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ORIGINAL ARTICLE

The Acute Effect of Different Specific Warm-up Phases on 1-Repetition Maximum Bench Press Results

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ABSTRACT

Background: Warm up is important to maximize the performance of exercise participants in different resistance exercise activities. In addition, bench press performance may differ according to warm-up types, warm-up phases and intensity.

Aim: The present study investigated the acute effect of different specific warm-up phases on 1-RM bench press performance.

Methods: Fourteen male volunteers between the ages of 18-25 and exercise regularly for two days a week, participated in the study (age, 21.64± 2.09 years; height, 174.21± 5.48 cm; 69.43± 7.19 kg; BMI 22.84±1.69). This group performed 4 different specific warm-up phases on non-consecutive days. Specific warm-up phases consisted of only eight minutes of light-intensity aerobic run (Nw), five minutes of light-intensity aerobic run + 3 sets of 30 seconds repetition and 30 seconds rest specific warm-up phases (30sw-30sr), five minutes of light-intensity aerobic run + 3 sets of 40 seconds repetition and 20 seconds rest specific warm-up phases (40sw-20sr), five minutes of light-intensity aerobic run + 3 sets of 20 seconds repetition and 40 seconds rest specific warm-up (20sw-40sr) phases.

Results: The 1-RM bench press' values observed after the 20sw-40sr (72.86±6.99) protocol were reported to be better than 30sw-30sr (62.14±6.71), 40sw-20sr (58.57±9.07) and Nw (57.86±11.72), respectively. In addition, it was determined that there was find statistically significant difference between the 1-RM bench press values [F(1,522)= 24,981 p= ,000, partial eta squared: ,658] reported after Nw, 30sw-30sr, 40sw-20sr and 20sw-40sr protocols (p< .05).

Conclusion: As a result of this study, 20sw-40sr are recommended to coaches and exercise participants in order to get more performance before bench press movement.

Keywords: Strength, Upper Body, Warm up.

INTRODUCTION

Muscular strength is one of the basic principles of a person's physical development and is extremely important. In addition, in everyday life they often cannot cope with the difficulties associated with the manifestations of maximum strength tensions, since the physical education system of young students practically does not use intensive, technically correct strength exercises[1,2]. In addition, it is important to increase body and muscle temperature in order to prevent micro-traumas that may cause injuries to the muscles while performing maximum strength activities[3]. One of the methods of increasing body and muscle temperature is warm-up activities.

Pre-exercise warm-up is a common practice defined as necessary to maximize the athlete's performance in different sports and physical activities by increasing muscle temperature, nerve conduction velocity, blood flow, and body temperature. However, both passive and active warm up can evoke temperature, metabolic, neural, and psychological effects, including increased anaerobic metabolism, higher oxygen uptake kinetics, and post-activation potentiation[4]. Moreover, warm up before exercise or competition can increase the efficiency of muscle glycolysis and high-energy phosphate degradation during exercise by increasing muscle temperature, muscle metabolism, and muscle fiber conduction velocity, resulting in a positive change in muscle contraction following previous contractile activity of VO_2 kinetics. It can improve muscle function by influencing muscle cross-bridge cycle rate and oxygen uptake kinetics[5]. In studies focusing on the effect of warm up on performance development, it has been reported that it improves individual (for example, judo, swimming) and team sports (basketball, volleyball)[6–9].

However, the different results of the warm-up methodologies that affect performance development, such as the type, intensity, phases, and duration, indicate that more research is needed for the literature. Also, little is known about the impact of different warm-up methodologies on performance in some other specific activities such as resistance training[10–13].

More research is need to examine the effects of standardized specific warm up activities on different repetition and resting modalities. These studies can be differentiated by consisting different methodologies. The purpose of this study was to examine the acute effect of different specific warm-up phases on 1-RM bench press performance. The hypothesis of the study is that 3 sets of specific warm-ups in the form of 20 seconds of repetition and 40 seconds of rest can better improve 1-maximal repetition performance.

MATERIAL AND METHODS

Participants: A criterion sampling method was used to determine the sample group. Volunteers were selected using the inclusion criteria. Volunteers did not have any health problems in performing tests and practicing exercises. The consent of all volunteers was obtained, and their participation was ensured regularly. This study is approved by Human Research Ethics Committee of the Inonu University (IU) (2021/2521). Fourteen male

volunteers between the ages of 18-25 and studying at the faculty of sports sciences, who exercise regularly for two days a week, participated in the study (age, 21.64± 2.09 years; height, 174.21± 5.48 cm; 69.43± 7.19 kg; BMI 22.84±1.69). All participants were informed about possible risks and details before starting the study and a voluntary consent form was signed. In addition, the participants were asked to sleep for 7-8 hours before the tests. All tests and training practices were performed at the same time of the day (09.00-12.00). All participants were required to keep to the same training, recovery, and diet habits during the evaluation days. They had to avoid vigorous exercise, refrain from smoking and consuming caffeine and ergogenic aids for 48 hours before testing days.

