

# “PSYCHING-UP” ENHANCES FORCE PRODUCTION DURING THE BENCH PRESS EXERCISE

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<sup>1</sup>University of Wales, Aberystwyth, Aberystwyth, Wales; <sup>2</sup>Centre for Sport and Exercise Science, The Waikato Institute of Technology, Hamilton, New Zealand; <sup>3</sup>School of Biomedical and Sport Science, Edith Cowan University, Joondalup, Australia.

**ABSTRACT.** Tod, D.A., K.F. Iredale, M.R. McGuigan, D.E.O. Strange, and N. Gill. “Psyching-up” enhances force production during the bench press exercise. *J. Strength Cond. Res.* 19(3): 599–603. 2005.—We investigated the effect of “psyching-up” on force production during the bench press. Twelve men (mean age  $\pm$  SD: 27.4  $\pm$  11.2 years) and 8 women (20.9  $\pm$  2.5 years) with strength-training experience performed 5 bench press repetitions on a modified Biodex isokinetic dynamometer during 3 interventions. The interventions were counterbalanced and included a free-choice psych-up, a cognitive distraction, and an attention-placebo. Peak force recorded after psyching-up (mean  $\pm$  SD: 764  $\pm$  269 N·m) was significantly different from both distraction (703  $\pm$  282 N·m,  $p = 0.003$ ) and attention-placebo (708  $\pm$  248 N·m,  $p = 0.01$ ). The mean percentage increase in peak force from distraction to psyching-up was 11.8% (6 to 18%, 95% confidence interval [CI]) and 8.1% from placebo to psyching-up (3 to 13%, 95% CI). The results of the present study indicate that psyching-up may increase force production during the bench press exercise in participants with at least 1 year strength-training experience.

**KEY WORDS.** mental preparation, psychology, performance enhancement, strength

## INTRODUCTION

Any athletes in strength-based sports, such as powerlifting and weightlifting, “psych-up” immediately prior to performance, both in training and competition. Psyching-up refers to the use of self-directed cognitive strategies designed to enhance physical performance (16). Strategies typically used include preparatory arousal, imagery, attentional focus, and positive self-talk (13). Athletes believe that such strategies will lead to increased performance, and researchers have found that psyching-up may increase dynamic strength (5, 6, 14, 16, 18–20, 22, 23), muscular endurance (3, 10, 21), and power (21).

Not all studies, however, have shown a positive effect (2, 12, 15, 16). The results from these nonsupportive studies cast doubt on the efficacy of the psych-up effect on isometric strength tasks and when participants are required to divide their attention across both a strength movement and a mental preparation procedure. Also, the psych-up effect may be inhibited by fatigue or when a strong learning effect is taking place with the movement.

Researchers have generally used untrained samples when investigating the psych-up effect on dynamic strength. It is not clear whether psyching-up has a beneficial effect for trained individuals (2, 17). In addition, the types of tasks used to measure dynamic maximal strength have been limited largely to the leg extension

and handgrip exercises. The specificity principle suggests that strength is defined in part by the nature of the task (24). Researchers need to examine a greater variety of compound sport-specific skills or movements that are regularly used in training to improve athletic performance, such as the bench press exercise.

At the beginning of the bench press exercise, individuals grip a barbell above their chests, with their arms fully extended, as they are lying on their backs. The weight is lowered to the chest in line with the nipples before being pushed up until the arms are again fully extended. The exercise is used commonly during training by both athletes and recreational lifters as well as being a competitive movement in its own right. Figure 1 contains a photograph illustrating the movement. For the bench press, there is evidence that psyching-up leads to greater muscular endurance, and instructor-led interventions influence maximal strength (3, 13). However, the influence of self-directed psyching-up on force production during the bench press exercise has not been investigated. The purpose of this study was to examine the influence of psyching-up on force production during the bench press exercise in trained individuals. We hypothesized that psyching-up would lead to greater peak force compared to distraction and attention-placebo control conditions.

## METHODS

### Experimental Approach to the Problem

This study examined the influence of self-directed psyching-up on force production during the bench press exercise using a within-participants repeated-measures design. Men ( $n = 12$ ) and women ( $n = 8$ ) with a minimum of 1 year of strength-training experience performed 3 sets of 5 bench press repetitions. Prior to each set, participants engaged in 1 of 3 interventions. The interventions were counterbalanced to avoid any order effect and included a free-choice psych-up, a distraction control, and an attention-placebo control.

