Assignment Two

**Effect of Psyching up on Torque, Work and Power**

by

Alan Hubbard

S326012

for

Dr. Elizabeth Grylls

SPE206 Exercise and Sport Psychology

Word Count: 1980

Effect of Psyching up on Torque, Work and Power

**Introduction**

Mental preparation immediately before an exercise is considered an effective method to improve physical output in strength activities, such as one repetition maximal effort (1RM) squat and deadlift, and short-term high output anaerobic exercises, such as 100 or 200 metre sprints. The HUMAC Norm isokinetic dynamometer is used to measure muscle function with a specified resistance, enabling assessable force production within a specified range of motion (ROM). Whilst it is often used to assess rehabilitation progress, during this assessment it was used to measure maximal output for torque, work and power using leg extension and flexion, only. Shown in figure 1. (Habets, et al. 2018; McGuigan, et al,2005)



**Figure 1.** HUMAC-NORM muscle evaluation system testing for torque, work and power using leg extension and flexion.

The mental preparation technique used in this experiment was psyching up. Psyching-up, for the purposes of this experiment and report, refers to the methods of self-directed cognitive preparation undertaken by an individual, in an effort to improve on past performance.

The aim of this study was to examine the effects of self-directed psyching up in relations to torque, work and power, as measured by the HUMAC NORM. For this experiment there were two hypotheses; 1. by directing participants to “psych-up” they will improve their performance on all test serials at a greater margin than the group directed to play cards, and 2. Group 1, using distraction control, will increase their measured physical output, due to familiarity to the testing mechanics and through inadvertent self-directed psyching up or preparation.

**Method**

**Study Design**

This experiment was a test-retest study, with an interval between the test and retest of 30 minutes, plus or minus 2 minutes. 30 minutes was determined to be sufficient time to recover from the previous test, as the exercise was short; however, required a maximal effort from the participant. The period of rest was also selected to better allow for the influences of the activity, being distraction control and free choice psych up, on the retest results.

To further control the time elapsed between Pre-test and Retest, each group was divided into groups of five, where individuals were assessed within 2 minutes of each other and were then directed to conduct a task, depending on the group designation, for 30 minutes, plus or minus 2 minutes. That is, Group 1 was divided into subgroups A and B, and Group 2 was divided into subgroups C and D. This division allowed for more accurate control of the elapsed time between test and retest, therefore improving the consistency of results.

Further, the experiment serials were preceded by familiarisation training on the HUMAC NORM and assessed exercises, so that participants understood the activity and expectations.

**Participants**

Participants were randomly selected to be separated into two groups; each group contained ten participants. All participants were male that were physically active. The limits of physically active was defined as conducting at least 180 minutes and not more than 300 minutes per week for the previous three months, to ensure that the individual’s physical abilities were not significantly different as far as practicable. All participants were aged between 23 and 28 years of age.

**Procedure**

All tests were conducted on five HUMAC NORM machines, located in separate rooms, supervised by an assessor familiar with the procedure and machine’s functions. Each participant was individually assessed on torque, work and power using the HUMAC NORM muscle evaluation system. These tests were evaluated using only leg extension and flexion. The sequence of test and retest was identical for each event, being leg flexion, ROM 90 degrees, then extension, ROM 90 degrees.

Time allowed for each test was between four and six minutes. This assessment was started simultaneously between the five test stations to allow for more similar rest time between participants.

During the 30-minute rest period Group 1 participants were directed to play cards for the duration. This was conducted in groups of five participants, being subgroups A and B. These groups were given no other direction and were monitored via a video camera placed at the front of the room, to observe and assess their compliance.

Group 2 participants were directed to conduct individual self-directed psyching up activities. There was no further education or direction on what or how these activities were to be conducted. Participants in these groups were also directed into rooms corresponding to their subgroup, C and D, and were given these directions in groups of five. These groups were also monitored via a video camera placed at the front of the room.

At the completion of the rest period and activity, participants were directed back to the same testing room to complete the retest examination. The retest was conducted in the same method as the pre-test, as far as practicable, to maintain consistency within the results.