Experimental Design of the Study: Anthropometric measurements of the volunteers were determined before starting the study. All volunteers who accepted to participate in the study were given necessary information about the content, place and time of the study before starting. The content of the study consisted of four different specific warm-up phase protocols. Specific warm-up phases consisted of only eight minutes of light-intensity aerobic run (Nw), five minutes of light-intensity aerobic run + 3 sets of 30 seconds repetition and 30 seconds rest specific warm-up phases (30sw-30sr), five minutes of light-intensity aerobic run + 3 sets of 40 seconds repetition and 20 seconds rest specific warm-up phases (40sw-20sr), five minutes of light-intensity aerobic run + 3 sets of 20 seconds repetition and 40 seconds rest specific warm-up (20sw-40sr) phases. Specific warm up applied protocols consisted of different phases (Nw, 30sw-30sr, 40sw-20sr, 20sw-40sr) and protocols carried out with the same metronomes (80 bpm). In addition, each protocols consisted of 8 minutes. Volunteers performed protocols consisting of different warm-up phases on consecutive days. Prior to the study, % 40 percentage of the volunteers' heart rate (HR) were calculated for the study's light-intensity jogging. In this context, individual standardization of mild intensity running was achieved (polar h10-Malaysia)[14,15]. In addition, the volunteers' performed 6 maximum repetitions (6-RM) tests in the session without specific warm-up. 6-RM was converted to 1 max rep (1-RM) using Brzycki equations (1-RM= (Weight lifted/ (1.0278 – (0.0278 ×Repeats))[16]. Body weights were measured with an electronic scale (Tanita SC-330S, Amsterdam, Netherlands) with an accuracy of 0.1 kilograms (kg). During the measurement, the height of the participants was measured with a stadiometer (Seca Ltd., Bonn, Germany) with precision of 0.01 meters (m). Body mass index and body fat ratios of all volunteers were measured and recorded with an electronic scale (Tanita SC-330S, Amsterdam, Netherlands)[17]. The experimental design of the research is visually reported in the flowchart below (Figure 1).

Statistical Analysis: All statistical tests were processed using SPSS Software 25 (SPSS, Inc., Chicago, IL, USA). “Repeated Measures Anova” was used to determine the effect of different specific warm-up phase protocols (Nw, 30sw-30sr, 40sw-20sr, 20sw-40sr) on 1-RM bench press performance. "Bonferroni" analysis, one of the multiple comparison tests, was used to determine which specific warm-up phase protocols favored the performance. Mauchly Test was used for homogeneity of variances and Greenhouse-Geisser correction factor was used to correct for variances. Data were expressed as mean±standard deviation ($\bar{x}$ ±ss) and significance level was accepted as $p<0.05$.

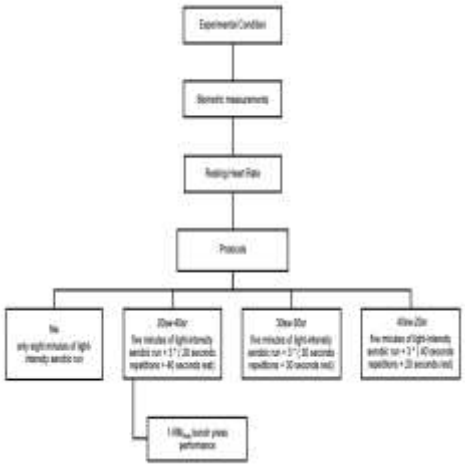

Figure 1: Experimental Design

RESULTS

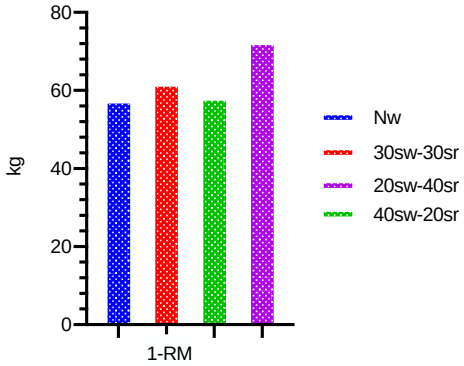

Figure 2: The differences on 1-RM bench press performance values after different warm-up phases protocols (Nw, 30sw-30sr, 40sw-20sr and 20sw-40sr).

