reflected transmission quantity, and responded to the commended action through CNS, controlling peripheral nervous system. The extension of muscle made the golgi tendon stretch longer, further stimulated the discharges of centripetal nerves and then back to CNS through the peripheral nervous system and spread separately on the sensory receptors of different muscles. When receiving the signal from receptors, the muscle had potential back to CNS. (Crago, Houk, & Rymer, 1981). However, this sense just has a short-term memory for 60 seconds on the peripheral nervous system (DeOreo & Williams, 1980). The softball players' adapted dominance was weakened at that period when entering the batter's box and seeing signals and balls that the pitcher threw. So the swing velocity also got slower and slower. This proved Sergo et al. (1993) study and indicated the improvement and stability of swing velocity needed practicing for a period.

CONCLUSION: According to this study, the results provide the information that swinging an overweighed bat in a warm up on-deck circle will have immediate effects over the softball players on improving the swing velocity, and the swing velocity of swinging the overweighed bat five times is better and faster than that of swinging the overweighed bat ten times. But the swing immediate dominance tends to decrease after two minutes rest.

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