### Subjects

Participants consisted of 12 men (mean  $\pm$  SD for age, 27.4  $\pm$  11.2 years; for body mass, 84.2  $\pm$  10.2 kg; for height, 1.80  $\pm$  0.07 m) and 8 women (age, 20.9  $\pm$  2.5 years; body mass, 72.5  $\pm$  11.9 kg; height, 1.66  $\pm$  0.05 m). All participants had a minimum of 1 year’s strength-training experience involving the bench press exercise. Before being accepted as participants, individuals were required to demonstrate correct bench press technique as

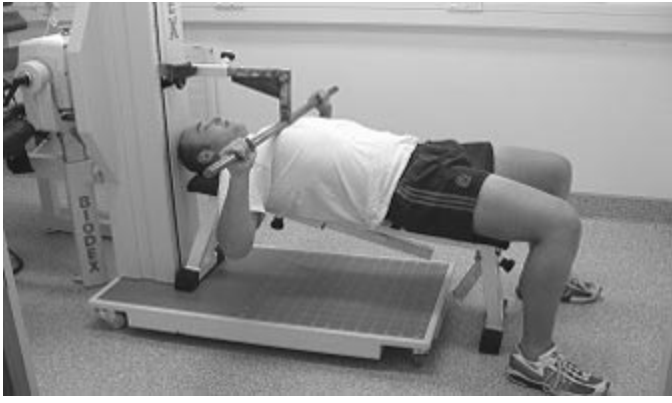


FIGURE 1. The bench arm attached to the lifting platform.

defined by the International Powerlifting Association (9). One woman's data were excluded from the final analysis because her results were more than 3 standard deviations from the mean results and therefore were unlikely to be representative of the population from which the sample was drawn.

### Testing Procedures

Before any testing was undertaken, ethical approval was obtained from the Waikato Institute of Technology's Human Ethics in Research Committee. Participants reported to the laboratory on 3 separate occasions spaced 1 week apart. During the first 2 sessions, participants were familiarized with the testing equipment and procedures. Data were collected during the third session. The same investigator and technician were present throughout. Participants positioned themselves so that the bar was at nipple height when lowered to the chest. The hand positions were self-determined, recorded, and used for all testing. Participants then completed a warm-up of 5 bench press repetitions at 60% of their perceived maximum effort, followed 1 minute later by a second warm-up at 80% of their perceived maximum effort. This warm-up was modeled on that previously used by Blazejich, Gill, and Newton (1). After another 60-second rest, participants then performed 3 sets of 5 bench press repetitions at maximal effort with 7 minutes passive rest between each set. During the experimental session, participants were asked to engage in 1 of the interventions during the final 30 seconds of the rest period. The interventions were counterbalanced to avoid any order effect. After the completion of the testing session, participants were debriefed on the interventions and received feedback regarding their performance.

### Measures

A bench arm (see Figure 1) was manufactured to allow the lifting platform of the Biodex isokinetic dynamometer (Biodex Model 900-800, Biodex Corp., Shirley, NY) to simulate the bench press movement. After consultation with competitive powerlifters, the lifting bench was tilted at an angle of  $7^\circ$  from horizontal to allow the bar to move upward and backward, and the speed of the bar was set at  $0.2 \text{ m}\cdot\text{s}^{-1}$ . Setting the angle and speed of the bar at these values helped ensure that the lifting platform closely simulated the bench press exercise. Peak torque (N·m) was recorded for each set of 5 repetitions.

Isokinetic testing is clinically accepted worldwide and is a reliable way of measuring maximum muscular strength over the total range of the motion. An isokinetic test was selected to provide a more controlled environment without the technical considerations needed when performing the free-weight bench press. Even though the participants were relatively experienced strength trainees, it was considered important to get an accurate measure of their force production. Research has demonstrated a high correlation between the isokinetic and free-weight bench press tests (8, 11). In a pilot study, 12 men (mean  $\pm$  SD for age,  $26.2 \pm 7.3$  years; for body mass,  $85.1 \pm 8.6$  kg; and for height,  $1.82 \pm 0.08$  m) and 8 women (age,  $22.0 \pm 2.0$  years; body mass,  $71.0 \pm 10.2$  kg; and height,  $1.65 \pm 0.09$  m) performed two 1 repetition maximum (1RM) bench press tests using the Biodex machine and free weights. Similarly, all participants in the pilot study had a minimum of 1 year's strength-training experience involving the bench press exercise. A correlation of 0.90 was achieved, and the regression formula was  $y = 9.864x + 9.7212$ . Based on pilot test results and previous research, it can be concluded that the maximum force subjects achieved during the Biodex test is predictive of their 1RM.