**Results**

All 20 participants were included in the test results and subsequent analysis. All assessments met the described time allocation. Individual results can be seen in table 1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Participants** | **Pre-test**  **Torque**  **(N.m)** | **Pre-test**  **Work**  **(J)** | **Pre-test**  **Power**  **(W)** | **Retest**  **Torque**  **(N.m)** | **Retest**  **Work**  **(J)** | **Retest**  **Power**  **(W)** |
| **Group 1** |  |  |  |  |  |  |
| 1 | 160 | 200 | 300 | 150 | 190 | 301 |
| 2 | 170 | 215 | 315 | 160 | 210 | 312 |
| 3 | 175 | 200 | 315 | 180 | 205 | 317 |
| 4 | 165 | 212 | 295 | 160 | 210 | 291 |
| 5 | 200 | 195 | 295 | 190 | 190 | 296 |
| 6 | 210 | 230 | 300 | 200 | 220 | 305 |
| 7 | 195 | 220 | 310 | 190 | 210 | 308 |
| 8 | 140 | 165 | 280 | 140 | 170 | 285 |
| 9 | 135 | 165 | 285 | 140 | 165 | 285 |
| 10 | 145 | 175 | 290 | 145 | 170 | 286 |
| **Group 2** |  |  |  |  |  |  |
| 1 | 162 | 205 | 305 | 170 | 215 | 325 |
| 2 | 168 | 205 | 310 | 175 | 219 | 320 |
| 3 | 170 | 210 | 315 | 204 | 215 | 325 |
| 4 | 170 | 215 | 290 | 185 | 225 | 299 |
| 5 | 195 | 195 | 299 | 199 | 199 | 299 |
| 6 | 215 | 235 | 305 | 222 | 245 | 315 |
| 7 | 200 | 215 | 300 | 205 | 225 | 315 |
| 8 | 142 | 170 | 280 | 155 | 185 | 290 |
| 9 | 135 | 165 | 295 | 155 | 185 | 301 |
| 10 | 150 | 180 | 290 | 159 | 189 | 305 |

**Table 1.** Results from individual test and retest

Results were analysed through SPSS using T-Test paired analysis, between the test and corresponding retest for the same activity with the same participant. Two-tailed factor analysis was used to assess significance. Paired samples statistics can be seen in table 2.

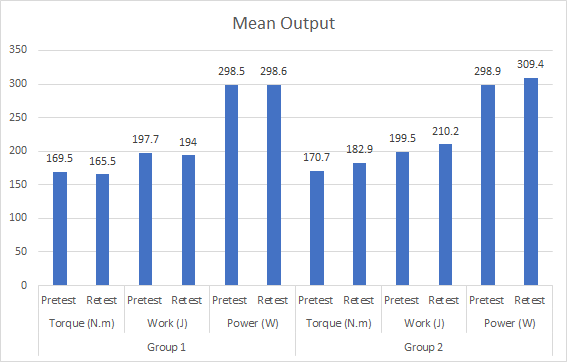
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean | N | Std. Deviation | Std. Error Mean |
| Pre-test Torque  Group 1 | 169.50 | 10 | 25.868 | 8.180 |
| Pre-test Torque  Group 2 | 170.70 | 10 | 25.867 | 8.180 |
| Pre-test Work  Group 1 | 197.70 | 10 | 22.891 | 7.239 |
| Pre-test Work  Group 2 | 199.50 | 10 | 22.042 | 6.970 |
| Pre-test Power  Group 1 | 298.50 | 10 | 12.030 | 3.804 |
| Pre-test Power  Group 2 | 298.90 | 10 | 10.482 | 3.315 |
| Retest Torque  Group 1 | 165.50 | 10 | 22.663 | 7.167 |
| Retest Torque  Group 2 | 182.90 | 10 | 23.765 | 7.515 |
| Retest Work  Group 1 | 194.00 | 10 | 19.972 | 6.316 |
| Retest Work  Group 2 | 210.20 | 10 | 20.049 | 6.340 |
| Retest Power  Group 1 | 298.60 | 10 | 11.768 | 3.721 |
| Retest Power  Group 2 | 309.40 | 10 | 12.222 | 3.865 |

**Table 2.** Paired Sample Statistics

There was no significant difference between the results between Group 1 and 2 during pre-test. The mean result differences between paired samples was less than 1.1%, for each assessment metric measured.