Figure 2 shows the difference in 1-RM bench press performance values of volunteers after different phases of warm-up protocols (Nw, 30sw-30sr, 40sw-20sr and 20sw-40sr). The 1-RM bench press' values observed after the 20sw-40sr (72.86±6.99) protocol were reported to be better than the values 30sw-30sr (62.14±6.71), 40sw-20sr (58.57±9.07) and Nw (57.86±11.72), respectively. In addition, it was determined that there was no statistically significant difference between the 1-RM bench press values [F(1,522)= 24,981 p= ,000, partial eta squared: ,658] reported after Nw, 30sw-30sr, 40sw-20sr and 20sw-40sr protocols (p< .05). When the different specific warm-up phases are analyzed within themselves, there was find statistical significance between 30sw-30sr and 40sw-20sr, 40sw-20sr and Nw, 40sw-20sr and 20sw-40sr (p< 0.05). The best 1-RM bench press performances were seen in the 20sw-40sr, 30sw-30sr, 40sw-20sr and Nw protocols, from bigger to lower values, respectively.

DISCUSSION

The purpose of the current study was to compare the acute effects of different warm up phases on 1-RM maximal bench press performance. As a result of the study the 1-RM bench press' values observed after the 20sw-40sr protocol were reported to be better than the values 30sw-30sr, 40sw-20sr and Nw, respectively. Bench press performance were selected because there are limited studies in the literature examining the effect of warm-up protocols on 1-RM bench press performance[18,19,25]. In addition, studies examining different warm up phases with a constant metronome speed are not found in the literature of warm up phases.

Akca and Aras (2018) were determined that Intermittent Low Intensity (ILI) substantially improved 1RM bench press performance compared to Constant Low Intensity (CLI), Constant Moderate Intensity (CMI), Intermittent Moderate Intensity (IMI) from high to low respectively[19]. Telles et al., (2020) found that the number of repetitions was higher following ischemic preconditioning (IPC) compared to the specific warm-up (SW) following three sets both for the bench press (BP)[18]. Pullinger et al. (2019) found that there was a main effect for load such that average force (AF) and peak velocity (PV) values were larger at higher masses on the bar than lower ones and time to peak velocity (tPV) was smaller at lower masses on the bar than at higher masses for both bench press and back squat[20]. Ribeiro et al. (2021) showed that after warm-up, the participants were able to perform the squat and bench press at a higher mean propulsive velocity in the first set (squat: 0.68 ± 0.05 vs. 0.64 ± 0.06 m·s−1, p = 0.009, ES = 0.91; bench press: 0.52 ± 0.06 vs. 0.47 ± 0.08 m·s−1, p = 0.02, ES = 0.56). They suggest that the specific warm-up seems to enhance neuromuscular actions that enable a higher movement velocity during the first training repetitions and to allow greater peak velocities in less time[21]. Wilcox et al. (2006) revealed that 1RM bench-press strength was significantly greater after plyometric push-ups (P = .004) or chest passes (P = .025) in comparison with the first trial (123.8 ± 23.5 kg and 124.0 ± 24.1 kg vs 120.9 ± 23.2 kg, respectively). They suggested that an acute bout of low-volume, explosive-force upper body movements performed 30 seconds before a 1RM attempt might enhance bench-press performance in athletic men[22]. The results of the literature and the results of our research are similar in terms of the improving effect of warm up on performance. In this context, since warm-up protocols have the potential to increase 1-RM maximal bench press performance level, it is claimed that warm-up protocols contribute to improving 1-RM bench press performance. However, there are studies in the literature showing that warm-up protocols do not affect bench press performance. Unlike other studies, Ribeiro et al. (2014) determined no significant difference for the sum of repetitions or for fatigue index among conditions for the 3 exercises (4 sets of bench press, squat, and arm curl at 80% of 1RM)[11]. Molacek et al. (2010) determined that there were no significant differences on 1RM bench press performance among any of the stretching protocols nonstretching (NS), low-volume PNF stretching (LVPNFS), high-volume PNF stretching (HVPNFS), low-volume static stretching (LVSS), and HVSS. They conclude that low- and high-volume PNF and static stretching have no significant acute effect on 1RM bench press in resistance-trained collegiate football players[23]. Rodrigues et al. (2020) didn't find any effects of warm-up protocols to modify strength, muscle electrical activity, or skin temperature in the bench press exercise[24]. These research findings are inconsistent with the results of our study. Among the reasons for this discrepancy, factors such as individual differences, current fitness levels, mental condition and training backgrounds of the volunteers participating in the research can be shown.

CONCLUSION

The current study took a novel approach to warm-up research by examining the effects of warm-ups on resistance training using some recent procedures to measure performance. In summary, an increase in 1-RM bench press performance was found after three sets of 20sw-40sr protocol. According to different warm up phase protocol, Nw protocol was the one with worse performances in 1-RM bench press performance. Some practical applications can be drawn. Despite some different responses for different phases of warm up protocols, 20sw-40sr should be use to maximize performance during 1-RM bench press performance. The fact that velocity was not measured in the study and it was not applied to volunteers of different genders can be considered as a limitation of the research. By increasing such studies, the effect of optimum warm-up on 1-RM bench press performance may be important. Our outcomes can provide new insights and recommendations for exercise participants, exercise professionals and researchers to improve training efficiency and optimize performance.

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