### Psych-Up Conditions

*Free-Choice Psych-Up.* A free choice psych-up intervention was selected because previous research has shown that it is associated with enhanced maximal strength (14). One minute before performing 1 of the test sets, participants were given the following instructions:

Before this next set you will have 30 seconds to psych yourself up. I want you to psych-up for your best effort. You may already have some methods you use to obtain your maximum strength. Do whatever you think will help you to obtain your maximum effort. I will give you some time now to psych yourself up. Do not actually psych yourself up until I tell you. Take some time now to think about it.

They were then given 20 seconds to identify the method that they would use, after which they were given the following instruction: 'I will now give you 30 seconds to psych yourself up using any method you like to obtain your best effort. After 20 seconds I will ask you to get ready to perform the set. Psych yourself up now.' At the completion of the 30 seconds, participants were instructed "Please lie down and I will say go." These instructions were based on those used in previous research (19).

*Attention-Placebo Control.* The attention-placebo control has been used in previous research (4, 22) and is designed to give participants the expectation that they will perform well without their engaging in a psyching-up strategy. One minute before completing a test set, participants were given the following instructions:

When athletes are aware of their level of physiological arousal prior to a task, they exhibit higher levels of performance. One accurate way to measure arousal is to estimate heart rate. I would like you to estimate your current heart rate, and then I will measure it. Please estimate your heart rate now.

The investigator then measured participants' actual heart rate. Inaccurate feedback was provided, informing participants that their estimate was within  $5 \text{ b}\cdot\text{min}^{-1}$  of their actual heart rate. The actual instructions given to the participants were as follows:

**TABLE 1.** The peak torque (N·m) produced by men and women in a bench press task following 3 different mental preparation strategies.†

|       | <i>n</i> | Distraction                    |        | Attention-placebo             |        | Psyching-up       |        |
|-------|----------|--------------------------------|--------|-------------------------------|--------|-------------------|--------|
|       |          | Mean* ± <i>SD</i>              | 95% CI | Mean* ± <i>SD</i>             | 95% CI | Mean* ± <i>SD</i> | 95% CI |
| Men   | 12       | 886 ± 160<br><i>p</i> = 0.013  | 102    | 870 ± 136<br><i>p</i> = 0.002 | 86     | 948 ± 121         | 77     |
| Women | 7        | 388 ± 96<br><i>p</i> = 0.004   | 88     | 431 ± 93<br><i>p</i> = 0.222  | 86     | 450 ± 85          | 79     |
| All   | 19       | 703 ± 282<br><i>p</i> = 0.0003 | 136    | 708 ± 248<br><i>p</i> = 0.001 | 120    | 764 ± 269         | 130    |

\* *p* values are for differences from psyching-up condition.

† CI = confidence interval.

**TABLE 2.** Percentage differences in bench press performance between psyching-up, attention-placebo, and distraction, along with the chances that these differences are substantial (i.e., greater than the smallest worthwhile change of 3.6%).

| Compared conditions               | Mean improvement (%) and 95% confidence limits | Chances (% and qualitative) of substantial improvement* |
|-----------------------------------|------------------------------------------------|---------------------------------------------------------|
| Psyching-up and attention-placebo | 8.14 ± 4.80                                    | 98; almost certain                                      |
| Psyching-up and distraction       | 11.82 ± 6.37                                   | 99.5; almost certain                                    |

\* Chances of a substantial decline in performance are less than 1% in both cases.

Well done, you have estimated your heart rate well. You are only a few beats out. Your actual heart rate is (a figure was included here). Please lie down and I will tell you to start the next set.

These instructions were based on previous literature (4).