Amongst the results between groups 1 and 2 for the retest, Group 2, not only, performed significantly better than Group 1, but also improved their results. In contrast, Group 1 decreasing results in two of three metrics, where the results from power did not significantly increase. In the measurements, torque, work and power, Group 2 performed 9.5%, 7.7% and 3.5% better than Group 1, respectively. The result differences were assessed to be statistically significant (P<.01).

In Group 1, the mean regression in result was a value of 4 N.m (2.3%) for torque, 3.7 J (1.9%) for work and the measured results from power increased, however insignificantly, by a value of 0.1 W (0.03%). In Group 2, all mean results increased. Torque increased by a value of 12.2 N.m (6.7%), work increased by 10.7 J (5.1%) and power increased by 10.5 W (3.4%). The mean increase or decrease in the output produced by each group can be seen in graph 1.



**Graph 1.** Mean Output by group, paired as pre-test and retest.

Of the 30 paired test results from Group 2, in only one instance, the measured output in the retest remained the same as its paired pre-test; comparatively, in Group 1, 17 of 30 paired test occurrences resulted in a reduced test output and 4 occurrences where retest output was the same as pre-test results. These are outlined in table 3, with lower retest results highlighted in red and retest results that were the same as pre-test results highlighted in yellow.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Participants** | **Pre-test**  **Torque**  **(N.m)** | **Pre-test**  **Work**  **(J)** | **Pre-test**  **Power**  **(W)** | **Retest**  **Torque**  **(N.m)** | **Retest**  **Work**  **(J)** | **Retest**  **Power**  **(W)** |
| **Group 1** | 1 | 160 | 200 | 300 | 150 | 190 | 301 |
| 2 | 170 | 215 | 315 | 160 | 210 | 312 |
| 3 | 175 | 200 | 315 | 180 | 205 | 317 |
| 4 | 165 | 212 | 295 | 160 | 210 | 291 |
| 5 | 200 | 195 | 295 | 190 | 190 | 296 |
| 6 | 210 | 230 | 300 | 200 | 220 | 305 |
| 7 | 195 | 220 | 310 | 190 | 210 | 308 |
| 8 | 140 | 165 | 280 | 140 | 170 | 285 |
| 9 | 135 | 165 | 285 | 140 | 165 | 285 |
| 10 | 145 | 175 | 290 | 145 | 170 | 286 |
|  |  |  |  |  |  |  |  |
| **Group 2** | 1 | 162 | 205 | 305 | 170 | 215 | 325 |
| 2 | 168 | 205 | 310 | 175 | 219 | 320 |
| 3 | 170 | 210 | 315 | 204 | 215 | 325 |
| 4 | 170 | 215 | 290 | 185 | 225 | 299 |
| 5 | 195 | 195 | 299 | 199 | 199 | 299 |
| 6 | 215 | 235 | 305 | 222 | 245 | 315 |
| 7 | 200 | 215 | 300 | 205 | 225 | 315 |
| 8 | 142 | 170 | 280 | 155 | 185 | 290 |
| 9 | 135 | 165 | 295 | 155 | 185 | 301 |
| 10 | 150 | 180 | 290 | 159 | 189 | 305 |

**Table 3.** Identification of reduced output from pre-test to retest results.

**Discussion**

The first hypothesis was that self-directed “psych-up” improved performance on all metrics. This was proven to be true through a review of the results and identifying the differences in mean results for each test group. These results are consistent with academic research previously conducted (Habets, et al. 2018; McGuigan, et al,2005). The second hypothesis assumed that the participants would increase their output despite the directed distraction control, due to increased familiarity with the test regime, however this was disproven. This is contrary to previous research conducted by McGuigan, et al, (2005), it is possible that the difference found in these results is due to the type of task chosen as the distraction control.

The method that participants in Group 2 used to psych up was self-directed therefore unknown at the time of the experiment. The specific technique used was dependent on the individual participant’s preference. The selection criteria, requiring experience in physical fitness, allows a level of consistency, in that, all participants had a similar level of experience with maintaining, building and testing physical fitness. Therefore, they are likely to have been, consciously or unconsciously, are likely to be exposed to and undertake their own, and preferred, method of psyching up.