**Distraction Control.** As commonly used in previous research (14, 17), participants were asked to engage in a mental task that prevented them from psyching-up. Participants were given the following instructions 45 seconds before the end of the rest period:

Before this next set you will have 30 seconds during which time I would like you to count backward out loud from 1,000 in groups of 7; for example, 1,000, 993, and so on. After 30 seconds have passed, I will ask you to get ready to perform the set, and I will say go. Please perform to the best of your ability. Start counting backward now.

These instructions were based on previous literature (14).

**Statistical Analyses**

Differences in peak torque among the 3 interventions were assessed using paired *t*-tests. Percentage changes were calculated from the raw scores, and paired *t*-tests were used to identify whether they were significantly different from 0. Independent *t*-tests were used to assess the differences in the percentage changes between the men and women. Using the Bonferroni adjustment equation, we set the  $\alpha$  level at 0.007.

Ninety-five percent confidence intervals (CI) were calculated for all mean and percentage change scores to represent the likely ranges of the true means. Percentage changes were then interpreted in light of their likelihood of being beneficial, trivial, or harmful (7). To carry out this analysis, it was necessary to estimate the smallest change in performance that was worthwhile to participants. We considered the smallest worthwhile change to be 2.5 kg, because this number represents the smallest increase available in many strength-training situations. Based on the regression equation reported earlier, the subjects’ maximum force produced (reported in the Re-

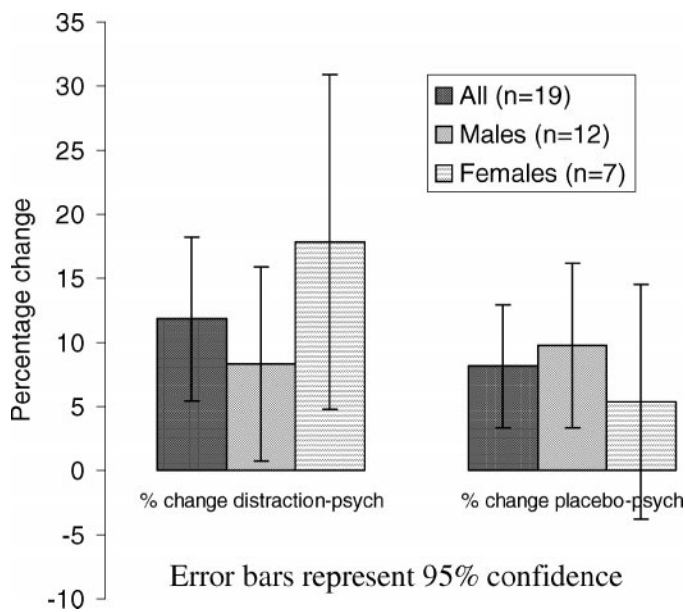
sults section) predicted a 1RM of 70 kg. The smallest worthwhile difference of 2.5 kg represents 3.6% of the subjects’ 1RM, and this figure was used to determine the probability that the results were meaningful (7).

**RESULTS**

Within-day intraclass correlations were calculated across the familiarization tests to determine reliability. The correlation was 0.98, indicating that the dependent variable, maximum force produced, was measured reliably. Table 1 presents the peak torque produced by the women and the men. The peak torque produced during the free-choice psych-up condition (mean ± *SD* [95% CI]: 764 ± 269 N·m [634–894 N·m]) was significantly greater compared to both the distraction (703 ± 282 N·m [567–839 N·m]) and the attention-placebo (708 ± 248 N·m [588–828 N·m]) conditions (*p* = 0.0003 and 0.001, respectively). There was not a significant difference between the 2 control conditions.

Table 2 and Figure 2 present the differences in torque produced as a percentage change from the respective control conditions to the free-choice psych-up. The torque produced after the free-choice psych-up condition was 11.8% greater than during the distraction condition (*p* = 0.001, 5.5–18.2% 95% CI). Assuming that the smallest worthwhile improvement is 3.6%, it is almost certain that this effect is beneficial (i.e., a 99.5% chance). Similarly, there was an 8.1% difference between the free-choice psych-up and the attention-placebo condition (*p* = 0.002, 3.3–12.9% 95% CI). Again, it is almost certain that this effect is beneficial (98% chance).