According to Havets, et al, (2018) individual performances improved without specific training or coaching on the techniques used. It is further discussed that the likely reason for this is that familiarity with the HUMAC NORM machine gave participants the ability to perform better, that is, without the hindrance of learning the technique during the exercise. This is contradictory to the results found in the Group 1 results, distraction control, where 21 of 30 retest results were the same or lower than the pre-test results. Therefore, it is likely that the distraction control used in this experiment had a negative effect on performance. This is similar to the findings in Hammoudi-Nassib, et al, (2017), where preparatory and imagery arousal participants performed better than distraction or attention-placebo methods in sprint testing. Also, that, whilst relaxation methods reduced performance, participants that were exposed to this performed better than those exposed to distraction control.

The distraction control method in Hammoudi-Nassib, et al, (2017), was also different in that participants were directed to count backwards from 1000 by 7. Participants were found to have experienced significant difficulty with this task and became frustrated and upset with their inability. This emotional state is likely to have affected the results from the study, although the findings are similar.

It is unlikely that the activity conducted in this experiment significantly impacted the emotional state of the participants. Whilst the activity choice was considered during experiment design, to reduce the impact on emotional state and therefore physical performance, a follow up questionnaire was not considered or conducted to ensure reliability nor impact on the study.

It is likely, that the distraction control used in this experiment were more similar to the progressive relaxation used in Pierce, et al, (1993), where subjects participated in a 20-minute instructor led relaxations and breathing exercise, in their results. Whilst the activity differed, the progressive relaxation and distraction control, both reduced muscular output in trained athletes.

The output increase by percentage, within Group 2, was notably higher in torque and work, whilst power saw the lowest increase, of 3.4%. The reason for this is unknown and requires further investigation to be able to fully explain these results. Regardless, the difference in results, by percentage, between Group 1 and 2 was similar. That is, in each group, the greatest difference, by percentage, was in torque, followed by work and finally, power.

The level to which the participants had been exposed to or had any specific training in mental preparation was unknown. This factor is unlikely to have significantly affected the results, however in following experiments, it may be considered to increase reliability in the results.

Further there was no control on the level and type of arousal that affected the participants in Group 2. As is discussed by Perkins, et al, (2017) lowered arousal decreases level of performance in explosive or maximal effort and short duration tasks. Also, the heightened arousal state that was specifically goal focused, also inhibited performance of participants; however, less goal focused heightened arousal states increased strength performance. Although these findings are consistent with this experiment, the specificity achieved in Perkins, et al, (2017) was not replicated, as participants in Group 2 were given brief direction to conduct self-directed “psyching up.” The lack of specificity allowed for a participant's preferred approach to the situation.

In summary, the self-directed psyching up method increased the muscular output by participants, thus proving hypothesis 1. Group 1, which played cards for 30 minutes between testing, yielded significantly lower results than in their pre-test, thus disproving hypothesis 2. These results are consistent with other research investigating the effects of relaxation and distraction on trained participants. The initial hypothesis did not consider the effects of the distractive activity, but rather, focused on the repetition of activity and therefore, increased familiarity. This typically results in increased performance by subjects, which did not occur in this study.

References

Habets, B., Staal, J. B., Tijssen, M., & van Cingel, R. (2018). Intrarater reliability of the Humac NORM isokinetic dynamometer for strength measurements of the knee and shoulder muscles. *BMC research notes*, 11(1), 15. <https://doi.org/10.1186/s13104-018-3128-9>

Hammoudi-Nassib, S., Nassib, S., Chtara, M., Briki, W., Chaouachi, A., Tod, D., & Chamari, K. (2017). Effects of psyching-up on sprint performance. *The Journal of Strength & Conditioning Research*, 31(8), 2066-2074. <https://doi.org/10.1519/JSC.0000000000000373>

McGuigan, M. R., Ghiagiarelli, J., & Tod, D. (2005). Maximal strength and cortisol responses to psyching-up during the squat exercise. *Journal of sports sciences*, 23(7), 687-692. <https://doi.org/10.1080/02640410400021401>

Perkins, D., Wilson, G. V., & Kerr, J. H. (2001) The Effects of Elevated Arousal and Mood on Maximal Strength Performance in Athletes, *Journal of Applied Sport Psychology*, 13, 239-259

Pierce, E.F., McGowan, R.W., Eastman, N.W., Aaron, J.G., & Lynn, T.D. (1993). Effects of

progressive relaxation on maximal muscle strength and power. *Journal of Strength and Conditioning Research*. 7(4), 216-218. <https://doi.org/10.32827/ijphcs.6.4.96>