Women produced 17.8% (4.8–30.6%, 95% CI) more torque following psyching-up compared to the distraction condition, whereas men increased by 8.3% (0.8–15.9%, 95% CI). Although this difference was not statistically significant (*p* = 0.13), when the data are analyzed using the methods described by Hopkins (7), it is likely to be substantial (i.e., an 85% chance).



**FIGURE 2.** The percentage changes in torque produced by men, women, and all participants in the bench press exercise when comparing distraction with psyching-up and attention-placebo with psyching-up.

## DISCUSSION

We examined the influence of psyching-up on force production during the bench press exercise in participants with at least 1 year's strength-training experience. After psyching-up, participants produced greater force than when they had engaged in the distraction or the placebo conditions. Based on the results from 7 studies, Tod, Iredale, and Gill (17) estimated that psyching-up leads to a 12% increase in strength compared with control conditions. In this study, we found that psyching-up led to an 11.8% increase compared to the distraction condition and an 8.1% increase over the placebo condition. Using the smallest worthwhile improvement method (7), these figures provide evidence that the psych-up effect has a 99.5% and 98% chance of being beneficial for this sample compared with distraction and attention-placebo, respectively.

When examining gender differences, the women produced 17.8% more force following psyching-up than after the distraction intervention, compared with the men, whose difference was 8.3%. Although this difference was not significant, it may very well be substantial (7). Researchers could further explore possible gender differences in psyching-up. The neurophysiologic mechanisms underlying force production are likely to be similar for both men and women. Any possible differences in results may have been due to training and familiarity with psyching-up, rather than neurophysiologic gender differences.

Previous research examining the bench press exercise has provided evidence that psyching-up leads to greater muscular endurance and that instructor-led interventions influence maximal dynamic strength (3, 13). Until now, the influence of self-directed psyching-up on force production during the bench press exercise has not been examined. Taken together, the results from this study and the previous bench press investigations support the conclusion that mental preparation may influence the pro-

duction of strength during this exercise. The bench press is a competitive movement, and researchers could investigate the efficacy of mental preparation when participants are competing. We measured force production in this study and not actual weight lifted. Research, however, has reported high correlations between isokinetic testing and the amount of free weight lifted (8, 11).

Much of the research that has examined the influence of psyching-up on dynamic strength tasks has been conducted on untrained samples; groups of well-trained people have been used in only a small number of studies (14, 18). Brody et al. (2) suggested that trained individuals are likely to have well-developed movement patterns and neural pathways that may not be readily modifiable by psyching-up, whereas untrained individuals may have less well-developed movement patterns and neural pathways that are modifiable. Furthermore, the performance of untrained participants is likely to be characterized by greater variation compared with the performance of trained individuals. Untrained participants, therefore, may receive more benefit from psyching-up. The current study has provided evidence that psyching-up may be beneficial for participants who have had at least 1 year of regular strength-training experience that includes the bench press. There is still a need for more research before the influence of psyching-up on strength can be determined for highly conditioned or elite participants. This does not imply that knowledge about the usefulness of the psych-up effect on less than highly trained individuals is unimportant. There are greater numbers of individuals who are not highly conditioned than those who are very well trained. Psyching-up may assist individuals who are less than highly trained to make gains from their conditioning programs.

The possible mechanisms underlying the psych-up effect were not examined in the present study. Currently, no explanation for why psyching-up may enhance force production has any substantive support. Altered psychological states, changes in physiologic arousal, and changes in mechanical factors have all been proposed as possible reasons, but the evidence is conflicting (17). A conceptual understanding of why force production may be enhanced via psyching-up, along with knowledge of the factors that influence the relationship, may allow recommendations given to participants to be based on empirical data.

Psyching-up refers to self-directed cognitive strategies used by individuals to enhance their performance. The literature examining the psych-up effect provides evidence that it may positively influence force production in simple dynamic strength tasks. In addition, much of the existing research has been conducted on untrained individuals. The results of this study indicate that psyching-up may influence maximal force production during the bench press exercise in individuals with at least 1 year of strength-training experience.

## PRACTICAL APPLICATIONS

The results from the present study suggest that self-directed cognitive strategies may improve the display of strength on the bench press exercise in participants with a minimum of 1 year of strength-training experience. It is almost certain that the increase in force production will be beneficial.

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